

Reciprocal Impacts of Climate Change and Socio-Economic Structures with
Implication for Poverty and an Analysis of Comparative Economic Paradigms
for Sustainable Policy Solutions – A Case Study of Pakistan

Kiran S Karrouchi

Submitted in partial fulfilment of the requirements of the award of

Doctor of Philosophy
Oxford Brookes University, UK

June, 2016

Declaration

I, Kiran S Karrouchi, hereby declare that this thesis and the work presented in it is entirely my own.

Dedication

This Dissertation is sincerely dedicated:

To my Late Father **Gen. Saleem Khan**

ABSTRACT

This study investigates two interrelated research questions: what are the reciprocal impacts of climate change and socio-economic structures with implications for poverty and how does neo-classical economic paradigm address climate change and these underlying socio-economic imperatives as opposed to competing economic paradigms, towards sustainable solutions. Climate change is changing the development debate and the changing development debate is, in turn, changing the very definition of sustainability. This research argues that the current debate on climate change is predominantly framed in terms of the effects of increasing greenhouse gas emissions on earth's radiation balance. Consequently, it fails to incorporate the socio-economic structures which drive these emissions. The failure to see the reciprocal link between climate change and the structural imperatives in which it is embedded gives a partial view of climate change, with implications for poverty.

The research methodological approach adopted under this research study is that of critical realism. Critical realism is a kind of realism which argues that in order to understand what is going on in the social world, it is important to study the underlying social structures which have given rise to the phenomena under consideration. The guiding metaphors of realists are structures and mechanisms. Critical realism is adopted as the research philosophy under this research study because it provides an approach which evaluates the emergent properties of social structures. These emergent properties act as 'generative mechanisms' that shape, constrain and enable socio-economic action and therefore reflect the historicity of these social structures. Important aspects of the research methods are in-depth policy level interviews and focus groups conducted under a critical realist case study.

Through this in-depth case study, of Pakistan, this research shows a reciprocal link between climate change and the socio-economic structures, with implications for poverty. By bringing forward an analysis of comparative economic paradigms, it develops a holistic perspective on the approach towards sustainability. The comparison between the two competing schools of thought leads to some key findings proposing policy recommendations based on a mix of reformatory and radical sustainability solutions, with potential to reasonably avoid a major environmental crisis in the form of climate change tipping over 750ppm CO₂e or beyond.

Table of Contents

Declaration	ii
Dedication.....	iii
Abstract.....	iv
List of Tables and Figures.....	ix
Abbreviations.....	x
Acknowledgements.....	xii
1 Introduction.....	1
1.1 Research Problem	1
1.2 Significance of the Study.....	3
1.3 Brief Synopsis of the Relevant Literature.....	4
1.4 Research Question and Objective.....	5
1.4.1 Research Questions.....	5
1.4.2 Research Objectives.....	5
1.5 Research Methods.....	6
1.6 Defining the Key Terms.....	6
1.7 Structure of the Thesis.....	7
2 Pakistan’s Socio-Economic Setup in context of Climate Change and Poverty.....	8
2.1 Introduction.....	8
2.2. A Socio-Economic overview of Pakistan.....	9
2.2.1 Socio-Economic Structures.....	9
2.2.2 The Economic Configuration.....	10
2.2.3 Effects of Agricultural Pricing and Labour Market Segmentation.....	12
2.3 Socio-economic structures during 1960s-1980s	13
2.3.1 The Nature of the Economy.....	13
2.3.2 The Economic and Ecological Effects of the Green Revolution	14
2.4 Socio-Economic structure from 1990s onwards.....	17
2.4.1 Socio-Economic implications of SAP with implications for Poverty Structure.....	17
2.4.2 Macro-Economic Policies as part of SAP.....	18
2.4.3 The Impact of SAP on Strategic Macro-Economic Variables.....	20
2.4.4 Socio-Economic Impact of SAP with further implication for Climate Change....	26
2.5 Legal framework in context of Climate Change, Agricultural and Indutry.....	30
2.6 Conclusion.....	31
3 3(I) The Impacts of Climate Change on Socio-Economic Structures with Implication for Poverty.....	33
3.1 Introduction.....	33
3.1.1 Framework to analyse the reciprocal impacts.....	33
3.2 Impacts of Climate Change in Climate Sensitive Economic Sectors.....	34
3.2.1 Climate Change Impact on Agriculture.....	35
3.2.2 Implications for the Water Sector.....	39
3.2.3 Urbanisation and Industrial Sector.....	41

3.2.4 Climate Change and Energy Sector.....	42
3.2.5 Climate Change and Transport Sector.....	46
3.3 Socio-economic Vulnerability reinforced by Past Climate Variability.....	47
3.3.1 Socio-economic impacts of climate change with implications for poverty.....	47
3.3.2 Vulnerability to hazards.....	48
3.3.3 Vulnerability to outcome.....	49
3.3.4 Further Implications for Poverty Level.....	50
3.4 Conclusion.....	51
3(II) Analysis of comparative economic paradigms.....	52
3.5 Introduction.....	52
3.6 Main issues surrounding the economics of climate change.....	52
3.6.1 Towards sensitivity analysis.....	54
3.6.2 Climate change impact analyses.....	55
3.6.3 Dominant economic literature on addressing climate change.....	58
3.6.4 Measuring impacts of climate change on the margin.....	60
3.6.5 Precautionary Approach to address structural uncertainty.....	61
3.6.6 Computable general equilibrium models in context of the research questions.....	64
3.7 Sustainability Analysis under Radical Economic Paradigms.....	67
3.7.1 Marxist view of nature and the concept of sustainability	67
3.7.2 Marx’s Labour Theory of Value.....	70
The positive proof.....	70
The controversial negative proof	77
3.7.3 Marx’s metabolic analysis.....	80
3.7.4 Metabolic rift analysis under Eco-Socialists.....	81
3.7.5 Further contradictions of capital.....	84
3.7.6 Towards an Eco-Socialist Approach.....	91
3.8 Conclusion of the Literature Review and Synthesis of the Main Findings.....	94
3.8.1 Main conclusions.....	94
3.8.2 The initial conceptual framework of the research study.....	96
3.8.3 Identification of gaps in the current literature – concluding remarks.....	98
4 Methodology.....	101
4.1 Introduction.....	101
4.2 Critical Realism as the Research Philosophical Approach.....	102
4.3 Critical Hermeneutics.....	108
4.3.1 Gadamarian hermeneutics.....	108
4.3.2 Critical hermeneutics.....	110
4.3.3 Rationale behind the research study’s critical inquiry.....	111
4.4 How does critical realism inform the case study methodology.....	115
4.5 Rationale behind Case Study Methodology.....	115
4.6 Triangulation.....	116
4.6.1 In-depth Interviews.....	117
4.6.2 Focus Groups.....	119
4.6.3 Research Design.....	121
4.7 Conclusion.....	122
5 Elite Interview Analysis.....	124

5.1 Introduction.....	124
5.1.1 The process of manual qualitative data analysis.....	124
5.1.2 Organisation of the chapter.....	126
5.2 Impacts.....	127
5.3 Sector specific impacts and policies.....	134
5.3.1 Water sector policies in context of climate change.....	135
5.3.2 Agriculture policy in context of climate change.....	142
5.3.3 Industrial sector policy in context of climate change.....	146
5.3.4 Energy sector policy in context of climate change.....	150
5.4Climate change legislation.....	155
5.5 Discussion and analysis of comparative economic paradigms.....	158
5.6 Conclusion.....	163
6 Focus Groups Analysis.....	164
6.1 Introduction.....	164
6.2 Sampling methodology.....	165
6.3 Analysis of socio-economic vulnerability from climate change.....	167
6.4 Analysis of economic sectors.....	173
6.5 Analysis of the current economic system.....	181
6.6 Conclusion.....	185
7 Valuation of Primary Data Analysis.....	186
7.1 Introduction	186
7.1.1 Strength of Case Study under Critical Realism.....	186
7.1.2 Quality Criteria under Critical Realist Case Study.....	188
7.1.3 Practical Implications of Critical Realist Research.....	189
7.1.4 Process of Data Analysis.....	189
7.1.5 Process of Coding.....	190
7.1.6 Method of of Analysis of Qualitative Data.....	191
7.1.7 Organisation of Chapter.....	193
7.2 Reciprocal impacts of climate change and Socio-Economic factors with implication for Poverty.....	194
7.3Sector specific impacts.....	195
7.4Legislation on climate change.....	198
7.5Analysis of comparative economic models.....	201
7.5.1Adaptation to climate change.....	201
7.5.2Mitigating climate change.....	212
7.6Current and Proposed Policy Frameworks in Pakistan’s context.....	218
7.6.1 Current Approach.....	218
7.6.2 Revised Conceptual Analysis.....	219
7.7 Conclusion.....	229
8 Discussion and Conclusions.....	230
8.1 Introduction.....	230

8.2 Research Background and Approach.....	230
8.2.1 Background.....	230
8.2.2 Research philosophical approach.....	231
8.3 Principle Findings of the Study.....	231
8.3.1 Findings related to climate change.....	231
8.4 Contribution to the Study.....	234
8.4.1 Contributions to climate change.....	234
8.4.2 Contribution to simultaneously stabilising climate change and socio-economic structure.....	236
8.5 Implications of the Findings.....	237
8.5.1 Implications for policy.....	237
8.5.2 Implications for practise.....	237
8.5.3 Implication for theory.....	238
8.5.4 Implications for future research.....	239
8.6 Limitation of the Study.....	239
8.7 Conclusion.....	240
 References.....	 242
 Appendix A: Coordination mechanism to align all relevant stakeholders.....	 281
Appendix B: Elite Interview Questionnaire (Policy Level).....	282
Appendix C: Focus Group Questionnaire (Poverty Level).....	286
Appendix D: List of Research Participant.....	290
Appendix E: Sample of reflective interpretation based on pre-understanding.....	293
Appendix F: Coding Sample leading to reflective analysis.....	295

List of Figures and Tables

Tables

Table 1: Structure of Savings and Investment.....	21
Table 2: Sectoral Contribution to GDP Growth.....	22
Table 3: Country Wise Workers' Remittances.....	23
Table 4: Pakistan's Growth of Foreign Trade (Million US \$).....	27
Table 5: Sectoral Share in Gross Domestic Product (GDP).....	29
Table 6: Sampling.....	166

Figures

Figure 3.1: Initial Conceptual Framework.....	97
Figure 3.2: Link between Critical Realism and Eco-Socialism.....	98
Figure 5.1: Initial Critical Realist Approach underpinning Eco-Socialism.....	126
Figure 5.2: Vulnerability Framework.....	131
Figure 7.1: Strength of Critical Realist Case Study.....	187
Figure 7.2: Climate Change Risk Assessment.....	199
Figure 7.3: Mitigating Climate Change - A Comparative Analysis.....	212
Figure 7.4: Revised Conceptual Analysis – linking Critical Realism to Eco-Socialism.....	220
Figure 7.5: Revised Conceptual Framework.....	227

Abbreviations

AR4	Fourth Assessment Report
AR5	Fifth Assessment Report
BAU	Business as Usual
CAP	Common Agricultural Policy
CBA	Cost Benefit Analysis
CGE	Computational General Equilibrium
CGIAR	Consultative Group on International Agricultural Research
CO ₂	Carbon dioxide
CO _{2e}	Carbon dioxide equivalent
CPI	Consumer Price Index
CSS	Carbon Capture and Sequestration
DDMA	District Disaster Management Authority
DRM	Disaster Risk Management
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
EU	Expected Utility
EU	ETS European Union Emissions Trading Scheme
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GLOF	Glacial Lake Outburst Flooding
HDI	Human Development Index
HYV	High Yielding Variety
IARCs	International Agricultural Resource Centres
IAM	Integrated Assessment Modelling
IEA	Initial Environmental Assessment
IPCC	Intergovernmental Panel on Climate Change
IMF	International Monetary Fund
IRS	Indus River System
IWT	Indus Water Treaty
MAF	million acre feet
MCF	a thousand cubic feet of natural gas
MoIP	Ministry of Industry and Production
MPAT	Multidimensional Poverty Assessment Tool
MW	Mega Watt
NCCP	National Climate Change Policy
NCSR	National Conservation Strategy Report
NDMA	National Disaster Management Authority
NDMC	National Disaster Management Commission
NEQS	National Environment Quality Standards
NIAP	National Impact Assessment Program
PDMA	Provincial Disaster Management Authority
PDMC	Provincial Disaster Management Committee
PIDE	Pakistan Institute of Development Economics
Rs.	Rupees
SAP	Structural Adjustment Program
SAR	Second Assessment Report
SCC	Social Cost of Carbon
SPM	Suspended Particulate Matter
TAR	Third Assessment Report

UCG Underground Coal Gassification
UNFCCC United Nations Framework Convention on Climate Change
WDR World Development Report

Acknowledgements

This study came to fruition with the help of some very important people. I humbly acknowledge and thank all of them for introducing me to many of the ideas discussed here. I would like to acknowledge and thank the assistance provided by my supervisory team, headed by Dr. Pritam Singh. I sincerely appreciate their guidance and I am very grateful for all their efforts. I would also like to thank all those concerned staff in the Faculty of Business and in the research degree team for encouraging and supporting me through these years. I also acknowledge the authors, identified in the reference section, whose works and writings provided ample guidance and help in pursuit of answering my research queries. My loving parents provided their inspirational support throughout this study for which I am truly thankful. I also extend my thanks to all the research participants who took part in this study and shared their insightful ideas and views without which this study would not have been possible.

1 Introduction

1.1 Research Problem

What is climate change and what implications does it have for the current development process? Is there a reciprocal link between climate change and the underlying socio-economic structure with implications for poverty? How does the neo-classical economic paradigm address climate change and the socio-economic structure with implications for poverty as opposed to comparative economic paradigms? These are the fundamental questions that this research study aims to answer.

Climate science is built on two centuries' of theory and evidence. In 1820s, Joseph Fourier recognized the atmosphere was trapping heat. Then in 1860, John Tyndall discovered the gases that were doing so, i.e., the greenhouse gas emissions (GHGs). At the end of the 19th century, Svante Arrhenius provided calculations of the effect caused by GHGs. In 1940s, Walter Elsasser explained that GHG molecules oscillate at a frequency that interferes with the escape of infrared radiation (Stern, 2014). In June 1981, James E. Hansen made one of the first assessments that human-caused warming had already measurably affected global climate (Hansen, et al. 1981). The Intergovernmental Panel on Climate Change (IPCC) was created in 1988, under the United Nations and the World Meteorological Organization. Since then, the IPCC has tried to induce state and public policies' options for adaptation and mitigation of climate change (IPCC, 2014). Given that climate change is a global phenomenon, it required a political platform among countries to cope with it. So, the IPCC played a decisive role in the creation of the United Nations Framework Convention on Climate Change (UNFCCC) in 1990, and the adoption of the Kyoto Protocol in 1997.

The structure of the climate change science is such that it embodies four major difficulties for understanding, analysing and setting public policy: immense scale, large risk/uncertainty, long lags, 'publicness' of the causes and effects (Stern, 2014). Therefore, the key implications for economics and analysis of climate change are about the management of immense risks and uncertainty involved. CO₂e concentrations are presently around 450ppm (Kyoto gases) (IPCC, 2014; Stern, 2014). Globally we are adding CO₂e at a rate of over 2.5ppm per year which is likely to accelerate with little or weak action. This is up from 0.5ppm per year in 1930-1950; 1ppm 1950-1970 and 2ppm 1970-1990 (Stern, 2014). A year

of not taking action on climate change and letting the world economy run on Business as Usual (BAU) that 2.5 ppm per year can go up to 300ppm CO₂e in the next 100 years, bringing the total CO₂e to 750ppm over a century which could potentially translate into a strong possibility of eventual catastrophic temperature increase of more than 4°C (or more than 5°C) (IPCC, 2014). Beyond 2°C is dangerous or catastrophic due to the risk of tipping points. Temperature increase of 4 or 5°C or more has not been seen for tens of millions of years (homo sapiens have been around for 250,000 years) (IPCC, 2014).

Currently we are at 0.8°C and already witnessing strong climate change effects around the globe yet these climate events are small relative to what we risk (IPCC, 2014). Current pledges made by nations around the globe are to have emission path at 55–60 GtCO₂e per annum by 2030 (Boyd et al quoted in Stern, 2014). This is an improvement on Business As Usual (BAU), the emission path or scenario which is likely to emit around 65–68 GtCO₂e. But the emission path that is sustainable needs to be at around 35-40 GtCO₂e per year by 2030 which requires very strong action (Stern, 2007). A path which is likely to require: zero emissions from electricity around mid-century, zero total emissions by the end of the century and net negative emissions in major economic sectors well before the end of century for a reasonable chance of holding to 2°C (Stern, 2014). The scale of policy action should match the scale of risks involved. The impact of about 2°C of warming could lead to global aggregated losses of 0.2–2.0% of income, according to the IPCC (IPCC, 2007). Impacts and damages are likely to be significantly more severe in tropical regions and developing countries and within developing countries, the poor are inevitably the most vulnerable group (IPCC, 2014). Climate change increases the probability of climate disasters by enhancing the intensity and frequency of extreme climatic events. Natural hazards become disasters when there is some sort of vulnerability. The less prepared an economy, the more affected it will be (Stern, 2007; IPCC, 2007). Therefore the impacts of climate change across multiple dimensions (region, sectors) are likely to be highly convex, with marginal damages that increase strongly as temperatures rise.

In Pakistan's National Climate Change Policy framework (NCCP, 2012; NCCP, 2013) the vulnerabilities to climate change in climate sensitive sectors, such as water, agriculture, forestry, energy and coastal areas are well laid out along with the appropriate adaptation measures. It also puts forward appropriate measures concerning disaster preparedness, capacity building, institutional strengthening, technology transfer and international

cooperation. However there are two concerns about NCCP which require attention. First, the real challenge is to turn these general policy statements into on ground targeted policy implementation, tailored according to the needs and demands of each locality, which has been severely lacking so far. The gap between policy making and policy implementation is due to a critical lack of appropriate development funds. Second, the Climate Change Policy framework considers the climate change issue from the perspective of the standard narrative of climate change and therefore develops a discourse within this framework which gives it a partial view of the climate change problem. This leaves little space to consider any comparative framework of climate change and poverty towards achieving sustainability which could have drastic implications for the overall sustainability process.

1.2 Significance of the Study

Investigating the study's research questions set out in section 1.4.1 has been important for various reasons. This research is of significance to the economics of climate change within the overall development studies framework. It hopes to contribute to the existing literature in two ways: a) by showing the reciprocal impacts of climate change and socio-economic structures with implications for poverty where most dominant studies have concentrated only on the impact of climate change on the socio-economic structures; and b) by analysing not only the existing literature based on the dominant narrative of climate change but it also brings forward an analysis of the radical economic paradigms to consider solutions which could address a radical issue such as climate change. This comparative analysis of these opposing economic paradigms is done under a critical realist philosophical approach.

This study aims to highlight the importance of bringing the viewpoints of the vulnerable section of the society about how climate change events increase their vulnerabilities and locks in such socio-economic factors such that poverty is reinforced. It further highlights the importance of participatory approach for balanced policy making where preparing a government level decision process to address climate change risks and uncertainties must include the consensual results of a public participation procedure to generate social rationality. This can be done by conducting district level/municipal level focus group sessions or similar community based disaster risk management forums. Moreover, this research proposes the collection of descriptive data and statistics under a well-defined metric as

opposed to pure quantification of data based on GDP to give a sense of the underlying dynamics as to how the society is served by different policies.

This study also attempts to show that poverty in Pakistan under the current socio-economic dynamics is being reinforced with more joining the ranks of the poor due to re-occurring climate disasters. The scale of the subsequent years of socio-economic flood damages have been more severe due to lack of disaster risk management of the economy and its weak economic resiliency.

This study also hopes to be noteworthy to other countries who are faced by the twin phenomena of climate change and socio-economic vulnerability in the development process.

This study is also important because it draws empirical evidence by conducting policy level in-depth elite interviews on the one hand and detailed focus group sessions based on the poor section of the society on the other hand, in search of getting answers for the research questions. The study triangulates both the results of the interviews and focus group discussions and draws conclusions from this triangulation analysis for policy makers for dealing with the critical issues of climate change and poverty.

1.3 Brief Synopsis of the Relevant Literature

In order to set the research topic in context, this study carries out a case study research with Pakistan serving as the case study country. The main literature that was examined revolves around the main topics of the research study: climate change and socio-economic structures with implication for poverty in the development process. These topics were analysed from the discipline of economics. Compared to poverty, anthropogenic climate change has been a recent phenomenon. However much recent scholarly work has been produced using conventional economic methods (IPCC, 1990; IPCC, 2001; IPCC, 2007; IPCC, 2014; Stern, 2007; Weitzman, 2012; Weitzman, 2009; Dasgupta, 2007; Dasgupta, 2008; Dasgupta and Barrett, 2012; Tol 2004; Tol and Yohe, 2008; Nordhaus, 2006; Nordhaus, 2007; Cline, 1992) amongst others. Nevertheless limited work has been done outside the sphere of conventional approach towards understanding and dealing with climate change.

Since 1980, the multidimensional aspects of poverty embedded in the underlying socio-economic dynamics of a society have received considerable attention by the academic community (Haq, 1995; Bukhari and Haq., 2008; Ravallion, 1996, 2010, 2011, 2012; Banerjee and Dulfo, 2011; Sachs, 2005; Sen 1999; Narayan and Petesch, 2007, Collier, 2007; Narayan et al., 2000) amongst others. But limited work has been done linking climate change to these underlying socio-economic structures where poverty is argued to be a result of these unequal socio-economic structures for integrated climate change policy making in the development process. This research shows this link bringing forward empirical evidence of the reciprocal impacts of climate change and socio-economic factors in the development process and then develops a discourse on how comparative economic paradigms address this critical link, with different policy implications.

1.4 Research Question and Objectives

1.4.1 Research Questions

1. What are the impacts of socio-economic structure on climate change with implications for poverty? (Chapters 2,3(I), 5, 6 and 7)
2. What are the impacts of climate change on the socio-economic structure with implications for poverty and is there a reciprocal link between climate change and the underlying socio-economic structures? (Chapters, 2,3(I), 5, 6 and 7)
3. How does neo-classical economic paradigm address climate change and underlying socio-economic factors as opposed to competing economic paradigms towards a sustainable policy framework? (Chapters, 3(II), 5, 6 and 7)

1.4.2 Research Objectives

This research focuses on the fast changing development debate which considers various aspects of the concept of sustainability under comparative schools of economic thought. This research aims to provide pragmatic, action-oriented recommendations for addressing climate change and the socio-economic imperatives by providing comparative solutions, under its own research findings to meet the fast changing economic realities.

1.5 Research Methods

Chapter 4 explains in detail the research philosophical approach adopted under this research study which is that of critical realism and the theory of interpretation of critical hermeneutics serves as a methodological aid. Important aspects of the research methods are primarily in-depth policy level interviews and focus groups.

1.6 Defining of Key Terms

For the purpose of this study climate change means anthropogenic climate change (IPCC, 2001; IPCC, 2007). Apart from this particular term, this study uses the common definitions of all the terms used in this research. A brief explanation follows.

Anthropogenic climate change refers to the production of greenhouse gases emitted by human activity (IPCC, 2007). "Adverse effects of climate change" means changes in the physical environment or biota resulting from climate change which have significant deleterious effects on the composition, resilience or productivity of natural and managed ecosystems or on the operation of socio-economic systems or on human health and welfare (UNFCCC, 1992).

Terms such as “vulnerability” and “poverty” are given a detailed definitional exposition, as the study progresses. For the purpose of this section, the UN definition of poverty, which combines absolute and relative features and is based on a budget of basic needs for a reference household, is taken as a point of reference. Two very broad concepts of poverty are being utilized today by many statistical agencies and researchers in different parts of the world, responding to different concerns. One is the concept of absolute poverty, understood as the minimum set of resources a person needs to survive. The other is the concept of relative poverty, which is a measurement of the resources and living conditions of parts of the population in relation to others. Absolute poverty is a matter of acute deprivation, hunger, premature death and suffering¹.

For the purpose of this study, vulnerability means having a high possibility of sliding into poverty. As the research develops, the secondary and primary research results of this study show that given the socio-economic impacts of climate change, vulnerability almost often results in poverty.

¹ UNDP Human Development Report 1997

1.7 Structure of the thesis

This dissertation is structured as follows. The next chapter assesses the historical development of the economy of Pakistan with the purpose of identifying the underlying social structures to understand its socio-economic reality under a critical realist methodological approach. By studying the underlying and emerging social structures of the case study country, this chapter analyses the impacts of socio-economic factors on climate change. Chapter 3 is divided in two parts: chapter 3 (I) explores the impacts of climate change on socio-economic structures and then establishes a link between the twin phenomena by drawing on the extent of their reciprocity with implications for poverty; and, chapter 3 (II) brings forward an analysis of sustainable development under neo-classical and competing economic paradigms to find comparative solutions towards a climate resilient sustainable solutions. Chapter 4 explains the methodology developed and implemented under this study to evaluate and analyse the research questions in a reliable and valid manner. Chapters 5 and 6 present the empirical results of the fieldwork conducted under this research study. Chapter 7 valuates the primary data analysis through triangulation of the focus group findings with the interview findings and it then draws comparisons with its secondary data findings to present a reasonable yet provisional sustainable policy framework. Chapter 8 presents conclusions based on the findings and limitations of the study. This chapter also suggests and discusses the implications of these findings for policy, practice, theory and future research.

2 The Impacts of Social and Economic Factors on Climate Change in the Development Process – Case Study of Pakistan

2.1 Introduction

Within the broad conceptual framework of the literature review that has been attempted later, this chapter makes a modest attempt to analyse the impacts of socio-economic structure on climate change, in Pakistan. The socio-economic structure of a country is the integrated system of production relations that determines the societal pattern of productive activities. The dominant economic structure defines the character of a society and serves as its foundation as a whole. The study of socio-economic structure, which includes, the agricultural patterns and productivity levels, the industrial setup, carbon intensive energy structure amongst other socio-economic dynamics in the development process, throw light on such emerging mechanisms of the society which shape, constrain and enable socio-political action reflecting the historicity of these social structures. These emerging mechanisms can help identify the impact of socio-economic structure on climate change, with implications for poverty.

When growth was the only thing that mattered for economists, conventional wisdom maintained that it did not matter how growth is achieved for it would eventually filter down to the people (Papanek 1967; Lewis 1969). Today, progress and economic development are being rethought in the light of being sustainable, participatory and distributive. Haq's work on the human development reports for South Asia emphasises that, while economic growth is necessary for poor countries, it does not automatically lead to human development (Haq, et al. 1995; Bukhari and Haq, 2010). These economists call for a pro-active role of the state to invest in human development to ensure that the benefits from economic growth are distributed evenly.

In addition to the changing realities of economic development, the issue of global climate change has also forced economists to re-think basic assumptions embedded in the traditional economic framework. For example, Dasgupta (2007) writes: "Climate change and biodiversity losses are two phenomena that are probably not amenable to formal, quantitative economic analysis. We economists should not have pressed for what I believe is misplaced

concreteness” (Dasgupta, 2007). Likewise, Weitzman (2007) in a commentary on the *Stern Review* writes: “But in lumping together objective and subjective uncertainties and thereby obscuring their distinction...I think that contemporary macroeconomics goes too far and leads to a mind-set that too easily identifies probability (and “economic science”) with exercise in calibration to sample frequencies from past data” (Weitzman, 2007). Weitzman calls for applying the “precautionary principle” to avoid the potentially catastrophic effects of global climate change (Weitzman, 2007). Weitzman’s thesis is discussed in chapter 3(II). This change of attitude among mainstream economists who have written extensively about the economics of climate change has important policy implications for economic development as it opens up avenues for critical thinking and comparative solutions.

This chapter develops as follows. Section 2.2 provides a socio-economic overview of Pakistan’s agricultural productivity and industrial structure and how it has developed over the years since its independence in 1947 till the 1960s, with the aim of identifying theoretical issues, gaps and limitations in the underlying social processes. Section 2.3 provides the socio-economic overview and from 1960-1980s, with implications for domestic economy and ecology. Section 2.4 reviews the literature on Pakistan’s economy from 1990s onwards in context of its economic policy with implications for its ecology and overall development process. Section 2.5 briefly provides the legal framework in context of climate change. Section 2.6 concludes the chapter with a summary.

2.2 Socio-economic overview: agricultural productivity and industrial setup in a historical background

This section reviews the literature on the socio-economic transformation in Pakistan in a historical background.

2.2.1 Socio-economic structures from 1947-1960: The India Act of 1935 provided the legal framework of Pakistan until 1956 when the state of Pakistan enacted its own constitution under which Parliamentary system was established with governments at central and provisional levels (Hussain, 2004; Jones, 2002). Post 1947, Muslim League, Pakistan’s main political party, broke into factions and with its failure to hold fair general elections, which was to resonate through Pakistan’s subsequent history, eventually led to the overpowering of

civilian politics through the military coup of 1958, establishing the dominance of military and bureaucracy in Pakistan's power structure (Hussain 2004; Ali 2008; Belokrenitsky 1991).

2.2.2 The Economic Configuration: Soon after independence, Pakistan government acknowledged the unstable nature of Pakistan's economy. In its Statement of Industrial Policy of April 1948, the government identified areas and formulated economic strategies that would need to be given urgent attention. The emphasis was to manufacture in its own territories, the products of its raw materials especially jute, cotton, hides and skin for which there is an assured market at home and abroad (Khan, 1985). Development of consumer goods industry was also promoted to reduce dependence on imports. The main feature of the 1950s was the attempt to expand large scale manufacturing sector. However agriculture stagnated to the extent that its growth rate was not enough to cope with the growth in population resulting in a fall in per capita consumption of food grain and the need to import food (Faruqee 1995; Zaidi, 2005). With 65 percent of the labour force employed in agriculture and more than 75 percent of the population living in rural areas, during the 1950s, the effect of stagnating agriculture was, the restriction of further growth rates in the manufacturing sector (Khan, 1985).

In September 1949, the pound sterling was devalued as well as currencies of numerous countries, including India – Pakistan's main trading partner. Pakistan did not devalue its currency, the consequence of which was that it sold raw jute at a higher price and could import machinery and capital goods at affordable prices (Ali, 2004). The Korean War broke out in 1950, with fears of World War III, so that the countries started stock piling raw materials and as the demand for these increased, so did the price (Ali, 2004; Zaidi, 2005). Jute and cotton were in increased demand and Pakistan made great profits on its exports. Pakistan could now diversify into new markets as opposed to its traditional markets of Britain and India. However after the Korean boom, in 1952, prices of raw materials began to decline but Pakistan was too slow to react and old policies continued nevertheless (Zaidi, 2005). With a high exchange rate, Pakistan faced a serious balance of payments crises and sharply falling reserves. The government did not devalue the rupee instead it imposed very strict exchange controls. With control imposed on imports especially on consumer goods, the prices of these goods increased sharply in the domestic market which changed the term of trade in favor of consumer product industry (Lewis, 1969). Hence, traders with their amassed wealth made

from the Korean boom converted their merchant capital to industrial capital, starting the process of industrialization in Pakistan (Lewis, 1969; Zaidi, 2005; Ali, 2004).

Through their substantial impact on relative prices, these exchange rate controls speeded the process of structural change both by imposing the inducement to invest in various industries and by transferring substantial amounts of income to industrialists who reinvested them in the now profitable manufacturing sector (Lewis, 1969). These protective policies led to a certain kind of import substituting industrialization where the emphasis was on light industry consumer goods instead of heavy industry capital goods. Consumer goods were encouraged because there was a relatively protected market for them and there was a relatively cheap source of imported capital goods and raw materials on which to base the production of the consumer goods. Consumer goods industries that develop under such dynamics, have heavy dependence on imported capital supplies leading to little incentive to developing domestic capital goods industry, to serve the consumer goods industry, as has been the case of Pakistan (Lewis, 1969). Henceforth, a group of industrial entrepreneurs who were supported in various ways through protective policies, liberal assistance and easy availability of foreign exchange for import of machinery and generous tax concessions, by the government, emerged playing a prominent role in the development of large scale industry based on consumer goods (Papanek, 1967; Lewis, 1969). In Pakistan therefore, in sharp contrast to India the light industry option was exercised with apparently better results in terms of realized growth rates (Naqvi, 2002). However exercising this option as opposed to undertaking investment in heavy industries to pursue domestic capital goods production, as India did, Pakistan has now much weaker fundamentals that is a significantly less diversified industrial sector compared to that what India has been able to achieve (Naqvi, 2002).

Agricultural activity stagnated in Pakistan during the 1950s which led to food imports and the resultant restriction of growth rates in the manufacturing sector. The annual growth rate in agriculture between 1949-1958 was just 1.43 percent, less than half of the annual growth rate in population, due to the reason that the ruling elite at the time believed in the need to industrialize at any cost, hence the bias in their policies emerged towards agriculture (Khan, 1985).

The application of technology is crucial to solving the agricultural food problem which requires major public investment in farmer's education, innovative agricultural research,

improving irrigation techniques and investments in institutional as well as physical infrastructures (Parikh and Thorbecke, 1996). Green Revolution is often seen in this regard as a successful strategy – a shift from traditional resource base to modern science based agriculture. In case of Pakistan, an important question arises concerning the impact of the Green Revolution of the 1960s on the country's ecology and economy. This will be expanded upon, in the next section. But it suffices to mention here that introducing any new agricultural technology into an inequitable social system cannot eliminate poverty because it is monopolised by large farmers and landlords, who have the financial capacity and access to new information (Rosset, Collin and Lapp, 2000). According to World Bank 1986 study of world hunger, a rapid increase in food production does not necessarily result in food security – that is less hunger. Current hunger can only be alleviated by redistributing purchasing power and resources towards those who are undernourished because if the poor do not have the money to buy the food, increased production is not going to help them (World Bank, 1986). Moreover, if the technology in question destroys the very basis for future production by degrading the soil nutrient cycle which undermines the regenerative capacities of the ecosystem, it becomes both economically and ecologically unsustainable (Ali and Byerlee, 2000). Although overall output of crops has increased in Pakistan what is alarming is that the rate of increase which is the average annual growth rate of major crops has fallen, since 1980 (Pakistan Economic Survey, 1992). According to the World Bank Rural Development Report (2000), the introduction of green revolution technologies in wheat and rice production in Pakistan's Punjab province reversed the country's food crisis and stimulated rapid industrial and economic growth. But resource degradation through intensification, mono-cropping and mismanagement of water resources has offset much of the productivity gains of the then technological change, revealing the unsustainable nature of the Green Revolution (World Bank, 2000).

2.2.3 Effects of Agricultural Pricing Policy and Labour Market Segmentation on Economic Productivity

Pricing policy of agricultural inputs and outputs can determine the direction of agricultural productivity, industrial productivity, exports and income distribution. In Pakistan agricultural prices have been used by various governments for meeting their own political purposes (Khan, 1985; Zaidi, 2005; Zaidi, 2004). A comprehensive report by the National Commission of Agriculture of the first two decades following 1947, concluded that agriculture was seen as a medium to subsidize industrial production and urban consumers (NCA, 1988). The aim was

to provide low cost food to the urban consumers, to provide cheap raw materials for the domestic industries, to keep wages of industrial workers low by supplying cheap food and to transfer resources from agriculture to the urban sector for investment in industries. These policies were not focused on improving agricultural productivity sustainably (Faruqee, 1995).

Another trend during the 1950 was that large scale industries with high capital intensity were promoted at the stage in which labour supply was relatively abundant, resulting in differentials in labour productivity and the wage rate (Ahmed and Rashid, 1982). In Pakistan, government protectionist activities to promote the large scale industry at the expense of agriculture resulted in incorrect relative factor prices that did not reflect fundamental relative economic scarcities. Capital has been subsidised and therefore under-priced for large scale industries while labour has been overpriced which led to the adoption of inappropriate technologies (Viqar and Amjad, 1984). In the formal sector consisting of medium to large industrial enterprises and government agencies, stable employment is possible and the wage rates are high since workers are protected by labour laws. However entry to this sector is closed to labourers from the informal sector who earn subsistence as employees in small enterprises, as casual day labourers on a daily employment contract, as petty traders and/or as self-employed manufacturers on a small scale (Viqar and Amjad, 1982). The income gap therefore tends to widen cumulatively between these two sectors. Government intervention has not been forthcoming to support and integrate small enterprises from the informal sector into formal economic activity through appropriate policy measures. These measures include less stringent access to financial resources, diffusion of appropriate technologies to facilitate economies of scale and provision of technical and managerial knowhow, including market information to reduce segmentation of the labour market between the formal and informal sectors (Naqvi, 2002).

2.3 Pakistan during the 1960s and 1980s

Economists and social scientists, who have analysed Gen. Ayub Khan's era during 1960s generally agree that considerable economic growth did take place and significant increases were brought about in industrial and agriculture production where growth rates in excess of 20 percent per annum were observed in the large scale manufacturing sector (Hussain 2004).

2.3.1 The Nature of the Economy: The government's presence was everywhere directing and encouraging the private sector and market (Lewis, 1969). A series of liberal trade policies were introduced to facilitate import liberalization – a step away from the earlier regime's import substitution. This was in an attempt to encourage private sector to invest and exporters to acquire additional foreign exchange by exporting more. The bias against producing machinery locally continued as the import duty on these goods was still the lowest making it easier to import these goods rather than produce them at home. The government through a range of protection measures and concessions in the sixties, enabled the emerging industrial elite to make large rupee profits from domestic and export sales without the market pressure to diversify into high value added industries to achieve international competitiveness (Hussain, 2004; Lewis, 1969). This set the basis for Pakistan's narrow export base that remains till today.

2.3.2 The Economic and Ecological Effects of the Green Revolution

Between 1960-1970, the expanded irrigation facilities were supplanted by high yielding variety (HYV) seeds, chemical fertilizers and pesticides, resulting in increased agricultural output and production. It is important to emphasize that the key variable that established the very spread of the Green Revolution technology, was none other than the timely availability of a sufficient quantity of water (Ali and Byerlee, 2000). The increase in the availability of water through tubewells or canals was estimated to be responsible for half of the total increase in output. Since the HYV seeds required large sources of water, the areas in Pakistan that had better irrigation facilities were the only beneficiaries of these seeds. This means that only a few districts in Punjab gained almost all of the benefits of the Green Revolution as opposed to the rest of the Punjab, Sind, Baluchistan and NWFP which caused interregional disparities (Khan, 1986). In the pre Green revolution period, the poor tenant relied on the landlord simply for the use of the land but used the government's water and his own seeds and animal manure. In the post Green Revolution period however since the power of the landlord increased, the peasant began to rely on the landlord for the purchase of inputs such as the HYV seeds, chemical fertilizers, pesticides, credit and the landlord's tubewell water for a seasonably flexible supply of irrigation which intensified the peasant's dependence on the landlord. At the same time due to the reduction in his operated area, the tenant was required to complement his income by working as a wage labourer (Hussein et al. 2003, cited in Zaidi 2005). This phenomenon persists today. So even though the economic growth rates during

the 1960s were recorded as high, the economic development was not sustainable as poverty due to socio-economic inequality got deeply entrenched within the country.

Overall agricultural land that is being used in Pakistan today is being used below its productive capacity, resulting in less than optimum output (Ali and Byerlee; 2000). The factors effecting land productivity are waterlogging and salinity, flooding, water erosion and wind erosion. Of the total cropped area in Pakistan, which includes area sown more than once, of 22.15 million hectares, 18.04 million hectares or 81 percent, is dependent on irrigation primarily through canals and tubewells, showing the importance of a good irrigation system to Pakistan's economy (Ali and Byerlee, 2000). For example, surveys have shown that three-fourths of the tubewells provide brackish water which is unfit or marginally fit for agriculture, resulting in salinity². Crop yields are reduced by one-third for crops grown on slightly saline areas and yields on moderately affected areas are reduced by almost two-thirds. Crop production of any kind is difficult on highly saline soils (World Bank, 2002). Salinity in much of Sindh province is destroying potentially good quality land and is also affecting rural housing. Furthermore, waterlogging is a function of a faulty water rate system which the conglomeration of big landlords and bureaucrats do not allow to be changed. Underpricing of water and the complicated system of assessing water rate liability eliminates incentives to use water efficiently thus aggravating waterlogging and salinity (WB Report, 2002). Capital intensive agricultural practices facilitated by factor price distortions lead to the adoption of production methods that do not reflect factor endowments, displacing labour. The indiscriminate use of fertilizers and pesticides on Pakistan's irrigated agriculture has expanded rapidly since 1960s. Dangerous pesticides on cotton crop which is Pakistan's main export, have caused hazardous health problems, including contamination of workers (who apply it mostly without protective clothing), harvesters (who are mostly women) and consumers (of these agricultural products). The evidence of this outcome is confirmed in blood test reports of cotton workers in Pakistan (Ilyas,1996).

The deterioration in the physical integrity of the irrigation and drainage system and quality of soil has become the single most important threat to the sustainability of agricultural growth in Pakistan (Khan 1997). The quantitative enhancement of water resources was a major priority of mainly private investment during the development process of the 1960s, along with an

² A study by Dubash, N.K. (2001) done in Gujrat India, challenges homogenous market based reforms, as a cure for ground water allocation and agrarian growth under the emergent capitalist production and exchange relations.

increase in private tubewells signifying timely availability of water, largely because of the Green Revolution, as part of the elite farmer strategy (Ali and Byerlee, 2000). The study carried out by Ali and Byerlee (2000), concluded that the overall soil and water quality in the province of Punjab has deteriorated in the post Green Revolution period. In recent years the irrigation system in Pakistan has weakened and a water crisis has emerged. A 1994 World Bank study revealed that the delivery efficiency of the canal irrigation system – from canal head to the root zone of crops – has decreased to 35-40 percent suggesting that substantial water is being lost due to canal seepage, spillage, breaches and watercourse losses. This phenomenon not only means less water for farmers especially towards the tail end of the watercourse but it also intensifies the problems of waterlogging and salinity. Pakistan does not have adequate reservoir capacity in its irrigation system to store water at peak flows where the country's rivers are highly seasonal with 85 percent of annual flows in the summer. Although a large irrigation structure exists, Pakistan does not have a drainage system proportionate to the size of the irrigation network which leads to rising water table further aggravating waterlogging and salinity (Ahmed and Rashid 1982; Pervez, 1997). Increased water table also leads to degradation of land and the destruction of lakes. This situation is aggravated by the inequality of power based on private property and privilege, with large landowners attempting to dominate the rural area, misappropriating a large share of water which they are not entitled to (Simms, 1988).

During early 1970s, with the change of the political regime, the first stage of nationalization took place in the large scale manufacturing sector, essentially in the capital goods industry and the second stage of nationalization took over the vegetable oil sector, cotton ginning and rice milling. This was followed by the nationalization of banks and insurance companies (Burki, 1980). Although land reforms were introduced, with the availability of credit to the small farmers, feudalism remained unshaken to the disappointment of the poor because the land reforms introduced only decreased the individual landholding under one feudal who dealt with it, by transferring extra holdings in, for example, a relative's name (Ali, 2008).

The loss of East Pakistan's market meant that Pakistan had to find new markets for its products. The devaluation of the Pakistani rupee in 1972 brought about positive outcome initially with very high export rate (Burki, 1980). Agricultural output also rose due to the higher support prices for major crops and timely and adequate supply of essential inputs (Viqar and Amjad, 1984). During the 1960s, agricultural growth and the Green Revolution

played a critical role in the development of small scale industrial sector particularly agricultural engineering in the Punjab. During this period of increasing farm incomes, other farm activities such as ploughing and threshing also started to get mechanized and it contributed to the overall increase in cropping intensity (Burki, 1980). During 1973, Pakistan suffered from floods due to excessive and prolonged monsoons which played havoc not only with the agricultural production but also with industry and exports, in which the crops were severely damaged, resulting in low output. The world recession after 1974 resulted in dismal growth rates and high rates of inflation, ever experienced in Pakistan (Pakistan Bureau of Statistic, 2016). The reason for this inflation was the large increase in the prices of imports following the oil price rise in 1973 which resulted in inflation close to 30 percent by 1973-74. The oil price rise had begun to effect growth gains from devaluation and exports, which wiped out the positive balance of trade from 1972-73 and economic growth remained slow for the rest of 1970s. However, socio-economic inequality reduced despite decreased growth rates (Amjad and Kemal, 1999).

The GDP growth rates of 7 percent on average per annum during 1980-88 in Pakistan were exceeded only by that of Korea, China and Hong Kong (World Bank Report 1990). The industrial policy focused on restoring private business confidence to revive investment in agriculture and industry. Denationalisation of a number of agro-based industries (rice husking, flour milling, cotton gining); various small engineering units; and a number of heavy chemical and cement industries, was carried out along with easing of government regulations in favour of private businesses. By not denationalising on a large scale, the government during the 1980s, did not alienate those groups and classes which had benefitted from nationalisation by seeking employment in the sector - this group largely comprised of the urban middle class. Agricultural structure was a continuation of the mechanisms set down during the 1960s (Zaidi, 2005).

2.4 Socio-economic structures: overview of the Pakistan economy from 1990 onwards

Since the 1990s, it became evident that the governments in Pakistan were willing to adhere to the Washington consensus with drastic results for the socioeconomic dynamics of the country (Khan, 1999; Khan et. al. 2011; Foster, et. al. 2001), under the Structural Adjustment Programs (SAP).

2.4.1 Socio-economic impact of SAP with implications for poverty

Until recently, the Bretton Wood institutions as well as a number of economists had assumed that growth trickles down to the poor, and exclusive reliance on growth was sufficient for a reduction in poverty. Therefore, Structural Adjustment and Stabilisation Programmes (SAP) that aimed at improving the efficiency levels and higher growth rates were pursued without worrying about poverty (Kemal, 2003). The conclusion that growth was sufficient for a reduction in poverty was supported by Dollar and Kraay (2001), who found unitary elasticity of poverty with respect to growth (Dollar and Kraay, 2001). However, this has been contested and Foster et al., (2001) show much lower elasticity of poverty reduction to growth, the impact of growth on poverty turns out to be negligible (Foster et al., 2001).

Pakistan's economic experience of the 1960s and the 1970s as assessed above does not support the trickle-down theory. Despite high growth in the 1960s, poverty increased, and the slowing down of growth in the 1970s was accompanied by a sharp reduction in poverty (Amjad and Kemal 1997). Since 1990, Pakistan has implemented various Structural Adjustment and Stabilisation Programmes (SAP) with varying degrees of implementation and success.

2.4.2 Macroeconomic policies as part of SAP

Macroeconomic policies not only impact the growth rate by improving the levels of efficiency but also the distribution of income and thus lead to socio economic stability and reduction in poverty levels. Macroeconomic policies pursued in Pakistan during the 1990s onwards have been influenced by the various structural adjustment and stabilisation (SAP) programmes. These policies include, fiscal policy; monetary policy; trade policy; exchange rate policy; investment policy; and privatisation policy. SAP primarily includes, rationalisation of the tariff structure; import liberalisation; broadening the sales tax net; rationalisation of government expenditures including a reduction in subsidies; deregulation of investments and foreign exchange; financial reforms; restructuring of public utilities; and divestiture of public assets (Anwar, 1996). A number of studies, including Khan and Nadeem-ul-Haq (1990); Cooper (1992); Corbo and Suh (1992); Jain and Bongartz (1994); Sachs and Warner (1995); Banuri, Khan, and Mahmood (1997); FitzGerald and Mavzotas (1997), FitzGerald and Perosino (1999); Pasha, Stubbs, and Clarke (1995); and IEA volume edited by Mahmud (2001) have examined the impact of SAP on the economy and largely

provide evidence that SAP policies adversely affect socio-economic structures reinforcing poverty (Kemal, 2003).

IMF sponsored SAP refer to a set of measures that countries need to implement in order to qualify for loans from these agencies. These measures include:

- 1) Privatization of government owned enterprises and government-provided services.
- 2) Reduction in government spending.
- 3) Orientation of economies for the promotion of exports.
- 4) Liberalization of trade and reduction of tariffs for imports.
- 5) Increase in interest rates.
- 6) Elimination of state subsidies on consumer items such as foods, fuel and medications.
- 7) Taxation increase.
- 8) Currency devaluation and control of monetary supply.

Regarding fiscal policy, one of the most stringent conditionalities of the SAP loans is that government should reduce the budget deficit through suitable demand management policies and by specific reforms aimed at cutting public expenditures. Curtailing public expenditure invariably translates into cuts in agricultural subsidies and in expenditure on social sectors (Kemal, 2003). These expenditure cuts are likely to adversely affect the poorer sections of society, as do wage restraints, general sales tax and increases in utility charges, which are also recommended by SAP. In a country like Pakistan, where the government is the largest employer, a reduction in government expenditure immediately translates into government office related redundancies. The imposition of greater taxes on the business community also tends to lead to large scale laying off of industrial workers. Inflation, the withdrawal of subsidies and consequently, higher food prices in urban areas and greater unemployment are all part and parcel of SAP (Khan, 1999).

With regard to monetary policies, there have been major reforms, under SAP, in the financial sector including the State Bank of Pakistan. These include market-based instruments to control the money supply and auctioning of the government securities through bids and changes in the regulatory capacity of the State Bank of Pakistan (Kemal, 2003). Despite excess liquidity with the banks, credit to private sector has been constrained. This is because of the reluctance of the banks to take risk and the lack of demand on the part of private investors. Private investment especially in the manufacturing sector and credit availability are

significantly related (Khan, 1996; Kemal; 1989). The liquidity in the system instead of financing real investment has flowed to stock exchange and the real estate.

The exchange rate has been floated, under SAP, to bring about equilibrium in the balance of payments. Due to financial and economic deregulation, there has been an increase in the degree of openness of the economy. With the increase in the balance of payments deficit there has been an increase in the rate of inflation, which has remained high since 1990s. The result was a devalued rupee with inflationary tendencies (Bhutta, 2001). Post 2001, due to the sharp increase in remittances and capital inflows, Pakistani rupee tended to appreciate.

Haq (1995) is particularly critical of the increased financial burden placed on South Asian nations through debt restructuring packages and structural adjustment programmes (Haq, 1995). Siddiqui and Malik (2001) found that debt accumulation was a major factor in the decline of Pakistan's relative economic position in the 1990s (Siddiqui and Malik, 2001). They support increased investment in social capital, education, and health care as a way to promote well-being and as a means of increasing the labour productivity, and thus the wages, Khan (1999) argues that in many cases, the positive effect of SAP imposed on developing nations have been exaggerated. Like Haq, he argues that the state must play a strong role in the development process and that development would have progressed faster if multilateral organisations had not been involved (Khan, 1999). He favours a regional approach which is also supported by Kardar (2003) (Kardar, 2003).

Macro-economic issues, such as investment and privatisation policies under of SAP have been impacted by liberalisation of the economy and deregulation of finance. These policies are discussed under sectoral impact analysis, in chapter 5. Pakistan's trade policy is discussed under implications of SAP in context of climate change, in the next section.

The following section analyses critical macro-economic variables under the above mentioned macroeconomic policies, affected by SAP.

2.4.3 The impact of SAP on strategic macro-economic variables

1) Savings and Investments

Domestic savings and foreign capital imports are the two main sources of domestic capital formation for a developing economy. However, in Pakistan like other developing countries, the net capital import from abroad in the form of, loans under SAP, represents a possible escape from the vicious circle of slow economic growth by artificially bridging the gap between domestic investment and savings (Zaidi, 2005; Naqvi, 2002). In theory, if the borrowed funds (like borrowed technology) are utilized to gain economic efficiency, for example, through installing sustainable production facilities, the commodities produced would contribute to decreased imports and increased exports (List, 1966; Shafaeddin, 1998). South Korea borrowed heavily during its development process but the foreign loans did not accumulate because its exports increased faster due to the expansion of its value added manufactured commodities amongst other favourable domestic policies (Hayami and Godo, 2002). So, domestic income was augmented by external finance resulting in increased value added production and export capacity, for earning sufficient foreign exchange to meet increased debt services (Hayami and Godo, 2002; Kim, 1994). In Pakistan, the net capital inflow, in the form of loans under SAP, failed to close the domestic Investment-Savings gap, due to the mismanaged socio-economic policies, inflationary pressures and asymmetric monetary transfers from deficit country to surplus country in terms of high debt servicing (Anwar, 2004; Naqvi, 2002; World Bank, 2007). Table 1 shows the structure of savings and investment since 2008.

Table 1: Structure of Savings and Investment

Structure of Savings and Investment (As Percent of GDP)										
Description	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15 P		
Total Investment	19.21	17.55	15.8	14.11	15.08	14.96	14.98	15.12		
Changes in Stock	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6		
Grossed Fixed Investment	17.61	15.9	14.2	12.51	13.48	13.36	13.38	13.52		
Public Investment	4.8	4.3	3.7	3.2	3.75	3.52	3.36	3.86		
Private Investment	12.8	11.7	10.5	9.3	9.73	9.84	10.03	9.66		
Foreign Savings	8.16	5.51	2.22	-0.1	2.07	1.08	1.28	0.6		
National Savings	11	12	13.6	14.2	13	13.9	13.7	14.5		
Domestic Savings	9.1	9.4	9.8	9.7	7.84	8.7	8	8.4		

Source: EA Wing Calculations P: Provisional

b) Growth rate of GDP

Shahrukh Rafi Khan (2007) in his analytical study brought about a comparison between economic performance under the political governments of the 1990s and that of the military regime from 1999 till 2006. The tenure of the military government coincides with good economic performance in terms of high GDP growth. The rapid growth in worker remittances and debt relief, enabled the building of robust foreign exchange reserves of over \$10 billion

in December 2005 from \$2.4 billion in December 1999 (Khan, 2007). However, the performance of the political governments during the early half of 1990s, at least in terms of the economic growth attained, was close to that of the military government. For example, public infrastructure construction such as installed electricity capacity, telephone and cable connections, new roads which were built, had a higher growth rate under the political governments. The stock market capitalization improved under the military government. Public sector management during the military government was dismal (Khan, 2007). The average annual power and distribution losses from 1999-2004, had increased to 25.73 per cent of total output, relative to 23.0 per cent during the political governments. Containing the inflation rate to an average of 6.53 per cent, compared to an average of 10.24 per cent during the political government, could be viewed as a notable achievement of the military government (Khan, 2007). In terms of agriculture, at the macroeconomic level the basic thrust of SAP in Pakistan has been to improve its balance of payment position by improving exports of cash crops, closure of public sector industries and removal of subsidies on food items and utilities.

Since 2008 onwards, the GDP growth rate has declined with a trend towards lower contribution of sectoral performance to the GDP growth, as shown in table, 2 below. GDP growth in Pakistan increased to 4.24 percent in 2014-15 against the growth of 4.03 percent recorded for 2013-14 (Pakistan Economic Survey, 2015).

Table 2: Sectoral contribution to GDP Growth

Sectoral Contribution to the GDP growth		(% Points)							
		2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15 P
Agriculture		0.41	0.76	0.05	0.43	0.79	0.58	0.58	0.61
Industry		1.81	-1.15	0.71	0.95	0.54	0.13	0.91	0.74
Manufacturing		0.87	-0.6	0.19	0.34	0.28	0.61	0.6	0.43
Services		2.77	0.75	1.81	2.24	2.51	2.95	2.54	2.89
Real GDP (fc)		4.99	0.36	2.58	3.62	3.84	3.65	4.03	4.24

Source: Pakistan Bureau of Statics

The above table reveals that agriculture primarily has not performed well since 2008. As emphasized earlier in the chapter, agriculture performs a double role in Pakistan's development by feeding the population and supporting economic growth by providing the essential raw materials for the industry. It also provides the major share of primary exports. It is also the major source of foreign exchange earnings for the country. It accounts for 20.88 percent of GDP and 43.5 percent of employment. The sector has direct and indirect linkages

with other sector of the economy and therefore plays a significant role in socio-economic development of the country. Apart from agricultural policies under SAP, climate related events have also adversely affected agriculture's performance especially since 2010. Sectoral performance is analysed in detail in Chapter 5.

c) Taxation and Balance of payments

The nature of the taxation strategy has been to accumulate revenue through sales tax and other indirect taxes, augmenting the regressivity of the tax system, without a significant widening of the tax base. Between the period of 1994-97, this source of taxation fetched the government Rs. 140 billion (Zaidi, 2005). The single most devastating factor for increased income and wealth inequalities in Pakistan remains the regressive tax system. Incidence of tax on the poor in the last 10 years has increased substantially (by about 35 per cent), (Bukhari and Haq., 2008). Furthermore, selling off, of state owned enterprises for facilitating privatization resulted in vast number of public sector redundancies. The administrative prices of utilities such as gas, electricity and petroleum products have been raised continuously along with incessant devaluation of Pakistani rupee as part of the SAP policy and together their cumulative implementation has fuelled inflation throughout the 1990s (Khan, 2007). It is important to stress here that subsidies that were critical to the consumption pattern of the poor have been cut while the indirect taxes on the poorest income groups have increased (Bhutta, 2001). Removal of non-tariff barriers, tariff rationalisation, and the exchange rates under SAP carry implications for exports and imports. Post 9/11, due to access to European markets, Pakistan's export activity through concentration in the primary sector (agriculture, forestry, mining) picked up. Due to a decline in the domestic investment levels and low levels of manufacturing activity, imports fell by 9.9 percent resulting in a sharp reduction in trade deficit to \$360 million. Simultaneously, because of a sharp increase in remittances, there was an increase in the foreign exchange accounts, such that the balance of payments deficit turned into a surplus of about \$1428 million (Kemal, 2003). During the 1990 and 2000s, the country received increased remittances by the members of the Pakistani diaspora, foreign direct investment and capital raised in international financial markets (Hussain, 2004). Table 3 shows the trajectory of remittances received from different countries from 2007-08 onwards.

Table 3: Country Wise Workers' Remittances

Country Wise Workers' Remittances US\$ Million									
Country	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	July-April*
USA	1762.03	1735.87	1771.19	2068.67	2334.47	2186.24	2467.65	2105.49	
U.K	458.87	605.59	876.38	1199.67	1521.1	1946.01	2180.23	1845.3	
Saudi Arabia	1251.32	1559.56	1917.66	2670.07	3687	4104.73	4729.43	4565.42	
U.A.E	1,090.30	1,688.59	2,038.52	2,597.74	28,48.86	2,750.17	3109.52	3,384.30	
Other GCC Countries	983.39	1202.65	1237.86	1306.18	1495	1607.88	1860.03	1751.22	
EU Countries	176.64	247.66	252.21	354.76	364.79	357.37	431.85	298.89	
Other Countries	728.68	771.51	812.08	1003.88	935.4	969.26	1059	1,019.04	
Total	6,451.24	7,811.43	8,905.90	11,200.97	13,186.62	13,921.66	15837.71	14,969.66	

Source: SBP * : Provisional

This increase in capital inflows lead the State Bank of Pakistan to purchase foreign currency primarily from the increased worker's remittances resulting in an increase of foreign exchange reserves (Anwar, 2004). Increased foreign exchange reserves, is a good economic indicator but to maintain it, involves heavy cost for a developing country. Theoretically, the opportunity cost of reserve holdings is defined as *“the difference between the highest possible marginal productivity forgone from an alternative investment in fixed assets and the yield on international reserve”* (Anwar, 2004). The cost of holding reserves therefore is the investment that a nation must forego in order to accumulate reserves. Rather than accumulating increased levels of foreign exchange reserves if the government had utilised the remittances efficiently by investing in climate resilient infrastructure and human development, it would have generated employment and eased off poverty to a substantial extent (Behram, 1995). It is important to note here that accumulation of foreign reserves in many developing countries is a reflection of imbalance in the current account of the donor countries primarily the USA. The USA has a twin deficit—the current account deficit of 5% of GDP and fiscal deficit of 6% of GDP (Anwar, 2004; Varoufakis, 2015). Ironically, it is the developing countries, like Pakistan that are financing the current account deficit of USA through investment of its foreign reserves in US treasury bills at a very low rate—less than 1% and negative in real term at present. But when Pakistan, like other developing countries borrows from abroad, (US in this case), a high interest rate as a risk premium is charged. This negative spread of the interest rates implies a transfer of income from poor (deficit) to the rich (surplus) (Anwar, 2004).

d) Employment

Growth of employment is a function of the growth rate of output, composition of output and employment elasticity (Kemal, 2003). Unemployment increased from 5.9 percent in 1997-98 to 7.8 percent in 2001-02 (Pakistan Bureau of Statistics, 2016). Post 2008, the growth rate of GDP fell; the major decline has been in the manufacturing sector, which has both significant

backward and forward linkages. Therefore, employment generation in other activities have also gone down. Unemployment rate in Pakistan averaged 5.46 percent from 1985 until 2015 (Pakistan Bureau of Statistics, 2016).

Khan, et.al (2011) analysed the effect of Structural Adjustment Program (SAP) on macroeconomic variables of Pakistan using annual time series data for the years 1981-2001. The impact of four policy instruments of SAP, i.e. reduction in budget deficit, increase in indirect taxes, adjusting the exchange rate and reduction of subsidies, on employment, income distribution, per-capita income and inflation was analyzed. It is found that the first policy instrument, i.e. decrease in budget deficit has affected employment, income distribution and inflation adversely. The second policy instrument of indirect taxation negatively affected the employment, income distribution, per capita income and positively affected inflation. With regards to the third policy instrument of adjusting exchange rate has resulted in increased unemployment and inflation. The fourth policy instrument of reduction in subsidies increased unemployment, unequal distribution of income and inflation and decreased the per-capita income (Khan, et.al. 2011). This study further gives evidence that SAP has adversely affected the major socioeconomic factors of the economy.

e) Trends in poverty levels and income inequality

Providing statistical evidence, Kemal (2003), shows that public sector employment which historically is an anti-poverty measure decreased by 10 percent during 1990 to 1993 and 43.2 percent of workers previously employed in public sector were laid off. Real wages which increased by 0.7 percent during 1980-91 fell by 2 percent between 1991 and 1995. Personal income distribution which improved, between 1979-1988 worsened considerably between 1987-91 with the overall Gini coefficient increasing from 0.35 in 1987 to 0.41 in 1991 (Kemal, 2003). According to Kemal (2003), studies on income inequality in Pakistan confirm that income inequality in the period of 2000-2007 was more than in any other time period in the history of Pakistan. In 2006, the Gini Coefficient for Pakistan was 68.0 (Bukhari and Haq, 2008).

According to Khan (1999) who has tested a number of hypotheses regarding the impact of SAP as applied to Pakistan, the segment of the society worst hit by the SAP has undoubtedly been the poor (Khan, 1999). There is extensive evidence - some studies conducted by IMF and WB themselves, that SAP causes more harm to the economy especially the low income

rural groups than supposed benefits (Bhutta, 2001; Kemal, 1995). High economic growth does not determine poverty alleviation; it is the nature and distributional impacts of that growth which has specific poverty alleviating outcomes (Haq et al., 1995; Sen, 1999). Furthermore, carbon intensive industrial growth under SAP has resulted in critical levels of air pollution which has brought in its wake lethal diseases like cancer and has added to the health costs of the poor especially in rural areas who are the most vulnerable (Ilyas, 2007).

Rural poverty has been the focus of some studies because despite the decline in rural poverty, more than a quarter (28%) of rural population still lives under the poverty line (World Bank, 2007). The major factor at work in weakening the relationship between growth and poverty reduction is inequality caused by disproportionate distributional aspects of economic growth (Malik, 2005). Inequality points towards the inability of the poor to benefit from high economic growth. It has been argued that because of this unequal distribution, much of the direct gain in income from crop production accrue to higher-income farmers (World Bank, 2007). There exist significant inequalities, province wise or even district wise. In Punjab province, central and northern districts are much better off than the southern districts and therefore attract much more investment due to better physical and institutional infrastructure. This growing provincial inequality may itself act as a brake on future growth and poverty reduction (Siddiqui, 2006). If inequality between provinces and districts rises above a certain threshold, because of the nature of capital investments which are concentrated around capitalist regions, it can trigger a violent conflict in addition to the threat posed by climate change which, in turn, can lead to decades of reduced economic growth (World Bank, 2006c).

While the arguments supporting the association between long-term growth and reduction of poverty in developing countries are persuasive, the evidence supporting the benefit of SAP on reduction of poverty and socio-economic inequalities is at best tenuous (Bhutta, 2001). In particular, there are few data on the benefits of SAP on sustainable economic growth *in the long term* (Costello, Watson, Woodward, 1994). However, it must be emphasized that there is little inherently wrong in the principles that underlie SAP, and that in an ideal and equitable world the 'trickle-down' benefits of fiscal discipline and growth would be shared by the masses. The real world however is far removed from such an ideal and equitable world. Most countries targeted by the IMF, are either under autocratic rule or suffer from fragile democracies with weak institutional and social structures, as this chapter shows with its case study.

2.4.4 Socio-economic impact of SAP with implications for Climate Change

Export growth is one of the major drivers behind a country's economic growth. According to the Planning Commission of Pakistan, the country has achieved considerable success in the global markets in the recent years as measured by the growth rate of export. Through export activity, domestic market expands and jobs are created, demand is expanded, economies of scale are generated, which make possible to achieve the high growth (Planning Commission Pakistan, 2012). The World Bank has categorized trade policy of Pakistan as one of the least restrictive in South Asia (World Bank, 2007). According to the World Bank, this policy has gradually reduced the anti-export bias to strengthen exports in existing markets and explore new markets around the globe. This trade policy is complemented by a market-based exchange rate regime (World Bank, 2007). As a result of these policies, not only the exports of the country picked up, the imports also surged manifold. Total exports increased from US\$5,587 million in 1990 to US\$14,058 million in 2005 whereas total imports rose from US\$7,383 million to US\$26,296 million during the same period (World Bank, 2007). Table 4 shows Pakistan's growth in foreign trade from the year 1996 till 2005.

Table 4: Pakistan's Growth of Foreign Trade (Million US \$)

Years	Exports	Growth	Imports	Growth
1996	9299	16.37	12150	6.01
1997	8632	-7.17	11611	-4.44
1998	8433	-2.31	9308	-19.83
1999	8439	0.07	10297	10.63
2000	8870	5.11	10721	4.12
2001	9205	3.78	10165	-5.19
2002	9883	7.37	11238	10.56
2003	11929	20.70	13049	16.11
2004	13284	11.36	17756	36.07
2005	14058	5.83	26296	48.10
Source: Direction of Trade Statistics, IMF				

However, implementation of IMF's Structural Adjustment Program (SAP) has led to an oversupply of primary products and a general deterioration of prices in primary commodity markets. Beyond 2005, IMF's trade policy has remained intact (Pakistan Economic Survey, 2015). Economic activities in the primary sector are characterized by higher environmental loads as compared to other sectors, but it has implications for other economic sectors (UNEP, 1999). These primary commodities are traded on the world market at prices that do not fully reflect the amount of social and environmental costs occurring in the process of producing. Since production prices do not reflect the underlying cost structures, less restricted trade can lead to a more inefficient allocation of resources, decreasing welfare as production costs overtake export revenue (Giljum, Eisenmenger, 2004; Jorgenson and Rice, 2005). Free trade protagonists oppose this view with their main argument of trade based on comparative advantage (Bhagwati 1993; 1994; 1997). Given the limited power of developing countries on the world markets and considering the falling prices of primary commodities, revenues can only be maintained through an increase of physical export volume (Maurdian et al. 2001; Woodward, 2015). This has severe implications for the environment especially if the production is carbon intensive.

Activities in the primary sectors (such as agriculture, forestry and mining) are the most resource intensive per unit of economic output (UNEP 1999). That means that for relatively little added value, they extract large amounts of materials and generate large amounts of waste in the process of extraction and refinement. Concerning the distribution of negative environmental consequences through specialization in the world economy, physical accounting studies³ and concepts such as ecological footprints (Andersson and Lindroth, 2001), can investigate whether negative environmental consequences are disproportionately concentrated in particular world regions. Low prices for primary commodities allow industrialized countries to appropriate high amounts of biophysical resources from the peripheral economies in the South while maintaining external trade relations balanced in monetary terms (Rice, 2008). So what seems a fair exchange within the system of prices in fact masks a biophysical inequality of exchange in which one of the partners has little choice but to exploit and possibly exhaust its natural resources and to use its environment as a waste dump whereas the other partner may maintain high environment quality within its borders (Giljum and Eisenmenger, 2004). In a study carried out by Muradian et al. (2002), the emission levels embodied in physical imports and exports between the three industrialized

³ Davis, S.J., Caldeira, K. (2010) have done a comprehensive research project in this area.

core regions (the United States, western Europe and Japan) and the countries from the South were investigated between 1976 and 1994. The study found that the embodied emissions in products imported by Northern countries from the South were generally higher than in products sold by the North (Muradian et al., 2002). This gives verification for a displacement of environmental load from North to South through international trade (Reilley, Hohmann and Kane, 2001; Bunker and Ciccantell, 1999).

According to the research by Grimes and Kentor (2003) and Machado, Schaeffer and Worrell (2001), foreign capital investments in developing countries of the South is positively associated with growth in total CO₂ emissions. The above mentioned research studies reconfirm that energy intensive core production of the North is increasingly relocating to non-core countries of the South where environmental controls are less stringent (Grimes and Kentor, 2003). Sustainability concepts like the concept of environmental space explicitly stress the global equity principle, demanding a fair distribution of resource use between the inhabitants of different world regions and the maintenance of an intact global environment as the base for prospering economic development for current and future generations (Machado, Schaeffer and Worrell, 2001). Empirical evidence from biophysical accounting studies suggests that the formation of specific metabolic profiles of societies in the North and in the South, as a consequence of economic specialization, leads to an unequal environmental distribution (Parks and Roberts, 2007; Giljum and Eisenmenger, 2004). Environmental cost shifting and appropriation of environmental space contribute to processes of underdevelopment within developing countries (Rice, 2008). Underdevelopment is a result of a loss of value associated with the export of undervalued natural resources, undervalued labour and diminishing socioeconomic opportunities (Rice, 2008). The statistics in, Table 5, masks this underlying reality. If the industrialized countries continue with their increasing consumptive demands through reliance upon renewable and non-renewable resources as raw materials from the developing countries under the current system of production (analysed in detail in section 3.8 of chapter 3II)), it may very well complicate equitable movement towards sustainable development and an acceptable standard of living in the developing countries (Giljum and Eisenmenger, 2004; Rice, 2008). Sectoral share of agriculture to the GDP of Pakistan is higher than that of its industrial sector, as shown in table 5 below.

Table 5: Sectoral Share in Pakistan's Gross Domestic Product (GDP)

Sectoral Share in Gross Domestic Product (GDP)									
Sectors/ Sub-sectors	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15 P	
Commodity Producing Sector (A+B)	44	43.4	43.1	42.9	42.6	41.8	41.6	41.2	
Agriculture	21.9	22.5	22	21.7	21.6	21.4	21.2	20.9	
1. Crops	9.3	9.7	9.1	8.8	8.8	8.6	8.5	8.3	
Important Crops	5.4	5.8	5.4	5.3	5.5	5.4	5.6	5.3	
Other Crops	3.2	3.3	2.9	2.9	2.6	2.6	2.4	2.3	
Cotton Ginning	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.6	
2.-Livestock	11.6	11.8	11.9	11.9	11.9	11.9	11.8	11.8	
3.-Forestry	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	
4.-Fishing	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.4	
B. Industrial Sector	22.1	20.9	21	21.2	21	20.3	20.4	20.3	
1. Mining and Quarryng	3.3	3.2	3.2	3	3	3	2.9	2.9	
2. Manufacturing	14.4	13.8	13.6	13.4	13.2	13.4	13.4	13.3	
Large Scale	12.3	11.5	11.3	11	10.8	10.8	10.8	10.6	
Small Scale	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.7	
Slaughtering	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	
3. Electricity Generation & Distribution & Gas Distt	1.5	1.3	1.5	2.4	2.4	1.7	1.7	1.7	
4. Construction	2.8	2.5	2.7	2.4	2.4	2.3	2.4	2.4	
C. Service Sector	56	56.6	56.9	57.1	57.4	58.2	58.4	58.8	
1. Wholesale and Retail Trade	19.9	19.3	19.1	18.8	18.4	18.4	18.4	18.3	
2. Transport, Storage and Communication	12.7	13.3	13.3	13.1	13.2	13.3	13.4	13.4	
3. Finance and Insurance	3.8	3.5	3.3	3	2.9	3.1	3.1	3.1	
4. Housing Services (Ownership of Dwellings)	6.4	6.6	6.7	6.7	6.7	6.8	6.8	6.8	
5. General Government Services	5.1	5.4	5.7	6.2	6.7	7.2	7.1	7.4	
6. Other Private Services	8.1	8.6	8.9	9.1	9.4	9.5	9.7	9.9	
GDP (fc)	100	100	100	100	100	100	100	100	

Source: Pakistan Bureau of Statics

2.5 Current Legal framework in the context of Climate Change, Agriculture and Industry

In an attempt to redress the previous neglect to the nation's mounting environmental problems, the Government of Pakistan issued its National Conservation Strategy Report (NCSR) in 1992, outlining Pakistan's state of environmental health, its national level sustainability strategies and viable program options for the future within the framework of the National Conservation Goals (Hassan, 2006). Building on the Pakistan Environmental Protection Ordinance of 1983, the NCSR stipulated three goals for the country's environmental protection efforts: a) conservation of natural resources; b) promotion of sustainable development; and c) improvement of efficiency in the use and management of resources. Fourteen program areas were targeted for priority implementation, including energy efficiency improvements, renewable resource development/deployment, pollution prevention/reduction, urban waste management, institutional support of common resources, and integration of population and environmental programs. In addition, in 1993 Pakistan

applied National Environmental Quality Standards (NEQS) which was revised in 1999 to municipal and liquid industrial effluents and industrial gaseous emissions, motor vehicle exhaust, and noise (Hassan, 2006). However, attempts to legislate environmental protection have fallen short, and regulations have not been enforced strongly due to institutional failure (Alam, 2009; Faiz et al., 1992; Arif and Ali, 1993; Syed, 2005; Ministry of Environment, 2012). Chapter 5 of this research study, analyses the theme of climate change legislation in detail in the context of the research questions.

The current PML (N) government elevated the climate change division to a ministry but it has not translated into effective policy making as shown by empirical evidence brought forward by primary research of this study in chapters, 5, 6, and 7, respectively. The ministry's development budget was slashed by more than 60% as part of a wider cost-cutting strategy (Waqas, 2013). According to Alam (2010), climate change is a potent threat multiplier that will make the underlying structural problems worse, if sustainable policy making is not forthcoming (Alam, 2010). Financing for climate change and development policy implementation is a serious challenge for developing countries. Chapter 7 of this study presents a sustainable policy framework for Pakistan, based on its data, in which the method for financing for climate change projects as part of the overall development policy framework, is suggested. After the passage of the 18th amendment to Pakistan's constitution in 2010, by the previous PPP parliament, issues such as environment, food and agriculture were delegated to the provinces (Ebrahim, 2015). The government allocated a total of Rs.58.8 million (US\$586,000) in 2014-15 to combat climate change compared to Rs.135 million (US\$1.3 million) in 2012-13 (Alam, 2010). This approach is strongly criticised by climate scientists and experts as well as those working on climate related issues in the country because it does not reflect the tremendous scale of challenge posed by climate change to the country (Ebrahim, 2015). These themes, i.e., climate change policy making and sustainable development legislation, are further analysed in light of the research questions in the primary research chapters. In agriculture, apart from SAP led changes, following have served as important, agriculture policy documents since 1988 (Malik, 2015):

- Report of the National Commission on Agriculture (NCA) 1988
- Pakistan Agricultural Policy 1991
- The Agricultural Perspective and Policy 2004
- National Food Security and Agriculture Policy 2013

Regarding industrial legislation, as shown in this chapter, five distinct industrial policy approaches have left a lasting impression on the underlying structure of industry in the country. The *first* was made in 1948; the *second* was embedded in the Second (1960-65) and Third (1965-70) Five year Development Plans; the *third* was to nationalize large scale industries with an increased presence of the public sector in industry and finance; the *fourth* was formulated by the several democratic governments under various Structural Adjustment Programs. However, an important policy initiative of this period during 1998 was the establishment of the Small and Medium Enterprise Development Authority, the SMEDA (Burki, 2008), to facilitate the development of indigenous small and medium-sized enterprises. These themes are further analysed in Chapter 5. The *fifth* was adopted by the government of President Pervez Musharraf, under SAP, where the pace of privatization quickened further as did financial deregulation. This dematerialisation of capital corroborates with the findings of the analysis of capital as a system in section 3.7 of the literature review. The current government is also following SAP program under IMF.

2.6 Conclusion

Evidence from this chapter shows that given the dominant socio-economic structure, natural resources primarily land and water, have been degraded by prolonged misuse, misappropriation and misguided socio-economic practices. Apart from having consequences for the economy, the socio-economic structure which drives the integrated system of production relations in a society impacts climate change through resource degradation and increased carbon emission levels. For example, the rich soil of the Indus Basin has been experiencing water logging and salinity due to misguided socio-economic processes and practices over decades, as shown in this chapter, which has led to the undermining of the soil nutrient cycle. Undermining of the soil nutrient cycle, as shown in section 3.7 of the literature review, compromises the regenerative capacities of the ecosystem, as a whole. It is the restoration of the soil metabolism that ensures ecological and economic sustainability for generations to come. Similarly other misguided macro-economic policies as discussed in this chapter under various regimes have had the impact of intensifying resource degradation.

The evidence builds up in the next chapter with Pakistan's industrial environmental problems which are categorized in four main groups: industrial wastewater pollution, motor vehicle

emissions, urban and industrial air pollution, and marine and coastal zone pollution. Some of the waste is biodegradable, but much of it is in the form of chemical compounds that do not degrade and cause damage to environment (UNIDO, 2000). Although data are scarce, it is clear that the socio-economic policies driving carbon intensive industrialisation and urbanisation are not only increasing at a very rapid pace under the dominant socio-economic structure but also that the impact on the ecology is significant.

Where this chapter analysed the impacts of Pakistan's socio-economic structure on climate change, the next chapter analyses the impacts of climate change on the socio-economic structure, with implications for poverty.

3 3(I) The Impacts of Climate Change on Socio-Economic Structures with Implication for Poverty

3.1 Introduction

Though vulnerability differs substantially across regions, it is recognized that "... even within regions... impacts, adaptive capacity and vulnerability will vary" (IPCC 2001). Handmer et. al., (1999) posit that many regions and countries will be capable of adapting to climate change, but that poorer countries and regions will have difficulty responding to climate change. These authors argue that the study of adaptation to climate change should begin with the study of underlying social and economic vulnerability of a given region (Handmer, Dover and Downing, 1999; Gaiha and Thapa, 2006; Bohle, et al., 1994; Adger, et. al., 2003). This

argument manifests the general framework under which the research questions are conducted in this research study, in accordance with the philosophical approach of critical realism.

3.1.1 Framework used to analyse the reciprocal impacts of climate change and poverty under this study

The next section, i.e., section 3.2, of this chapter analyses the sectoral specific socio-economic impacts of climate change on key climate sensitive economic sectors for policy implications (point {i} of this framework, as set below). These key climate sensitive economic sectors are agricultural production, water, fisheries, industry, urban sector, energy and transport. Section 3.3, of this chapter presents the consequences of these socio-economic impacts on the livelihoods and vulnerabilities of the poor (point {ii} of this framework, as set below). This chapter looks at the literature on the impacts of climate change on poverty in general and also on the specific literature on the impacts of climate change on poverty in Pakistan.

Framework of the main study tools to analyse impacts of climate change on poverty

Three main strands of the literature analysing the impacts of climate change and poverty are considered for the purpose of this literature review, to answer the research questions:

- (i) studies focusing on the poverty impacts of climate change in the agricultural sector as well as other climate sensitive economic sectors. Such sector-specific impacts predict longer-term climate change effects on poverty and vice versa, the size of such impacts, the potential heterogeneity and possible magnitude of these impacts (section 3.2 of this chapter).
- (ii) studies exploring how past climate variability impacts poverty. Changes in the patterns of climatic variability are likely to add to the already high vulnerability of poor households, by exacerbating the incidence, severity and persistence of poverty in the absence of Disaster Risk Management (DRM) (section 3.3 of this chapter).
- (iii) a conceptual analysis of the assumptions underlying economy-wide computational general equilibrium (CGE) growth models analysing climate change impacts to work out consistent scenarios as to how climate change might affect growth and development and hence poverty over subsequent decades; (this aspect of impact analysis is presented in the next chapter, i.e., chapter 3(II)).

3.2 Impacts of Climate Change on Climate Sensitive Economic Sectors

On a strictly sectoral level, many economic sectors seem lucrative when conventional economic calculations are used. For example, pre-tax profit margins for iron, steel, and cement production, and for crude-oil and natural-gas extraction, range from roughly 7% to nearly 20%. But, after factoring in externalities, the global cement sector has average pre-tax losses of 67%, and crude-oil and natural-gas extraction barely breaks even (Trucost, 2013; Steiner and Maxwell, 2013). Trucost's report estimates that the top 100 environmental externalities worldwide – including natural-resource depletion, climate change, and air pollution-related health problems – cost the global economy roughly \$4.7 trillion annually (Trucost, 2013). But such losses are rarely captured in the balance sheets of the companies concerned. Rather, they are passed on to taxpayers, the poor, and, in the form of a degraded planet, to the future generations (Stiglitz, 2003). Among the sectors with the highest impact in this regard are coal-burning power plants in East Asia and North America, with externalities totalling \$453 billion and \$317 billion, respectively – higher than the value of the electricity that they produce (Steiner and Maxwell, 2013). Cattle ranching and farming in Latin America is the third most damaging sector, with losses linked to deforestation of \$354 billion – more than 20 times the value of the sector's annual output of \$17 billion (Munich Re, 2006; Trucost, 2013). Calculations for water-intensive industries, such as corn, rice, or wheat farming in dry regions like North Africa and South Asia, and for energy-intensive sectors, including cement production and iron and steel milling, are similarly sobering. Therefore, the supposedly lucrative economic sectors as mentioned above, may show profits on their balance sheets but when climate change and other non-market impacts are factored in on these balance sheets, the profits can instantly turn into actual losses (Steiner and Maxwell, 2013; Dow and Downing, 2011; Munich Re, 2006; Munich Re, 2004)⁴.

3.2.1 Climate Change Impact on Agriculture

Modern Industrial Agriculture with regards to Climate Change - Agriculture - Poverty nexus:

The main likely impacts of climate change on agriculture productivity with implications for poverty are caused by:

⁴ it is important to note the difficulties of making meaningful quantitative forecasts of the cost of externalities because of the huge number of variables.

1. Changes in temperature and precipitation;
2. Changes in the length of growing season; and
3. Changes in soil moisture and soil fertility.

Change in temperature, precipitation and changes in the length of growing season

Dell et al. (2009) use cross-sectional data from 134 countries to examine the effects of temperature on the level of GDP. Their output-climate elasticity estimate, based on historical data, reveals that each additional degree Celsius is associated with a statistically significant reduction of 8.9 percentage points of per capita GDP. The authors also provide evidence of this elasticity at the sub-national level by considering the temperature-income relationship using data at the municipal level for twelve countries in the Latin America and Caribbean region. They find a negative relationship between income and temperature when looking within countries, and even when looking within states within countries. However, they make no attempt to either simulate the impacts of the predicted temperature increase on income, or estimate its effect on poverty (Skoufias, Rabassa and Olivieri, 2011).

Influential studies, such as that by Rosenzweig & Parry (1994) have examined world food supply, food prices and the number of people at risk from hunger in developing countries, due to climate change. These studies have found that whilst developed countries are likely to experience some increase in agricultural output, developing countries suffer a decrease in the scenarios which were constructed (Hanif, 2010; Parry, M.L, Rosenzweig, C, Iglesias, et. al 2004; Rosenzweig, C., Iglesias, A., 1994; Parry, et al. 2005). But the extent to which crops respond depend on their physiology and other prevailing conditions, i.e., water availability, nutrient availability, pests and diseases. There have been criticisms of the Rosenzweig and Parry study, from those who feel that the predicted yield losses are too large, to others who have suggested that not enough attention was paid to the likelihood of adaptation by farmers (Reilly 1994). It is also important to note that the analytical framework for assessing agricultural impacts from climate change is undergoing an evolution, with large scale global modelling losing importance, as more local level studies are underway due to regional climate change impacts.

Assunção and Chein Feres (2009) provide an estimate of the poverty impacts of climate change based on cross-sectional data at the municipality level in Brazil (Assunção and Chein Feres, 2009). Their estimates suggest that global warming is expected to decrease the agricultural output per hectare in Brazil by 18 percent. However, doubling agricultural productivity reduces poverty at the municipality level by 12.8 percentage points and that poverty impacts of climate change are likely to be lower depending on the extent to which households are able to adapt by migrating across municipalities or switching sectors of employment or through other risk coping mechanisms (Assunção and Chein Feres, 2009). According to Janjua, et. al. agriculture sector of Pakistan is more vulnerable to climate change because of its geographical location with consequences for the length of the growing seasons (Janjua et al, 2010). The conclusion of another similar study confirm these findings (Shakoor, 2011).

Soil Moisture and Soil Fertility

Behind the sources of increasing greenhouse gas emissions are broader driving forces related to economic growth under capital's economic system. Industrial agriculture uses ploughing and chemical intensive monoculture instead of organic no till conservation methods. Empirical evidence shows that the intensive chemical use has destroyed natural predator insect populations and has decreased genetic diversity and natural resistance of the main commercial crop varieties. As one third of our food including fruit and vegetables require pollination, many of the natural pollinating insect populations have been damaged by industrial farming practices due to toxic chemicals (Bello, 2007; Hertel and Rosch, 2010). In the US, hives are transported over long distances to follow the pollination season and make up for the decreased population as bees abandon their hives which results in the whole colony collapsing, possibly due to parasites (Fitzroy and Papyrakis, 2010). According to Stiglitz, when farming becomes capital intensive (with farmers getting government subsidies and the overall price of land increases), it has to use heavy fertilizers which are good for mass food production but bad for the environment as they negatively affect the fragile ecosystem and they are also bad for small farmers in developing countries (Stiglitz, 2002). This finding is confirmed by studies carried out by Bernstein, 2001 and Bernstein, 2004 (Bernstein, 2001; Bernstein, 2004).

These practices are aided by policies such as the Common Agriculture Policy (CAP) of EU, which is an asymmetric trading scheme (Fitzroy and Papyrakis, 2010; Stiglitz, 2013; Stiglitz,

2002; Stiglitz, 2006). Agricultural subsidies, affect the livelihoods and food security of more than half the world's population. Furthermore, the International Financial Institutions insist that subsidies to different sectors and protection in underdeveloped countries be done away with, yet they do not follow suit within the developed countries (Stiglitz, 2002; Morris, et.al. 1992). Subsidies that wealthy countries give their farmers and agribusinesses (as opposed to what developing countries are allowed to give their farmers) are mostly classified as "non-distorting" measures, and remain high (Stiglitz, 2013; Bernstein, 2004). Due to this approach, speculation in commodity futures markets has created volatile price movements that do not reflect true changes in demand and supply (Stiglitz, 2013). This affects small producers adversely especially in developing countries, who do not benefit from price increases and lose out when prices decline with import surges. According to authors such as, Schapiro, Stiglitz and Bernstein, EU and US policy is largely designed to secure the big agribusinesses through patented seeds and other intellectual property rights at the expense of the welfare of small farmers (of the developing countries) or consumers (at home) alike (Schapiro, 2014; Stiglitz, 2006; Bernstein, 2004).

Can productivity be raised in developing countries by purchasing these patented seeds and agrochemicals from the developed countries? An emerging view in the wake of climate change is that of relying on industrial agriculture with ever more expensive fertilizers and the promise of miraculously new genetically modified varieties in a second generation of Green Revolution. According to authors like Bello, Schapiro, Dessler and Parson, this will raise the probability of a catastrophic global food supply failure (Dessler and Parson, 2006; Bello, 2007; Schapiro, 2014). It is because intensification of modern industrial agriculture on current lands and extension of industrial agriculture to marginal lands will only increase carbon loss and soil erosion aggravating climate change (Foster, 2011; Schapiro, 2014; Montgomery, 2007). The health of the soil is a neglected topic from the perspective of sustainability as it sustains agriculture and agriculture in turn sustains the whole economy (Foster, 2011). Marx's *metabolic rift framework* is employed in the next chapter to analyse this particular area to show how a metabolic rupture occurs due to mechanised large scale farming and industrialisation under capital with direct implications for climate change and poverty. David Montgomery in his book 'Dirt' explains erosion as an insidious and invisible process resulting directly from modern agricultural methods that lead to loss of topsoil- a loss that is hundred times faster than the natural rates of soil formation in problem areas (Montgomery, 2007). Decline of soil organic matter means that farmland has now become a

carbon emitter whilst losing topsoil through erosion. Industrial agriculture, food manufacturing and retailing equals 20% of carbon emissions in advanced economies (Dawson and Spannagle, 2009).

The alternative to modern agriculture's methods, such as, ploughing, monoculture and intense fertiliser usage is sustainable conservation, low till or no till methods of agriculture which leave crop residue on the surface to form a mulch or organic cover that retains moisture and protects the soil from erosion (Montgomery, 2007; Bello, 2007; Fitzroy and Papyrakis, 2010). This methodology reverses carbon loss because organic matter accumulates in the surface layer which increases carbon content and provides resistance to draught, wind and water erosion simultaneously avoiding the costs of expensive ploughing and chemical inputs. This combination of low or no till methodology and organic farming increases crop yields hence food production and it also combats climate change effectively by sequestering carbon in soil. It further reduces water demand for irrigation (Smith, 2012; Schapiro, 2014). Mechanised industrial agriculture aggravates climate change by turning the farmland into a carbon emitter (Foster, 2001; Foster, 2011). These areas of concerns for climate change and poverty under agriculture are further analysed in subsequent chapters.

Over the last few years a large body of literature has attempted to quantify the impacts of climate change on agricultural productivity at the regional as well as at the country level, as mentioned above. The general consensus emerging from this literature is that climate change will negatively affect agricultural productivity and yields, and that the impacts will vary across countries as well as within countries (Stern, 2014; IPCC, 2014).

3.2.2 Implications for the Water Sector

Increased sea-levels will bring salinisation and an intrusion of seawater into freshwater sources, flooding and loss of land, erosion, loss of wetlands and mangroves and loss of soil fertility (Schmidt and Wolfe, 2008). Changes in temperature will alter ocean circulation patterns, vertical mixing of water and wave patterns which will impact on marine

productivity, availability of nutrients and disturb the structure of marine and coastal ecosystems (Jones, 2008; Arnell, 2004; IPCC, 2001).

Marine fisheries supply an important proportion of the world food supply and represent a much greater importance for local food security in Pakistan where fish is an important source of diet. Several major ocean fisheries have already been subject to collapse and almost all of the 200 main fisheries monitored by the Food and Agriculture Organisation (FAO) are fully exploited (UNEP, 1999). Clearly it is more difficult to monitor the marine environment in the same way as crop yields can be investigated, a task further complicated by the fact that fish populations are affected by many natural factors. However weather events such as El Niño have shown how fish populations can be reduced by changing water temperature in upwelling regions (Schmidt and Wolfe, 2008). The IPCC (2007) Working Group II report predicts changes in the abundance, distribution and species composition of some fish populations, as well as the collapse of some fisheries, although the expansion of others is also a possibility (IPCC, 2007).

Critically, implications for the water sector due to climate change ultimately mean that the differences in water availability will become sharp across regions on a global scale (IPCC, 2007; Shiva, 2002; Yang, 2011). Dry areas like the Mediterranean basin and parts of South Africa and South America are likely to experience further decreases in water availability, for example some climate models predict up to 30% decrease in annual runoff in these regions for a 2 degree C global temperature rise and 40-50% for 4 degree C (Arnell, 2006a; Rosegrant et al., 2002). In contrast South Asia and parts of Northern Europe and Russia are likely to experience increases in water availability (runoff) for example, 10-20% increase for a 2 degree C temperature rise and slightly greater increases for 4 degree C, according to some studies (IPCC, 2007). These changes in the annual volume of water in different regions masks another critical element of climate change- its impact on year to year and seasonal variability. This is an important area of this research which is analysed in detail in chapter 5.

Primarily classified as an arid and semi-arid country, Pakistan has been endowed with both —surface and groundwater resources, which together cater to approximately 80 per cent of Pakistan's agricultural needs (ADB, 2009). As the Indus system has been formed by the deposition of water transported sediments of the Himalayan waters, the soil in Pakistan is naturally rich in alluvium, sediments and salts (Aftab et al., 2012). It has sufficient capacity

to store water within its layers and as a result, the plains of the Indus basin have large quantities of groundwater (Aftab et al., 2012). Due to over-exploitation of groundwater through excessive tube well usage, groundwater in Pakistan is now becoming more saline, thus adversely affecting the quality of crops (Ali and Byerlee, 2000). Pakistan's groundwater resources mainly lie in the irrigated areas of the Indus basin. It is only in the Balochistan province that groundwater resources are outside the basin. In Balochistan, monsoon rains in the summer and western rains in the winter are the source of groundwater recharge. According to Pakistan Institute for Legislative Development and Transparency (PILDAT, 2009), the total annual ground water potential in Pakistan is 56 MAF which is likely to be impacted by combined implications of climate change.

Precipitation and river flows are the two major sources of surface water that meet the agricultural needs of the country (Ali and Byerlee, 2000). While the mean annual rainfall in Pakistan varies from less than 100 mm in Balochistan and in parts of Sindh provinces, it is over 1500 mm in the foothills and northern mountains –areas in Pakistan Occupied Kashmir (PILDAT, 2009). According to a World Bank study published in 1994, the large investment in surface irrigation infrastructure has not only transformed the economy and landscape of Pakistan, but also has had a huge impact on ground water, particularly in terms of water logging (WB, 1994). Thus while there was an evident physical expansion of the irrigation system, it has had an adverse impact on the quality and equal distribution of water across and within provinces (ADB, 2009). In order to cope with these rising challenges, series of reforms in Pakistan were undertaken in the years that followed. The legal framework of Pakistan's water economy is governed by the Canal and Drainage Act, 1873; the Indus Water Treaty; Five Year Plans of Pakistan Planning Commission; and the 18th amendment to the Constitution of Pakistan. Recently, to address water issues the government of Pakistan has drafted a comprehensive National Water Policy 2016, prepared by the Water and Power Development Authority (WAPDA). This National Policy advocates an 'integrated water resource management regime' for optimal use of the country's water resources. Primary data analysis of this research brings forward, water legislations in terms of: water policy and regulations; water rights and permits; water treaties and conflict resolutions (trans-boundary and inter-provincial); water allocations, entitlements and distribution; water pricing and subsidies; and institutional mechanisms and reforms.

3.2.3 Urbanisation and Industrial Sector in context of today's climate change

Urban climates are dominated by the geometry and composition of built up surfaces and by the effects of human urban activities. The composition of the urban atmosphere is modified by the addition of aerosols, industrial gases such as sulphur dioxide and automobile exhaust fumes, all of which inhibit both incoming and outgoing radiation (Golden, 2004).

The different surfaces that make up the city modify energy availability by changing the water balance. Rain falling on urban and non-urban areas is disposed off differently (Golden, 2004). In rural areas, some of the water in building free rural surfaces is retained as soil moisture. Plants draw upon this water and eventually return the moisture back to the air through transpiration (Trenberth, 2010). At the same time, standing water and soil moisture evaporate. Both transpiration and evaporation require solar energy (Barry and Chorley, 2010). In contrast, the city surfaces: pavements and buildings prohibit entry of water into the soil with limited green grass transpiration. Most of the rain water drains off and passes into the storm sewers greatly reducing the water for evaporation (Jones, 2008). The implication of such mechanisms underlying urban structures are dire as analysed in the next chapter under Marx's metabolic rift framework presented as one of the major contradictions of capital leading to the crisis of climate change and poverty. Warming-induced evaporation causes drought in some places, while higher atmospheric water content leads to more intense downpours elsewhere, with potential to cause floods⁵ (Trenberth, 2003; Trenberth, 2010). Furthermore, a high energy carbon intensive consumption and production of the city environment means that much heat from factories, buildings and transportation systems passes to the atmosphere, intensifying the warmth. Combustion of fossil fuels causes cities to have higher air pollution levels than their rural counterparts (Golden, 2004; Jones, 2008; Trenberth, 2003).

Currently, 14 of the top 20 mega-cities are characterized as tropical or subtropical. The solar forcing can be extreme in these regions, especially at subtropical (higher latitude) regions where cloud cover is generally less. As surfaces throughout a city become hotter, overall ambient air temperatures increase in the urban regions more than that in the rural regions. This phenomenon, known as an "urban heat island" (UHI), can raise temperatures in a city from 2 degree to 8 degree F (Bornstein, 1987; Chandler, 1965, Landsberg, 1981 and Oke,

⁵ It should be noted that climate science tells us that global warming makes certain types of flooding more likely but there is no specific link between global warming and a particular flooding event.

1987 cited in Golden, 2004). This is the localized regional effect in addition to the IPCC estimates that put the potential of global warming to be +1.4 degree Celsius to +5.0 degree Celsius, over the next 100 years including the 0.6 degree Celsius temperature increase already observed during the 20th century (NASA; WMO).

Carbon intensive industrial growth in Pakistan has resulted in critical levels of atmospheric pollution and added to the health costs of the poor who are the most vulnerable (Arif and Ali, 1993). Furthermore, amongst numerous studies, a survey that examined industrial waste pollution in Karachi, Multan, Faisalabad, Nowshera and Peshawar found that a number of industries were discharging effluents with high concentrations of pollutants varying from toxic metal to bacteria, acids and salts (Arif and Ali, 1993). In Karachi, contaminated and heated sea water is sent back into the creek after the industrial use effecting sea life and marine ecological balance. Contamination by petroleum hydrocarbon residues, chlorinated hydrocarbons is also common on the sea coast in Karachi (Planning Commission Pakistan, 2012). The effluent from the cotton industry is less noxious but does contain traces of chromium and copper. The quantities of cadmium, mercury and arsenic entering the environment from economic activities is increasing (Hutton and Symon, 1986). Neutralising the industrial impact of high CO₂ levels in the atmosphere and on the oceans is therefore critical (Bovenburg and Goulder, 2000) to attend for sustainability solution.

3.2.4 Climate Change and Energy Sector

Pakistan, like many other developing countries, is characterised by an urban fossil fuel based system, while the rural energy system remains dominant by non-commercial biofuels. Food preparation, water heating and animal-warming are main demand areas in rural areas and traditional fuels continue to be preferentially used even when grid power is made available, in some villages. Some of these fuels pose environmental and health concerns when used in crude form, such as dung, but they can be adapted with small technological innovations that filter out pollutants such as inexpensive “clean” stoves that have been used in other developing countries like Mexico and China (Saleem, 2006). The main traditional energy resource is biomass, which under its current usage pattern is utilized inefficiently and with significant negative health impacts due to indoor air pollution and environmental impacts (ADB, 2012).

For the first 12 years since Independence in 1947, Pakistan generated electricity through both thermal and hydropower means with thermal dominating the system. There was a mixed pattern for the next 15 years (with the construction of indigenous dams). Then came a sudden increase in thermal power generation in the year 1976 but the next 10 years were again dominated by hydropower generation. However, from 1990 till 2015, a total of 25 years, Pakistan has again generated more power through thermal means, based on imported fuels (Rizvi, 2015).

In 2014-15, Pakistan's total fuel mix for electricity generation has been: thermal, 65 percent; hydropower, 31.5 percent; nuclear, 3 percent; wind and solar, 0.5 percent. The public sector's contribution is 58.5 percent in this mix including thermal (fossil fuels and nuclear) and hydropower, while private sector's thermal (fossil fuels), hydropower and wind energy is 41.5 percent (Rizvi, 2015). Between 2015 to 2018, Pakistan plans to add 10,400 MW to the system via liquefied natural gas (LNG), coal fire, wind, solar and hydropower projects. The current installed capacity is 22,571 MW (Pakistan Economic Survey, 2014-15), out of which 7,097 is based on hydropower generation and 15,474 on thermal generation. The additional 10,400 MW should take Pakistan up to 32,971 MW installed capacity by the end of year 2018. This should effectively end load-shedding, in theory (Muzamil, 2015). The new fuel mix would get 52 percent from renewable (solar, wind and hydropower), and 48 percent from thermal (LNG, coal and nuclear) by the year 2018 (Rizvi, 2015).

Pakistan's National Energy (Power) Policy 2013 emphasizes the use of indigenous resources such as natural gas, coal (Thar coal) and hydel for the generation of inexpensive and affordable electricity for domestic, commercial, and industrial use. Recently, as per the decisions of Economic Coordination Committee of the Cabinet and Cabinet Committee on Energy, the emphasis has slightly shifted (Pakistan Economic Survey 2014-15). Due to power shortages the large manufacturers have started installing their own captive plants to generate electricity and thus have become Independent Power Producers (IPPs). The concept of Independent Power Plants (IPPs) was introduced in Pakistan in the 1990s under the Power Policy 2002. All IPPs are thermal power plants primarily using imported furnace oil, as a fuel. Thus the share of oil in thermal power generation remained high since 1990s, implying a heavy dependence on oil prices (Muzamil, 2015). The use of furnace oil substantially increased post 1990 due to the propping up of thermal power plants.

The availability of biomass in Pakistan is widespread. Approximately 50, 000 tonnes of solid waste; 225,000 tonnes of crop residue; and over 1 million tonnes of animal manure are produced daily (PRES, 2016). It is estimated that the potential production of biogas from livestock residue is 8.8 to 17.2 billion cubic meters of gas per year (equivalent to 55 to 106 TWh of energy) (Harijan, Uqaili and Memon 2008). Additionally, the annual electricity production from bagasse (the fibrous residue remaining after sugarcane or sorghum processing) is estimated at 5700 GWh; this figure is approximately 6.6% of Pakistan's power generation level (Harijan, Uqaili and Memon 2008; PRES, 2016).

The biofuels are important segment of the renewable energy sector. Pakistan has been producing ethanol from molasses and has the potential to further increase its production from sugarcane crop. Initially biofuel was obtained from sugarcane. But more recently, due to high food prices and high costs of petroleum products attention has been diverted towards new sources of biofuel extraction. Algae have given a new dimension to biofuel production as part of the feedstock of biofuel (Manzoor et al., 2015).

The Alternative Energy Development Board (AEDB) was established in 2003, in Pakistan. AEDB introduced the Policy for Development of Renewable Energy for Power Generation in 2006 (Pakistan Economic Survey 2014-15). This is Pakistan's first renewable energy policy which promotes renewable energy technologies to provide 10% of Pakistan's energy supply. The AEDB has proposed policy recommendations, the primary aims of which are to minimize the bill of imported fuel of the country and cut GHG emissions renewables such as through solar, wind and small scale hydro power projects (Pakistan Economic Survey, 2014-15).

South Asia accounts for 42% of the global population without access to electricity. Such a situation continues to exist despite several initiatives and policies to support electrification efforts by the regional governments (Palit, Chaurey, 2011). The importance of rural electrification in bringing about both direct and indirect social and economic benefits for communities, ranging from incremental livelihood leading to reduced poverty to better facility for health and education has been well documented (Bastakoti, 2006; DFID, 2002; ESMAP, 2002; GNESD, 2007; NRECA,2002; Zomers, 2003 quoted by Palit, Chaurey, 2011). Historically, the predominant model for electrification in developing countries has been grid extension and conventional energy powered mini-grids developed by large, state owned utilities. Recently, the spectrum of electrification models has widened, including off

grid solutions, such as wind home systems and solar home systems, amongst others (Shukla, 2011). Off-grid rural electrification refers to the provision of electricity independent from the main electrical grid. There are about 3 million households where grid connectivity is not feasible, according to Alternative Energy Development Board of Pakistan (Cheema, 2016). The challenges to enhance electricity access are manifold including technical, financial, institutional and governance barriers.

The poor remain at a disadvantage because the priorities of energy policies tend to be disproportionately oriented towards the richer section of the population and the formal sector of the economy (Shah and Bhatti, 2012). Supply-side policies driven by GDP growth targets are used which calculate the amount of energy which would be required to meet those growth targets (Saleem, 2006). A review of the various energy sub-sector policies and strategies reflects the same omission, where the emphasis is on large scale, commercial supply and demand factors, focusing on economic growth (Mills, 2012). Energy policy planners continue to concentrate on meeting the country's rapidly growing energy needs in the formal sector, while failing to respond to sustainable distribution of energy based on urban-rural demand structure (ADB, 2009).

It is well established that "energy poverty," or the lack of access to modern energy, inhibits the ability of the rural poor to escape from poverty (Pakistan Planning Commission, 2012). This lowers output per capita resulting in higher poverty levels while its availability opens a range of transformation opportunities for the poor (Hathaway et al., 2007; Shah and Bhatti, 2012). Higher-income communities generally use more efficient and more convenient sources of energy, such as gas and electricity, whereas lower-income people use less efficient and less convenient sources, such as fuel wood (Mills, 2012). Efficient clean production and equitable distribution of energy at low cost per unit are therefore an essential part of any sustainable agenda. Chapters 5 and 7, bring forward a detailed analysis on these energy issues, in context of the research questions.

3.2.5 Climate Change and Transport Sector

Carbon intensive transport sector globally carries serious implications for climate change due to rising GHG emissions (Stern, 2014). Transport currently represents 14% of global emissions and has been the fastest growing source of emissions due to continued growth of road transport and rapid expansion of air transport (Ilyas, 2005). In Pakistan, the continuous and rapid carbon intensive growth under SAP with regards to urbanization, industrialization and transportation in the city of Quetta, Karachi and Lahore, amongst other cities, in recent years has caused tremendous damage to the environment (Khan, 1986; Zaman, 1985; Ilyas, 2005). The most likely major sources of atmospheric lead pollution in the city are traffic and industrial emissions (Quinn, 1985), iron mill (these use scrap iron from ships which is coated with lead), municipal wastes, contaminated food and the use of insecticides. Other sources include lead smelters, paints, solder, water pipes, storage batteries which also cause adverse effects (Hutton and Symon, 1986). Air pollution has been consistently linked with substantial burdens of ill-health in developed and developing countries, with the bulk of research focused on urban outdoor (ambient) air pollution. Four major cities of Pakistan, including Karachi capital of Sindh province, account for about 15% of the national motor vehicle fleet (Rowchowdhury, 2002; Ilyas, 2007; Automobile Manufacturers Association, 2005).

The rapid growth in carbon intensive motor vehicle activity in cities of Pakistan has brought in its wake a range of serious socioeconomic and environmental impacts (Alam, 2009). Of these impacts, those resulting from urban air pollution, due to emissions from motor vehicles among other sources, have been the focus of considerable public concern and policy attention but policy implementation, as shown in Chapter 5, has not been forthcoming (Hassan, 2006). Air pollution is one of the leading causes of death worldwide with PM 2.5 as the main killing agent which comes from coal, diesel and petroleum (Stern, 2007). It was reported in 2001 that 70 million people in Karachi, and 40% of its children, suffered from respiratory diseases (Ilyas, 2005; Roychowdhury 1997). Fuel and lubricating oil quality have also contributed significantly to air pollution. Until the 1990s, when significant improvements in fuel quality began to be implemented, lead content was excessively high (Ilyas, 2005). Lead in gasoline has been a serious public health concern globally, because it is released predominantly in the form of PM10, and even low lead levels can cause neurological effects in children, which can persist even after exposure ends (Ilyas, 2007; Faiz et al., 1992). Benzene, a known carcinogen implicated in adult leukemia and lung cancer (Faiz et al., 1992), was not controlled in Pakistan until recently. Ambient benzene levels in Karachi in the late 2000 were on order of magnitude higher than those allowed by the European Union (Hassan, 2006). Levels of

sulfur, an important constituent in particulate emissions, were excessively high in Pakistan's gasoline and diesel until the 1990s and several orders of magnitude higher than in their US and Californian counterparts at the same time (Hassan, 2006; Faiz et al., 1996).

Another important issue in the Pakistan context is that of gasoline evaporative emissions. There are no evaporative controls on the fuel distribution system, or on vehicles except vehicles produced from 1997 (Ilyas, 2007). Pakistani gasoline has a high volatility, and the vast majority of gasoline vehicles are carbureted, not fuel-injected. These facts, along with Pakistan's high ambient temperatures, heighten the potential for evaporative emissions rich in reactive hydrocarbons, which participate in the formation of ground-level ozone that adversely affects tropical crops and human health (Ilyas, 2007).

3.3 Socio-economic vulnerabilities reinforced by past climate variability

Section 3.2, brought forward important observations regarding the socio-economic sectoral specific impacts of climate change with a potential to shrink national output levels and a potential to aggravate the national poverty level. These observations and potential changes based on the above secondary data will be analysed further in chapter 3(II) and linked to relevant themes in context of the research questions, in primary data analysis chapters 5, 6 and 7.

3.3.1 Climate Change impact on socio-economic structures with implications for poverty

This section explores past climatic variability which impacts socio-economic factors with implications for poverty due to climate risks and uncertainties involved especially in the absence of Disaster Risk Management. South Asia is one of the regions deemed most vulnerable to climate change (IPCC, 2007). Majority of the poor live in rural areas where agriculture is the predominant form of economic activity; their fate is intricately linked to farming and agriculture (WDR, 2010; IPCC, 2007). What reinforces their vulnerability is the fact that the poor are also extremely vulnerable to increases in food prices (Ivanic and Martin, 2008). Apart from agriculture, potential climate damages to infrastructure such as roads, rails, public and commercial buildings, housing and sanitation from climate disasters have localised adverse impacts for the poorer population as a whole. Several studies (Barnett, 2001; Heltberg, Jorgenson and Siegel, 2008; Morton 2007; Raleigh, Jordan and Salehyan,

2008; Reuveny, 2007) have demonstrated that climate shocks resulting from conflicts over scarce natural resources (not due to their paucity but due to the mismanagement of their production and distribution); ethnic strife due to migration from low lying climate vulnerable areas; and diseases caused by natural disasters such as floods, droughts, heatwaves, have had a profound adverse impact on the underlying social structures with implications for poverty.

The combination of considerable observable losses due to climate shocks and the likewise-substantial, although less obvious opportunity costs of climate risk management play an important role in perpetuating poverty in developing countries (Barret et al., 2007; Barnett, 2001; Morton, 2007). Natural disasters affect the performance of the economy by changing the level and structure of public expenditure (Stern, 2007, IPCC, 2007). This usually affects the current level of public services and future public investments, reducing transfers particularly to the disenfranchised and poor (Rasmussen, 2004; Heltberg, Jorgenson and Siegel, 2008). Overall macroeconomic studies have found that natural disasters and resultant pattern of climatic variability can lead to an immediate contraction in economic activity and an increase in poverty due to a downfall in trajectory of incomes accompanied by an increase in income disparities (Morton, 2007; Raleigh, Jordan and Salehyan, 2008; WDR, 2010; Stern, 2014).

3.3.2 Vulnerability to hazards

Apart from the macroeconomic effects of natural disasters which lead to a fall in the real income level of vulnerable populations leading to poverty, the other major element that affects the vulnerable population in context of climate change is that they inhabit the most vulnerable areas with inadequate housing and working facilities (WDR, 2010; Olmos, 2001; Ribot, 1995; Ruth and Ibarraran, 2009). Their vulnerability is reinforced because they have fewer assets, almost no access to insurance and credit markets to compensate for income losses and consumption needs. Poor are forced to live in marginal areas due to lack of endowments and income level. In India, for example, 20 years after the 1977 cyclone, more of the poor South Indian labourers migrated to vulnerable coastal regions that were less expensive but more prone to damage from natural disasters (Winchester, 2000 quoted in Ruth and Ibarraran, 2009). Therefore susceptibility to disasters can increase as poor groups tend to overexploit natural defences, such as wetlands, mangroves and forests for their livelihoods, pushing against fragile ecosystems leading to higher environmental loads. This implies that

poverty impacts climate change. Dilley and Boudreau (2001) argue that the ‘vulnerability to hazard’ framework – embraced by the disaster risk community since 1979 provides a useful theoretical structure for a transparent translation of concepts into practise. The vulnerability to hazard approach argues that the key policy intervention is to expand decision capacity through preparedness and response (Dilley and Boudreau, 2001). This has been the dominant framework for climate change disaster risk management (DRM) in general.

3.3.3 Vulnerability to outcome

Ribot views issues of vulnerability from a different perspective. He proposes that it is misleading to designate undesired outcomes as impacts of external hazards such as climate variability or change. For him, households are vulnerable first and foremost due to social and political economic relations and processes (Ribot, 1995). He proposes vulnerability to outcome framework which builds on Sen’s work on entitlements (Sen, 1981). Entitlements are the bundle of goods and services that a particular unit can obtain through production, exchange or legitimate conventions (Sen, 1981). Extreme events become disasters only when entitlement systems fail. From this perspective the root cause of vulnerability is related to the dynamics of social systems such as extraction, accumulation and marginalisation. These concepts will be explored in the next chapter.

According to Sen, environmental sustainability should be reconfigured to encompass the preservation and expansion of current freedoms and capabilities without compromising the capabilities of future generations (Sen, 2009). The core capabilities are freedom to accomplish things deemed necessary for a dignified life such as being able to achieve bodily health and integrity as well as control not ownership over one’s environment (Sen and Nussbaum, 1993). In other words, each generation acts as a trustee of the core capabilities for succeeding generation. Ultimately ‘vulnerability to outcome’ approach proposes to identify the social, political and economic processes that produce vulnerability through the misallocation of state funds, through private ownership of land and property and through the structuring of socially differentiated access to alternative opportunities. Once identified, these processes need to be confronted beyond redistribution ‘to identify and correct countervailing processes’ in order to prevent misappropriation of natural and capital resources (Ribot, 1995; Ribot, 1996; Johnson and Holt, 1997). The focus is to transform the social processes that perpetuate vulnerability by increasing the bundle of entitlements so that the ability to meet

basic needs is not dramatically affected by climate extremes (Handmer et al., 1999). Transformation of social processes in this context challenges the traditional economic paradigm, which is a discussion explored in the following chapter.

3.3.4 Socio-economic factors that get affected by climate change disasters with implications for poverty level

Climate related disasters disproportionately affect local rural populations and the agriculture sector, the effects of which are compounded by less reliable physical and institutional infrastructure, which could effectively respond to socio-economic shocks. These patterns are aggravated by spatial inequality in the coverage and effectiveness of public and veterinary health systems, which strongly favour richer areas (Gaiha and Thapa, 2006). Overall, people in low-income countries are four times more likely to die due to natural disasters and costs per disaster as a share of GDP are considerably higher in developing than in OECD countries (Gaiha and Thapa, 2006; Hertel and Rosch, 2010; Morton, 2007). The epidemiological consequences of climate related disasters, due to predictable, if transitory, increases in water and insect-borne disease transmission compound the losses and precipitate human health shocks that are especially strongly associated with long-term collapse into poverty (Heltberg et al., 2008; Ibarraran, 2009; Barrett et al., 2007). Furthermore, catastrophic climate shocks in the absence of disaster risk management can trigger destructive coping responses, such as withdrawal of children from school, distress sale of assets, severe reduction of nutrient intake, refugee migration and crime, that further contribute to severe human suffering (Barnet, 2001; Barret et al., 2007; Gaiha and Thapa, 2006).

Natural resource goods are the non-monetary goods relevant to household consumption, production and asset accumulation. Climate change has the potential to alter the goods and services that natural resources can provide to the vulnerable households which can disproportionately affect their consumption, production and asset accumulation (Farauqee, 1996; CDKN, 2012). Natural resources also provide services for soil and biodiversity conservation, carbon sequestration, air quality and water availability and quality (Dawson and Spannagle, 2009).

3.4 Conclusion

The conclusions drawn from the above studies, based on the sectoral and past climate variability analysis, suggest that climate change impacts socio-economic factors as such that it reinforces poverty, especially in the absence of DRM. Instead of vulnerability to hazard framework, Sen calls for a new narrative in the development debate based on the reconfiguration of these socio-economic structures when he proposes that environmental sustainability should be reconfigured to encompass the preservation and expansion of current freedoms and capabilities without compromising the capabilities of future generations (Sen, 1981). Ribot's vulnerability to outcome framework built on Sen's entitlement work (Ribot, 1995), discussed earlier, provides a useful theoretical structure for moving concepts into practise and it becomes a theme of analysis in the subsequent chapters.

Given the secondary analysis of the above literature, this literature review identifies the following gaps in view of the subject under this research project. The current literature offers, a) little guidance available on how to address the inevitable tensions and trade-offs between the capabilities of the present vulnerable and of the future vulnerable. This raises concerns surrounding uncertainty, ethics and intergenerational distributional justice inherent to the economics of climate change which will serve as a point of departure in the next chapter for a deeper analysis to study the third main research question i.e., how does neo-classical economic paradigm address climate change and the underlying socio-economic factors with implications for poverty as opposed to competing economic paradigms; b) the research methodology underpinning this study has not been used before and, therefore, it is based on the hope that new insights would emerge from this collection of data; c) this study makes a modest attempt to show the reciprocal impacts of climate change and socio-economic structure with implications for poverty. By providing comparative perspectives as done in the next chapter this study attempts to broaden the debate to address the research questions for more dynamic solutions toward sustainability.

3 3(II) Analysis of Comparative Economic Paradigms towards a Sustainability Framework

3.5 Introduction

This chapter answers the third main research question as laid out in section 1.4.1. The research question is: how does the neo-classical economic paradigm address climate change and underlying socio-economic factors with implications for poverty as opposed to competing economic paradigms? Section 3.6 analyses the dominant narrative of neo-classical economics. Section 3.7 of this chapter brings forward a detailed analysis of radical (Marxist and Eco-Socialist) economic paradigms in context of the research questions.

Section 3.6 analyses the assumptions underpinning the computational general equilibrium (CGE) modelling with implications for impact studies, issues of ethics, discounting, inter-generational and intra-generational issues, deep structural uncertainty, the immense scale and long time lags involved under climate change. How these sustainability solutions carry implications for poverty, is also analysed. Section 3.7 brings forward Marx's economic paradigm in an attempt to find solutions for climate change and underlying social structures in the development process by incorporating the framework of the contradictions of capital. Utilising the theoretical framework of eco-socialism, comparative sustainability solutions are subsequently proposed based on the literature review findings.

Since the scope of this literature review is very ambitious, only a modest beginning is being attempted in this chapter. This research work is intended to be followed up in post-doctoral work. This literature review has made some effort to deal with the original texts of the neo-classical, Marxist and eco-socialist strands with a substantial reliance on secondary but well known interpretations of the original texts.

3.6 Main issues surrounding the dominant economics of climate change – discounting, ethical values, intergenerational efficiency and distributional justice

Any neo-classical economic analysis of climate change requires some model that describes the impact of climate change on future GDP and consumption. This climate change impact is shown by a model of damages, i.e., a relationship that translates changes in temperature and other climate-related variables to economic losses. So models essentially translate climate damages to economic losses (DeCanio, 2003; Delworth, 2012). Economic losses will include losses of GDP and consumption that might result from, for example, reduced agricultural productivity or from dislocations resulting from higher sea levels. Most quantitative economic studies of climate change policy utilize such “damage functions” that relates temperature change directly to the levels of real GDP and consumption under a utility function (Brock, 2001; Delworth, 2012). So, any projected path for temperature can be directly translated into an equivalent path for consumption. Given a social utility function that “values” consumption at a given point of time and given its cost schedule; one can then evaluate a particular policy (Tol and Yohe, 2012). Most integrated assessment models (IAMs) relate temperature to the level of real GDP and consumption (Tol, 2004). A detailed analysis of the damage functions and utility functions under Computable General Equilibrium (CGE) modelling is beyond the scope of this study. However, it can serve as an important area for related future research. The assumptions underlying the climate adjusted utility functions in CGE modelling have direct implications for climate change policy direction with implication for poverty. Therefore, this chapter only discusses these assumptions underlying these models in assessing the impacts of climate change, in context of the research questions.

Discounting as generally used in economics is a technique relevant for marginal perturbations around a given growth path assumed in a CGE model. With marginal perturbations the key concept is the discount factor: the value of an increment in consumption at a time in future relative to now (Stern, 2015; Dasgupta et al., 2008). There is an important debate amongst economists about discounting regarding the ethical value of pure time preference (δ) which should be used for intergenerational discounting in the determinist version of the Ramsey equation that forms the analytical backbone for most studies on the economics of climate change (Dasgupta, 2007; Ackerman, 2007). Discounting, in the economics of climate change, is the issue of how we value the welfare of the future generations relative to the present ones (the time discount rate). Depending on the discount rate chosen by policy makers, the direction of climate change policy making can be determined, which has implications for poverty (Gollier, 2009a; Gollier, 2009b).

3.6.1 Towards sensitivity analysis as part of climate change impact analysis

The risks and uncertainties around the costs and benefits of climate policy are large (Dasgupta et al., 2008; Weitzman, 2009). Under the Stern Review uncertainty is met in the models by adding utilities over possible scenarios of the world that might result from climate change, weighted by the probability of those states. This yields what is called ‘expected’ utility which is essentially an extension of social utility under the framework of welfare economics and it is concerned with the uncertain ‘stochastic’ environment (Stern, 2007). Neoclassical utility functions attach significant importance to two underlying variables, i.e., cost of capital and the rate of growth of consumption (Stern et. al., 2014). The focus of policy is economic growth. This is an important perspective from neoclassical economists where high credibility is attached to capital. The analysis of capital is brought forward in section two of this chapter under Marx’s thesis.

The Stern Review is the dominant literature on the economics of climate change to date. Stern Review’s main emphasis is on the need for increasing the price of carbon emissions as policy measure, to deal with climate change externality (Stern, 2007). The Review summarizes its discussion as, “creating a transparent and comparable carbon price signal around the world is an urgent challenge for international collective action.” This remains Stern’s position in his new book, *The Global Development of Policy Regimes to Combat Climate Change* (Stern et. al, 2014). Behind the Review’s modelling is the assumption that the world economy is in a long-run equilibrium of a Ramsey optimal growth model. In a Ramsey equilibrium with stable population, there are two observables – the rate of return on capital and the rate of growth of consumption; and there are two normative parameters – the social discount rate and the curvature of the utility function (more precisely, the elasticity of the marginal utility of consumption). However, it does not take into account distortions in the tax system, uncertainties and risk premiums, and the equity-premium puzzle or technological changes (Ackerman, 2008). Critique within the neoclassical circles of the Stern Review estimates of the economic impacts of climate change can be summarized in a series of succinct statements (Ackerman, 2008):

1. Stern et al., (2007) use an extraordinarily low discount rate without reporting a sensitivity analysis.

2. The Stern Review's low discount rate does not match the equally low assumed rate of risk aversion. The treatment of risk and uncertainty is inappropriate.
3. Stern et al. (2007) give too little consideration to the poverty problem of current generation.
4. The time horizon in the Stern Review is too short for the chosen discount rate.
5. Vulnerability to climate change is assumed to be constant.

3.6.2 Climate Change impact analysis under the neoclassical tradition with implications for inequality and poverty structure

In the opinion of a number of economists who have discussed the Stern Review, these criticisms invalidate Stern's conclusion that the costs of climate mitigation are much smaller than the benefits (Tol and Yohe, 2006; Ackerman, 2008; Tol et.al., 2004; Nordhaus, 2004; Tol and Yohe, 2012; Pearce, 2006; Weitzman, 2009; Weitzman, 1998; Dasgupta, 2007; Dasgupta et al., 2008). Most of the economic debate concerns Stern's quantitative estimates, as follows:

In selecting the appropriate discount rate for long-term public policy decisions, economic theory often distinguishes between two components (Ackerman, 2009). The rate of pure time preference is the discount rate that would apply if all present and future generations had equal resources and opportunities. The rate of pure time preference might or might not be zero; a zero value treats the welfare of all generations as equally important. In addition, there is a wealth-based component of the discount rate, reflecting the assumption that if future generations will be richer than we are, then there is less need for us to invest today in order to help them protect themselves (Ackerman, 2009). In the notation of the Stern Review, the discount rate, r , is the sum of these two parts (Dasgupta, 2007):

$$r = \delta + \eta g$$

Here δ (delta) is the rate of pure time preference⁶, and g is the growth rate of per capita consumption. If per capita consumption is constant, implying that $g = 0$, then the discount rate $r = \delta$. The second parameter, η (eta) or the marginal utility of consumption, determines

⁶ where δ is the rate of pure time preference, i.e., the rate at which utility is discounted. Note that this rate is different from the consumption discount rate, which in the Ramsey growth context would be $R_t = \delta + \eta g_t$.

how strongly economic growth affects the discount rate. A larger value of η implies a larger discount rate, and hence less need to provide today for future generations, as long as per capita consumption is growing (Dasgupta, 2007). Stern Review takes a very low pure time discount rate of 0.1% (Stern, 2007; Weitzman, 2007b; Nordhaus 2007). According to Stern, the unitary value for the elasticity of the marginal utility of consumption $\eta = 1$ together with $\delta = 0.1\%$ place stronger efforts on current costs and future benefits than higher η or higher δ would imply (Stern et al., 2007). Stern Review's model does not take into account distributional impacts of climate change. Poor countries are likely to suffer the largest impacts and estimates are conservative about damages post 2200. There is no disaggregated approach to risk assessment on regional studies. Furthermore, like other models Stern Review's model does not account for:

- a) the risks to our climate from dynamic positive feedbacks: It is essential to examine the *positive feedback* from an increase in the atmospheric CO₂ concentration level, as they amplify the global surface temperature change induced by the climate forcing.
- b) heightened climate sensitivity parameter, analysed in section 3.9.6 (Weitzman, 2014; Weitzman, 2010; Weitzman, 2012).

Dasgupta presents a complementary critique of Stern and focuses on the ethical implications of discounting which has implications for poverty (Dasgupta, 2008). He interprets δ as the measure of the trade-off between present and future, independent of wealth differences, and η as the elasticity of the social weight (Dasgupta, 2007; Dasgupta, 2008). In this framework,

- $\eta = 0$ implies that every pound is of equal value regardless of who receives it;
- $\eta = 1$ implies that every 1% increase in a person's income is of equal value regardless of the wealth of the person who receives it; and
- $\eta > 1$ implies that a 1% increase in income is of greater value to a poorer person.

Dasgupta endorses Stern's argument that δ is close to zero, but maintains that *equity requires much more concern for the poor which is reflected in a larger η* ; Dasgupta suggests a range of 2 to 4 as opposed to 1. Distributive ethics of John Rawl's theory of justice requires that elasticity of social weight be infinity which reflects an aversion to inequality and risk in consumption (Rawls, 1971). If per capita incomes are expected to continue growing in spite of climate change, as most economists (including Stern) assume, then using a larger η in equation leads to a higher discount rate, and indirectly to less investment in the future.

Dasgupta calls for substantial redistribution within the present generation. Such a perspective carries significant implications for synchronised climate change and poverty policies. Dasgupta considers that Stern's $\eta=1$ (as opposed to $\eta=2$ or more) reflects an insufficient concern for the problems of poverty today – as well as an excessive concern for the well-being of the allegedly more affluent generations to come (Dasgupta, 2007; Dasgupta et al., 2008).

Nordhaus, makes a conclusion of his studies on the economics of climate change - conducted on his Dynamic Integrated Model of Climate and the Economy (DICE) model that despite the potential serious threats to the global economy posed by climate change, little should be done to reduce carbon emissions in the near future (Nordhaus, 2006). The idea is not that climate change shouldn't be taken seriously, but that it would be more equitable (and efficient) to invest in physical and human capital now, so as to build up the productive base of economies (especially poor countries), and divert funds to meet the problems of climate change at a later year. These conclusions are reached on the basis of an explicit assumption that global GDP per capita will continue to grow over the next 100 years. In his 'climate policy ramp' emission reduction would start slow and get bigger later but would nonetheless lead eventually in the next century to an atmospheric carbon concentration of nearly 700ppm (Nordhaus, 2006; Nordhaus, 2000). These proposals need to be questioned in light of one of the world's most famous climatologists, James Hansen's perspective who argues that in order to avoid catastrophic climate change it is necessary to cap atmospheric carbon to a level of 550ppm (Hansen, 2002; Hansen et al., 2005).

Weitzman proposes, $\delta = 2\%$, $\eta = 2$, $g = 2\%$. The result is a discount rate 6%. Weitzman draws on his work on the economics of uncertainty which favours a discount rate that declines sharply over time, approaching the Stern Review level, as time goes on (Weitzman, 2007b). Weitzman describes Stern as being "right for the wrong reason," because Stern places too much emphasis on a debatable cost-benefit analysis, but too little on the need for social insurance against low-probability, catastrophic events (Weitzman, 2007; Weitzman 2009). Weitzman's thesis on Dismal Theorem based on low probability catastrophic climate events, is discussed, in section 3.6.5.

The above analysis on choosing the most appropriate ethical discount rate to address inter and intra generational justice under the economics of climate change is not easy given the

immense scale, uncertainty and long lags involved. However, whichever discount rate is chosen in climate change policy making it will have implications for poverty and the socio-economic structures poverty is embedded in.

3.6.3 Dominant economic literature on addressing climate change

The protection of the environment has been one of the issues under debate between the two main dominant currents, i.e., state interventionists and market liberals. There has been a wide space for a variety of policies in between the two extremes (Hepburn, 2010). The conceptual framework of the debate has been based on the neoclassical utility theory at social level, i.e., modern Welfare Economics, developed since the late 1930s by, among others, Bergson (1938), Arrow (1951) and Debreu (1954). It is commonly accepted that outcomes that are not Pareto efficient are to be avoided, and therefore Pareto efficiency becomes an important criterion for evaluating economic systems and public policies. If a market failure exists, mainstream – both neoclassical and Keynesian – economists believe that it may be possible for a government to improve the inefficient market outcome (Napoles, 2014; Bator, 1958). Different economists have different views about what events are the sources of a market failure. Joseph Stiglitz points out that, early discussions of market failure, like the one of Bator (1958) focused on externalities, natural monopolies, and public goods but later discussions focused on problems of incomplete markets, imperfect information, and the pervasiveness of imperfect competition (Stiglitz, 1991).

But what about unequal income distribution resulting from free market operation? Is it a market failure? Recently, another source of market failure has been added: the question of incentives or principal-agent problems. The Theory of Incentives or Principal-Agent models (Laffont and Martimort, 2002) is a recent development within the neoclassical anti-interventionist approach (Chang, 2003). These models are usually presented as neutral efficiency arguments but have much deeper political impacts (Chang, 2003). The Principal-Agent approach has inspired market oriented environmental policies for various areas of concern (Franck and D'Amato, 2009; Szatzschneider and Kwiatkowska, 2008). In the case of climate change mitigation policies, the Principal - Agent theory is at the base of the “Carbon markets” policy, aimed mainly to incentivize producers, which are high GHG emitters, to switch from high carbon technologies to low carbon technologies, i.e. the “Cap-and-Trade” policy (Franck and D'Amato, 2009). The model is less oriented to consumers (Schatzki and

Stavins, 2012). In either case, it has very strong limitations in practice (Ackerman, 2007). Stiglitz shows that all principal-agent problems are not Pareto efficient, given the pervasiveness of imperfect competition and imperfect information which is why, they are market failures as well (Stiglitz, 1991; Stiglitz, 2013). If free market, as an institution, is not working, then there is a market failure, and so it is justified to use government interventionist measures, as a second best policy (Stiglitz, 1991).

With respect to mitigation policies, the *IPCC Working Group III Report on Mitigation*, recommends that government interventionist measures to climate change can be more effective if deployed as a portfolio of policy instruments to limit greenhouse gas emissions and correct market imperfections. According to Stern, these may include emissions-carbon-energy taxes, tradable or non-tradable permits, provision and/or removal of subsidies, deposit-refund systems, technology or energy performance standards, energy mix requirements, product bans, voluntary agreements, government spending and investment, and support for research and development, information campaigns, environmental labelling, and green marketing, alone or in combination with incentive subsidies (Stern, 2014). Another issue that calls for state action is the issue of equity, namely the extent to which the impacts of climate change and environmental regulation create or exacerbate inequities both within and across nations and regions (Dasgupta, Mody, Wheeler, 1995; Mody, et.al. 1995; Kling and Rubin, 1997; Jorgenson and Wilcoxon, 1990; Jorgenson and Wilcoxon, 1993; Schneider and Goulder, 1997). The analysis of capital under section 3.8.6 elaborates its relationship with the principle of equity.

The dominant literature, proposes the ‘New Growth Paradigm’ as the way forward in tackling the twin phenomena of climate change and poverty. The New Growth Paradigm advocates that growth and development complement and support climate action and poverty reduction (Stern, 2014; Jackson, 2009; Kitchen and Marsden, 2011; Woodward, 2015). To portray them in conflict misunderstands development and the opportunities of a low-carbon transition. An analysis follows.

The New Growth Paradigm proposes a policy framework which corrects market failure through carbon tax, it emphasizes heavy investments in green technology, overall restructuring of cities with climate resilient infrastructures toward a low carbon trajectory, energy efficiency, research, innovation and sophisticated networks (electric grids, transport,

broadband, recycling) and bringing the cost of capital down through the help of appropriate financial schemes from multilateral development banks (Stern, 2014). In neoclassical schema, all climate change investments are capital intensive whilst sun, air and nature in general, are free (Stern, 2014). With regards to the costs and damages of climate change, the dominant economic literature finds that the damages from business as usual would be expected to reduce global GDP by 5% based on market impacts alone, or 11% including a rough estimate for the value of health and environmental effects that do not have market prices (externalities) (Stern, 2007). Stern Review further speculates that an adjustment for equity weighting, reflecting the fact that the impacts will fall most heavily on poor countries, could lead to losses valued at 20% of global GDP.

The Stern Review compares the magnitudes of the costs of abatement (around 1% of GDP) to the costs of climate change (5-20% of GDP) and concludes that the latter justifies the former. Tol and Yohe, among others, point out that Stern's mitigation expenditures of 1% of GDP, will not avoid all climate damages – and therefore should be compared to the damages it will avoid, not to total damages (Tol and Yohe, 2006; Tol and Yohe, 2007).

3.6.4 Measuring impacts of climate change on the margin

According to Tol (2004), expressing total impacts in monetary terms is not sufficient because it does not allow a consistent comparison of the (avoided) impacts of climate change to mitigation costs or to compare climate policy to other policies, e.g., on education, public health care or urban air quality. To be able to do that one needs to gain an understanding of the impact of climate change at the margin, i.e., the effect that can be achieved by a small alteration in GHG emissions (Tol, et.al. 2004). Estimates of the marginal damage costs of CO₂ however controversial and uncertain are useful if only to provide a benchmark for the costs of emission reduction policies.

The costs of avoiding emissions of carbon dioxide, the principal greenhouse gas, depend on substitution possibilities on several margins: the ability to substitute across different fuels (which release different amounts of carbon dioxide per unit of energy) and to shift away from energy intensive goods, which is what CGE exercises tend to model. The greater the potential for substitution the lower the costs of meeting a given emissions-reduction target (Nordhaus 1994). The desire to relate costs to mitigation benefits (avoided damages) has

spawned the development of integrated assessment models (IAMs) in context of the CGE exercise (Tol, 2004). These models link greenhouse gas emissions, greenhouse gas concentrations, and changes in temperature or precipitation, to consider how these changes feed back on production and utility. Many of the integrated assessment models are optimization models that solve for the emissions time-path that optimises marginal abatement costs (MAC) and marginal abatement benefits (MAB) (Tol, 2002a; Tol, 2002b; Tol, 2003; Tol, 1999; Schmalensee, 1993).

The abatement in MAC refers to the reduction in emissions (as in abatement of GHGs). It has a corresponding concept, namely Marginal Abatement Benefit (MAB), referring to the value of the reduction in the damages caused by the emissions (Tol, 2002a). By using a special set of theoretical assumptions the MAC and the MAB are identical at the optimal equilibrium level in neoclassical tradition (Tol, 2002b). The “optimal carbon price,” or carbon tax, is the calculated price of carbon emissions that will balance the incremental costs of reducing carbon emissions with the incremental benefits of reducing climate damages. It is common to present policy towards climate change in terms of the social cost of carbon on the margin (SCC) (Tol, 2002a; Tol, 2002b). The social cost of carbon (SCC) is the marginal cost of emitting one extra tonne of carbon at any point in time. According to economic theory, if SCC estimates were complete and markets perfect, a carbon tax should be set equal to the SCC (Yohe et al., 2007). With respect to carbon prices the idea is to establish an appropriate price on carbon –through tax, trading or regulation – so that individuals and businesses are led to switch away from high-carbon goods and services, and to invest in low-carbon alternatives. But to be efficient, this price must be a common global carbon price to avoid the risks of locking into a high carbon infrastructure (Stern, 2007).

However, the structural uncertainty, immense time scales and long lags involved in climate change makes the practise of designing optimal carbon taxation policy difficult (Weitzman and Gollier, 2010; Weitzman, 2014). This has led to arguments in favour of taking a precautionary approach, when designing climate policy (Tol and Yohe, 2012; Weitzman, 2009).

3.6.5 Precautionary Approach to address structural uncertainty fundamental to the economics of climate change

Weitzman introduces his '*Dismal Theorem*' - a critical scale parameter to understand climate change impacts that multiplies an exogenous shock or perturbation to the system (Weitzman, 2009). At a very high level of abstraction the generic role of this uncertain multiplicative amplifier or scale parameter is illustrated by the role of an uncertain "climate sensitivity" coefficient in climate change models (Weitzman 2009; Weitzman, 2011). Climate sensitivity is a key macro indicator of the eventual temperature response to GHG changes. Weitzman, in his study, is concerned with climate sensitivity values substantially higher than 4.5 degree C which, according to him, cannot be excluded from climate modelling. In chapter 1 of this study, catastrophic temperature increase was mentioned as more than 4 degree C which has not been seen for millions of years (Stern, 2014). Instead of the concept of, climate sensitivity narrowly defined, denoted by S1 in standard models, working at below 2 degree C, Weitzman works with S2 which stands for a more abstract 'generalised climate sensitivity like scaling parameter at 4.5 degrees C (Weitzman, 2009).

According to Weitzman, how warm our climate gets ultimately depends on two important factors which are both uncertain (Weitzman, 2011):

- anthropogenically injected GHG emissions, and
- a critical climate sensitivity like scaling parameter reflecting uncertainty.

This critical scale parameter reflecting huge scientific uncertainty, regarding catastrophic climate events, is used as a multiplier for converting aggregated GHG emissions into eventual temperature changes. The true value of this scaling parameter is unknown because of limited past experience therefore a situation needs to be modelled inductively from a finite number of data observations (Weitzman 2009; Weitzman, 1998). When fed into an economic analysis the great uncertainty about the eventual mean planetary temperature change cascades into yet greater even more open ended uncertainty, about eventual changes in economic welfare (Weitzman, 2009; Weitzman, 2012).

General economic models show the processes of how inductive knowledge, i.e., knowledge based on observed instances, is acquired (DeCanio, 2003). Inductive knowledge is what we learn from empirical data evidence. The core underlying problem is the difficulty of learning limiting tail behaviour inductively from finite data (Weitzman, 2011). Seemingly thin tailed probability distributions (like normal distribution) which are actually only thin tailed conditional on known structural parameters of the model (like standard deviation) become fat

tailed (like the Student-t or t distribution) after integrating the structural parameter uncertainty for which there exists no a priori knowledge based on past observations or experiences (Weitzman, 2009; Tol, 2003; Tol, 2004). This is a core issue for neo-classical economics⁷.

IAMs are multi-equation computerised models linking aggregate economic growth with simple climate dynamics to analyse the economic impacts of climate change (DeCanio, 2003) giving a picture of the expected utility (EU) consequences of GHG mitigation policies. A finite grid of a Monte Carlo simulation based on observed data may not reveal the true expected stochastic discount factor or true expected discounted utility in simulations of these models (Weitzman, 2011). This is because the most extreme negative impacts in the fattened tails will have been truncated and evaluated at a single point representing an artificially imposed lower bound on the set of all possible bad outcomes from all conceivable negative impacts (Weitzman, 2009; Weitzman, 2011). Such artificially imposed threshold cut-off truncations are typically justified, by neo-classical economics, on the thin tailed logic that probabilities of extremely rare uncertain events are statistically insignificant and therefore can be ignored. The policy relevance of any CBA coming out of such thin tail based models will be sketchy until this fat tailed issue is addressed to some reasonable extent⁸ (Tol, 2003; Weitzman, 1998; Weitzman, 2009). This is a challenging issue for climate change analysis because the prospects of fat tailed catastrophes raises difficult conceptual issues that cause the analysis to appear less scientifically conclusive and more contentiously subjective.

In contrast to CBA analysis, precautionary approach is informed by the above “Dismal Theorem” offered by Weitzman which also falls under the neo-classical tradition. It shows that profound uncertainty cannot be overcome by moment generating function with lognormal distributions (Weitzman, 2011). This is because climate change uncertainty is reflected in fat tailed distribution which means probability distribution that exhibits lack of statistical symmetry as opposed to lognormal distributions (Tol and Yohe, 2012; Yohe, 2007; Weitzman, 2009; Weitzman, 2014; Pizer, 1999). In other words climate change uncertainty which reflects non-linearity and lack of symmetry cannot be evaluated by standard CBA which is based on inductive knowledge of past empirical data showing statistical symmetry.

⁷ See Weitzman, 2009; Higgins et al, 2012; Sokolo, et al., 2009

⁸ Fat tails are probability distributions whose outcome are represented as thick ends or tails that form towards the edges of the distribution curve indicating an irregularly high likelihood of a catastrophic event (www.youtube.com/watch?0dA27-ap99s&sns=em)

According to Tol and Yohe, timely social and economic interventions that effectively could remove the thick tails could undercut Dismal Theorem if the impacts of its profound uncertainty were regional (Tol and Yohe, 2012). This particular observation, i.e., timely social and economic interventions especially under disaster risk management (DRM) emerged as an important theme in chapters 5 and 6 of primary analysis. But for global uncertainty precautionary approach to climate policy making becomes important which is not confined to Bayesian learning, that is simply observe and infer, about climate sensitivity and other critical parameters in climate models. Instead a rigorously defined and informed precautionary approach to policy design would include the following dynamic principles for the policy makers to consider (Delworth, 2012; Tol and Yohe, 2012; Weitzman, 2009):

- Identification of tipping point/triggers of climate catastrophes such as the shutdown of the thermohaline circulation or the collapse of a West Antarctic ice sheet (updated science);
- identifying the parameters of fundamental change that define those triggers (updated science);
- designing such monitoring mechanisms that can effectively track the pace of change relative to the identified triggers (innovative technologies);
- estimating the lag time between that trigger and a climatological commitment to crossing the threshold (sophisticated mathematical software programming);
- conducting small and large scale research experiments and space time modelling exercises (moving from static to dynamic modelling);
- allowing statisticians to calculate possibilities of type 1 and type 2 errors along a range of transient future paths (contingency planning).

3.6.6 Assumptions underlying Computable General Equilibrium (CGE) models in context of the research questions – dynamic modelling vs static modelling

The following axioms are the foundation of all neoclassical theory underpinning CGE models (Varoufakis, 2015):

a) methodological individualism, where all explanations are synthesised from the level of the individual and where strict explanatory separation of structure from agency is imposed and all agency feed into structure with no feedback from structure to agency. So that any socio-economic phenomena is to be explained via a synthesis of partial knowledge derived at the level of the individual;

b) methodological instrumentalism, where behaviour is defined by some well-defined function mapping the combination of all rational agents' behaviours to some homogenous index of individuated success where agents' preferences are given, fully determining and utilities are aggregated (as also referred in section 3.6.1); and,

c) methodological equilibration where one set of equilibria is deduced from the available primitive data (motivations, constraints, production possibilities) and the focus of study is restricted to that set and only behaviour consistent with it is admitted. Sensitivity analysis is then introduced to discern the equilibria at which small, random perturbations are incapable of creating centrifugal forces able to dislodge behaviour from that path.

CGE models quantify the impact of climate change policies, on the equilibrium allocation of resources and relative prices of goods and factors, under the above explained assumptions (Bergman and Henrekson, 2003; Bergman, 1990; Bergman, 2005). These models rest upon strong assumptions about optimising consumer behaviour based on rational utility maximising individuals, competitive markets and flexible relative price. (Böhringer, C., Löschel, A., 2007). They are made up of systems of equations that represent production and consumer demand as well as spell out the market conditions that determine the prices and quantities of goods bought and sold (DeCanio 2003; Brock, 2001; Böhringer, C., Löschel, A., 2007). The meaning of general equilibrium is that all markets clear in the sense that the plans and intentions of consumers and producers are fulfilled, i.e., consumers maximise utility and producers maximise profits (Mas-Colell, 1995; Samuelson and Nordhaus, 2004). CGE modelling is an attempt to use general equilibrium theory as an operational tool in empirically oriented analyses of resource allocation and income distribution issues in market economies. In general, technology is assumed to exhibit constant returns to scale and preferences are assumed to be homothetic. Utility maximisation and profit maximization behaviour on part of households and firms is assumed, with excess demand functions taken as homogenous. Moreover, product and factor markets are assumed to be competitive with relative prices flexible enough to simultaneously clear all product and factor markets. Markets for financial

assets are not included which means money has no role in these models (DeCanio, 2003; Keen, 2012).

With the dominance of general equilibrium theory, spatial economics was expelled from mainstream economics (Puu, 2015). In the neoclassical paradigm, the general concept of commodity is an entity which is distinguished, not only through a detailed description of its physical characteristics, but also through its period attribution and its location in space and time. However, temporal processes and spatial structures become hidden in the index numbers of commodities (Puu, 2015). Marx's analysis in section 3.8 of this chapter clarifies this concept. It suffices to mention here that rational expectations are part of the theory and transform temporal processes into a special characteristic of an equilibrium point (Puu, 2015). According to the view of Paul Samuelson equilibrium analysis is a simplified study of stationary processes (Samuelson, 1952). Introducing time and space into economics means moving away from the standard equilibrium point towards multiple equilibria reflective of the real world situation with temporal and spatial processes and structures involved. Section 3.8 elaborates on the rapid turnover time of capital which assesses the concept of time and space in economics, with its implication for climate change and socio-economic dynamics. Even with all the special assumptions of the neoclassical theory, models of economics and ecology are very complicated to run on a realistic dynamic scale despite the sophisticated mathematical and statistical software modelling tools (Lawson, 2007; Böhringer, C., Löschel, A., & Rutherford, T. F., 2007). Yet, if one is prepared to assign particular numbers to the parameters, they can often be solved on the computer. Where the sophisticated tools of mathematical modelling and innovative science are critically important for the discipline of economics, they must be operationalised under dynamic space time modelling where multiple equilibria are allowed (Keen, 2012).

Towards Radical Economic Paradigms - According to Georgescu-Roegen, neoclassical economics is a "closed system" where consumers consume and firms produce both at abstract equilibrium levels (Georgescu-Roegen, 1999). It's a circular flow and implicitly a boundary circle has been drawn around the system. Things outside this circle, such as natural resources, the environment or even other species, either don't exist or are treated as "externalities" and very often not even "priced" (Daly, 1999; Pepper, 1993; Farley and Daly, 2005). An influential and diverse body of opinion has arisen claiming that the path can be found out of the ecological crisis that does not require the overthrow of the present economic system. One

variant of this body of thought is known as ‘green economics’ which echoes concerns such that the system suffers from gigantism, that its values especially the support for quantitative over qualitative is flawed, that it misallocates resources, promotes inequity hence poverty and ecological destruction (Daly, 1999). But green economics also includes the premise that the system has recuperative powers (Pepper, 1996).

The error of assuming that green capitalism will stem the crisis of climate change and poverty arises from confusion about its relation to capital (Harvey, 2010). Capital will tolerate any number of improvements and rationalisations so long as its basic expansion is secured (Harvey, 2010). Green capitalism and politics along with other movements and ideologies - such as populism and social ecology, ecofeminism, bioregionalism – coming from below as progressive response to the crisis, have been tried (Peet, 1999; Kovel, 2007). Radical approaches of sustainable development challenge the above mentioned reformist approaches by analysing the underlying causes of unsustainability (Kovel, 2007). Such radical schools of thought call for systemic change. Radical paradigms are different than reformatory paradigms because of their relation to capital (Pepper, 1993).

3.7 Section Two - Sustainability Analysis under Radical Economic Paradigms (Marxist and Eco-Socialist Approach)

3.7.1 Marxist view of nature and the concept of sustainability

To propose any reasonable solution for climate change and sustainability it is important to know as to what determines value in Economics? Before any sustainable alternative is proposed, it is important to face the value theory that is dominating us, as a society and is implicated inside our current mode of capitalist production, to transform it into something else. Value, according to Marx, is socially necessary labour time and depending on how value is determined, has implications for the society and the environment. Value is determined by average productivity or the workers’ degree of skills, level of technological development and its application, social organisation of the process of production and the conditions found in the natural environment. These determinants are subject to perpetual revolutionary transformations. The ‘socially necessary’, according to Marx, is always changing due to changing reproduction needs. Marx’s fundamental concept is that value is immaterial but objective. It is a social relation that is why it is immaterial and the process of socially

necessary labour time gets objectified in the thing called, commodity. One cannot dissect a commodity to measure its internal value. The value can only be found when it is put to exchange with something else, in the market. Money then arises out of this simple act of exchange.

For Aristotle, exchange was for equivalents – there is no exchange without equality and no equality without commensurability. Marx, however looks at the symbolic quality of money and commodity versus its deep rootedness. In *Capital*, he accepts classical political economy's liberal thesis which became the basis for neo-liberal theory, of perfect market economy working according to the coercive laws of competition. He further accepts the proposition that if markets were left to do their job without state or monopolistic interference than the economy will be in equilibrium, at a point where demand equals supply. But Marx's thesis in *Capital* revolves around the question as to whether this classical political economy's liberal thesis benefits the society as a whole or not? His answer in *Capital* is that far from benefitting the society as a whole, the liberal thesis will only benefit the bourgeoisie. He carries out his analysis by deconstructing the liberal economic vision of the bourgeoisie. So, Marx is accepting the liberal thesis to show that in their own terms, the liberal political economists are wrong about the outcomes (Harvey, 2013).

Marx sought a truly scientific political economy through the critique of the classical political economy instead of direct historical, anthropological and statistical enquiry and induction. He proposes a syllogistic framework of analysis derived from classical political economy which describes the approach of capital but he uses dialectics to build his critique and explore alternatives. His syllogistic framework of analysis is based on generalities of production which are deterministic and law like; particularities of exchange and distribution which are conjectural; singularities of consumption which are unpredictable and universality of the natural law, i.e., the metabolic relations with nature (Harvey, 2013). Marx's thesis in *Capital* operates primarily at the level of the law-like generality of production. In *Capital*, most of the time Marx confines his theoretical investigations to the level of generality within a purely functioning capitalist mode of production. Confining himself to this level of generality allowed Marx to construct an understanding of capital that transcended the historical particulars of his time and that is why *Capital* is still relevant to today's day and age (Harvey, 2013).

Where Marx sees the miseries of the system (e.g., the conditions inside the factory), he also sees the possibilities within it, like Bhaskar and Habermas. What liberates these negative elements? And how to mobilise what Marx sees as positive possibilities that the system presents toward a social transition for a sustainable society and economy?

For the analysis of sustainability, climate change and poverty from Marx's perspective, it is important to explore two major contradictions of capital identified by Marx. These contradictions of capital are, the metabolic relations to nature leading to a metabolic rift. According to Marx, production that predominates the capitalist mode of production is the production of surplus value which is a social not a physical material relation. This means that the emancipatory possibilities available to human beings are dominated by this social necessity to produce surplus value. This leads to the other major contradiction of capital, i.e., universal alienation of human beings from their own potential capacities and creative power. Concrete material labour processes that are surplus value producing are all that matter whereas material production processes that do not produce surplus value are valueless. To understand these concepts it is important to revisit other contradictions of capital such as capital and labour where labour is the only source of value; the distribution of poverty and wealth under capital; and the time horizon of the accumulation of capital in search of limitless capital growth. The nature-society dialectic embodied in Marx's *Grundrisse*⁹ and *Capital* form the basic interrelated themes analysed in section 3.8 of this chapter. These themes are summarised as follows and are explored in context of the research questions:

- a) Use value and exchange value
- b) Theory of value (capital and labour)
- c) Metabolic relations to nature
- d) Capital's exponential growth
- e) Universal alienation

As we move away from determinism under the neo-classical approach, the importance of man in relation to nature increases to such an extent that at the other extreme there is no nature distinct from what man wills it to be (O'Boyle and McDonough, 2011). Here the object subject dualism collapses and man and nature become one, not separate.

⁹ Grundrisse (1973), The Chapter on Capital

Phenomenology is holistic, takes emotions, values, interactive relationships and intuitions into account as opposed to Cartesian objectivity where cause-effect relationships are based on law seeking analytical methods (O'Boyle and McDonough, 2011; Bhaskar, 1998).

Marx distances itself from idealist approaches like phenomenology because here reality/nature is seen as moulded by man's consciousness so man becomes internally sufficient and investigations of nature are therefore limited to descriptive appearances without penetrating any objective reality (Bhaskar, 1998). Marx rejects determinism on the grounds that historical developments cannot be explained, from extra-social and extra-historical matters.

For Marx, the conceptual analysis of nature, is based on the philosophy of historical materialism – which shows that nature is not a fixed thing for all eternity instead it varies in relation to man's industry and the state of society (Bhaskar, 1998). So Marxist method essentially turns the 'philosophy' of nature into a 'history' of nature. Labour with its resultant transformation of nature makes the development of society 'historical' as opposed to preordained biological evolution under neoclassical philosophy (Bhaskar, 1998; Burkett, 2009). This means that man's needs and natural resources are *time* based relative to the historical stages of development based on particular modes of production. (Pepper, 1996; Meszaros, 2014).

3.7.2 Marx's Labour Theory of Value: Where Smith and Ricardo were very vague about the labour theory of value, Marx was clear and emphatic. Labour was the only source of value implying that no other input could contribute to surplus value or profit (Marx, 1990; Marx, 1991). Marx called this the difference between the value embodied in a worker and the value of the worker added to production, as 'surplus value' and saw it as the sole source of profit. Marx gave two explanations for the origin of surplus value. One was a positive proof, based on a general theory of commodities. The other was a negative proof by a process of elimination based on the unique characteristics of labour.

The positive proof to labour theory of value

Marx opens *Capital*¹⁰, with the idea that the material commodity is simultaneously a use value and an exchange value and that the two forms of value necessarily oppose each other. This opposition (which is internal to the commodity) achieves its external expression in the

¹⁰ Marx, K. (1990) *Capital*, Vol. I (Chapter 1, page 1).

separation between commodities in general (use values) and money (the pure representation in exchange value). But money then internalises contradictory functions within itself which can in turn be resolved only if money circulates in a certain way, as capital. And so the argument proceeds to encompass the class antagonism between capital and labour, the contradictory dynamics of technological change and finally evolves into an elaborate and lengthy disquisition upon those seemingly irreconcilable contradictions that lead capitalism into the cataclysms of crises (Harvey, 2010). On reviewing Marx's *Capital*, it is apparent that to unlock the secrets of the commodity is to unravel the intricate secrets of capitalism itself (Harvey, 1997). *The only attribute that all commodities have in common is that they are products of human labour. When commodities are looked at as crystals of this social substance, common to them all, they are – "Values" (Marx, 1990)*¹¹.

The argument is almost identical to that laid out in Ricardo's *Principles of Political Economy and Taxation* (Ricardo, 2004). Marx appears to follow Ricardo entirely in treating the problem of value at this stage, as one of finding an appropriate standard of value. The only modification in his introduction is of a distinction between 'concrete useful labour' defined as 'human labour exercised with a definite aim to produce use values' and 'human labour in the abstract' which 'creates and forms the values of commodities' (Marx, 1990). Marx then moves on to an analysis of the difference between abstract and concrete labour. In Chapter 2, Vol I of *Capital*, Marx says that all labour is concrete in the sense that it requires the material transformation of nature (Marx, 1990). But market exchange tends to destroy individual differences both in the conditions of production and on the part of those doing the labouring. If it takes a day to make a pair of shoes on average, the abstract labour embodied in a pair of shoes is one day irrespective of whether it takes the individual labourer two or fifty hours to make. Abstract labour is value defined as 'socially necessary labour time' (Marx, 1990).

What Marx eventually brings to surface through his analysis is that he marks the boundaries between freedom and necessity under capitalism, that human labour in the abstract is a distillation, finally accomplished under very specific relations of production, out of a seemingly infinite variety of concrete labour activities. *Abstract labour becomes a measure of value only to a degree that a specific kind of human labour – wage labour – becomes general.* This immediately differentiates Marx's theory of value from conventional labour theories of value (like Ricardo's). Marx's value theory reaches out beyond the problem of

¹¹ Marx, K. (1990) *Capital*, Vol. 1, Part 1, Chapter 1.

simply defining a standard of value for determining the relative prices of commodities which is the reason why it provides rich insights for the climate change and poverty crisis. This is because, his value theory comes to reflect the essential social-natural relations that underlie the capitalist mode of production which reveal the market conditions behind the wage system. Value is conceived of as a social relation. Furthermore, Marx does not throw this concept at the reader arbitrarily. He seeks to show step by step how the law of value as he perceives it operates as a guiding force within the evolution of a capitalist economy (Marx, 1990). His strategy is of unravelling the secrets of capital by employing a dialectical methodology of commodity use and exchange values. According to him, a *'use value is the object of satisfaction of any system whatever of human needs is commodity's material side, which the most unrelated epochs of production may have in common and whose examination lies beyond political economy'*¹². But he then adds, *'... the use value falls within the realm of political economy as soon as it becomes modified by the modern relations of productions or as it in turn intervenes to modify them'* (Marx, 1970, page 28¹³).

To understand the positive proof, it is important to understand Marx's dialectical philosophy. In brief dialectics is a philosophy of change. It begins from the propositions that any entity exists in a social environment. The environment will emphasize some aspect of the entity and necessarily places less emphasis on all the other aspects of the entity. However the entity as a whole, cannot exist without both the foreground aspects (the features the environment emphasizes) and the background aspects (the features that the environment neglects). This sets up a tension within the entity and possibly between the entity and the environment. This tension can transform the nature of the entity and even the environment itself (Marx, 1990; Marx, 1973). The dialectic between use-value and exchange value, is in fact the first method which Marx employs in Capital, Vol. 1 to show that surplus value emanates from labour (Marx, 1990).

Marx reasoned that the commodity was the unity of use value and exchange value. In a capitalist economy the exchange value of a commodity is brought to the foreground while its use value is pushed into the background (Marx, 1992). What this means essentially is that the use value is irrelevant to its price: its price which is determined by its exchange value. Yet the commodity cannot exist without its use value so that a dynamic tension is set up between use

¹² Marx, K. (1970) Contribution to the Critique of Political Economy , p. 28.

¹³ Marx, K. (1970) Contribution to the Critique of Political Economy, p28.

value and exchange value in capitalism (Marx, 1992; Marx, 1990). Marx's exploration of this concept occurred in Capital Vol. 1 when he questions as to should the value not be conceived as the unity of use value and exchange value and does it not have significance in economics (Marx, 1990). Marx used this positive proof or methodology based on a dialectical analysis of the commodity to explain the source of surplus value.

As mentioned above, Marx accepts in Capital, the classical axiom that exchange involves the transfer of equivalents. He however concludes that exchange itself cannot provide the answer to where the surplus value comes from. Yet at the same time circulation based on exchange of equivalents must be the starting point from which the source of surplus value is deduced (Marx, 1990¹⁴). Marx began the solution of this dilemma with a powerful application of the dialectic of the commodity. If the exchange value of the commodity cannot be the source of surplus, then the dialectical opposite of value, use value, is the only possible source. Marx used the quantitative difference between the exchange value of labour power and the value which that labour power creates in the labour process, i.e., use value, to uncover the source of surplus value in the transaction between capitalist and worker. This difference in two values was what the capitalist had in view when he was purchasing the labour power.

According to Marx, in *The Poverty of Philosophy*, "*The economists have very well explained the double character of value; but what they have not set out with equal clearness is its contradictory nature; ... it is a small matter to have signalled in utility-value and exchange value this astonishing contrast, in which the economists are accustomed to seeing nothing but the most simple matter; it is necessary to show how this pretended simplicity hides a profound mystery which it is our duty to penetrate... In technical terms use-value and exchange value are in inverse ratio the one to the other*" (Marx, 2012)¹⁵.

Use value and exchange value together make up a commodity but for classical economists use value plays no role in determining price. Neoclassical economists hold the view, as discussed earlier in the chapter, that the equilibrium ratios at which two products exchange is determined by the ratio of their marginal utilities and marginal costs. But according to Marx,

¹⁴ Marx, K. (1990) Capital, Vol.1, Chapter 5 Contradictions in the General Formula of Capital, and; Marx, K (1973) Grundrisse, The Chapter on Capital. p.239-50

¹⁵ Marx, K. (2012) The Poverty of Philosophy, citing Proudhon, p. 37.

the sale price reflects the cost of production whereas the *subjective utility* of the buyer and seller (as in neoclassical tradition) are irrelevant to the price¹⁶ (Marx, 1973).

Marx's concept of use-utility could also be described as "concrete", as opposed to the "abstract" utility of neoclassical economics, differing in the same sense as do Marx's concepts of concrete and abstract labour. The former, i.e., concrete labour pertains to a single commodity and is in no way additive across commodities¹⁷. The neoclassical concept of utility pertains to commodities in general, can be treated as additive, and is the substance which economic agents strive to maximise. In the classical Marxist scheme, the goal of the capitalist, the primary economic agent in capitalism, is to maximise exchange value, and the use-value of commodities is irrelevant in this task, apart from being a pre-requisite to exchange. Both Smith and Ricardo went on to dismiss use-value as a potential explanation for the exchange rate between commodities, and thereafter ceased to make mention of the concept, save as a prerequisite to exchange (Smith, 1993; Ricardo, 2004). The traditional interpretation of Marx argues that he likewise drew this distinction simply to exclude use-value from any role in political economy. Sweezy, for example, reasoned that "Use-value is an expression of a certain relation between the consumer and the object consumed. Political economy, on the other hand, is a social science of the relations between people. It follows that 'use-value as such lies outside the sphere of investigation of political economy'". This has been the conventional Marxist position since Hilferding (2009)¹⁸ whose argument Sweezy simply paraphrased (Rosdolsky, 1977).

This traditional Marxist analysis limits use-value to being a pre-requisite to exchange: for a good to be exchangeable, it must have some use-value to a potential purchaser (while it is normally a non-use-value for its producer). However this is where its role in economic analysis begins and ends. Ricardo, like Smith, equated value to effort in production, but appeared more inclined than Smith to equate effort to labour: "everything rises or falls in value, in proportion to the facility or difficulty of producing it, or, in other words, in proportion to the quantity of labour employed on its production" (Ricardo, 2004). Where Smith and Ricardo were open to interpretation, Marx was uncompromising: labour was both

¹⁶"The value (real exchange value) of all commodities (labour power included) is determined by their cost of production, in other words by the labour time required to produce them. Their price is this exchange value of theirs, expressed in money."Marx, K. (1973) Grundrisse , p. 136.

¹⁷ Marx, (1990) Capital Vol. 1 Part 1, Part4 and Part 5.

¹⁸ Rosdolsky (1977), referring to Sweezy , p. 26.

the measure and the only source of value. Criticising Wagner for identifying labour as the substance of exchange value (rather than of value), Marx comments that “*Nowhere do I speak of ‘the common social substance of exchange value’ but [I] say, rather, that exchange values ... represent something common to them [commodities] which is wholly independent of their use-values*”¹⁹. Thus value was the basis on which commodities were exchanged, and the acknowledged existence of surplus value had to be explained on the basis of the exchange of equivalents.

Based on Marx’s work, including *Theories of Surplus Value, Contribution* and the brief *Notes on Adolph Wagner*, Rosdolsky criticised those traditional Marxists who dismissed the role of use-value in Marx’s economics, such as Sweezy, Hilferding, Dobb²⁰ and Meek²¹ amongst others (Rosdolsky, 1977). Rosdolsky notes that, among Marx’s numerous critical comments on Ricardo’s system the most striking can be found only in the *Rough Draft*, namely that Ricardo, much like Marx’s critics, abstracts from use-value in his economics... and that consequently for him it “*remains lying dead as a simple presupposition*”²² (Rosdolsky, 1977). He gives as his first example Hilferding’s edict that “*use-value, lies outside the domain of political economy*”. Rosdolsky comments that while this appears to paraphrase Marx, in fact it distorts him, by omitting a crucial sentence. The full statement in the *Contribution* reads: “*To be a use-value is evidently a necessary pre-requisite of the commodity, but it is immaterial to the use-value whether it is a commodity. Use-value as such, since it is independent of the determinate economic form, lies outside the sphere of investigation of political economy. It belongs in this sphere only when it is itself a determinate form*”²³. Rosdolsky concludes that “*It must be conceded that the original differs considerably from the copy, and that Hilferding’s arbitrary reproduction of these sentences is tantamount to a clumsy distortion of Marx’s real view*”²⁴ (Rosdolsky, 1977).

The same can be said of Sweezy, who claims that use-value was excluded by Marx because it did not embody a social relation²⁵. According to Rosdolsky, what Marx meant by excluding use-value from political economy except when it is ‘*a determinate form*’, is that in the case of

¹⁹ Marx, K. (1975) Notes on Adolph Wagner in Carver, T. Karl Marx: Texts on Method, Basil Blackwell, Oxford. Page, 183.

²⁰ Dobb, M., (1973) Theories of Value and Distribution since Adam Smith, Cambridge University Press, London.

²¹ Meek, R.L., (1973) Studies in the Labour Theory of Value, 2nd Edition, Lawrence & Wishart, London.

²² Rosdolsky, op. cit., p. 72-83 quoting Grundrisse p.267

²³ Marx, K., (1859) A Contribution to the Critique of Political Economy, Part 1, The Commodity. Progress Publishers, Moscow. Online version: www.marxists.org/archive/marx/works/1859/critique-pol-economy/index.htm

²⁴ Rosdolsky, (1977), p. 74.

²⁵ Ibid, referring to Sweezy, op. cit., p. 26.

the simple exchange of commodity for commodity (in the C—M—C circuit), the use to which the exchanged commodities are put is of no interest. However Marx states in the *Grundrisse* that it would be highly erroneous to conclude from this that the distinction between use-value and exchange value is never of relevance in economics (Marx, 1973). For commodities consumed in the circuit of simple commodity exchange C—M—C, the lack of a relation between use-value and exchange value simply meant that the use-value of a commodity was qualitative, while its exchange value was quantitative, and that a commodity's qualitative utility played no part in determining its quantitative price. However the use-value of labour power to its capitalist consumer in the circuit M—C—M is quantitative—its ability to produce commodities—as is its exchange value—its cost of production, also measured in commodities (Marx, 1973). *The lack of a relation between labour's quantitative use-value and its quantitative exchange value means that the two will normally be different, and this difference was the source of surplus value.* M-C-M circuit is a determinant form which implies that according to Marx, use value of a commodity plays an important role in political economy (Marx, 1990). Marx gradually approaches this proposition from a dialectical perspective, in which the concept of use-value is far from absent (Marx, 1990).

Marx notes that, for capitalism to function, labour has to be unable to produce directly for itself, because in the latter case it would produce not commodities but use-values only. Barter indicates that, under simple commodity production, use-value is not an economically determinate form, because the object of the exchange is to acquire use-values, not to accumulate exchange value (Marx, 1973). The incommensurability of use-value and exchange value is the incommensurability between something qualitative and something quantitative. However under capitalist commodity relations, use-value becomes a determinate form in political economy in the relationship between capital and labour because the incommensurability of the use-value and exchange value of labour power is expressed as a quantitative difference, from which the capitalist can derive surplus.

In the case of a commodity purchased by ordinary consumers, the use-value of the commodity is qualitative, while its exchange value is necessarily quantitative. However in the case of labour power purchased by a capitalist, the use-value is quantitative, as is the

exchange value²⁶. While it is conceivable that the use-value of labour power could equal its exchange value, it will normally be the case that its use-value will exceed its exchange value, yielding surplus for the capitalists (Marx, 1990).

Behind the relative concept of exchange value, Marx sees absolute value. The source of this cannot be use-value: “the exchange of commodities is evidently an act characterised by a total abstraction from use-value”, and at this stage he makes the discernment to conclude that if use-value is not the “common property” of value, then the only common property left is “that of being products of labour.” Marx distils this crucial aspect of abstract labour as the “residue” of all commodities (Marx, 1990). Use values equal concrete labour; absolute values equal abstract labour. Concrete means the individuality of labour remains through material transformation of nature whereas abstract labour means the individuality is destroyed due to market forces and individual differences are done away with for socially necessary labour time. Thus human labour in the abstract, undifferentiated by the type of labour, is the essence of absolute value. This is one method of deriving the source of value and of surplus value, which developed into the traditional interpretation of Marx.

The controversial negative proof to labour theory of value

According to Marx, labour is the only source of value because it is the only commodity where one can distinguish between commodity and commodity power²⁷. When any other commodity is sold the purchaser takes it lock, stock and barrel. But with labour, the capitalist purchaser does not own the labourer. Instead he pays a subsistence wage, which is the cost of production for the ability to work which Marx describes as ‘commodity labour power’. So the value of labour power is the value of the basket of commodities required to reproduce labour. The labourer is put to work for a length of the day where he produces commodities worth more than his subsistence wage (Marx, 1990). The difference between the output of labour and the cost of maintaining labour power is the source of profit. With the machine however, there is no such distinction. The capitalist gets what he paid for and no more when he buys the machine whereas with labour he gets more than what he paid, for. Since the value of

²⁶ Marx, K., (1990) Capital Volume, 1. Part III: The Production of Absolute Surplus-Value Chapter Seven: The Labour-Process and the Process of Producing Surplus-Value.

²⁷ It is evident in various works of Marx such as, Contributions, 1859; Grundrisse, 1973; Capital, 1990; Theories of Surplus Value, 2013.

labour is an underlying factor in understanding the phenomena of poverty and climate change under Marx and hence the solutions to sustainability, it is analysed in detail in this remaining section.

Capitalism is the stage of commodity production where the ability to work itself has become a commodity, because the direct producers of commodities have been dispossessed of the means of production, and therefore must sell their labouring ability to others (Marx, 1990). As a commodity, the value of labour power is determined like that of any other commodity, by the labour-time necessary for its production. The capitalist purchaser of labour power pays for labour power at its value, and this reduces itself to “the value of the means of subsistence necessary for the maintenance of the labourer.” (Marx, 1990).

In the *Economic and Philosophic Manuscripts of 1844*, Marx comments when discussing Smith that “*The capitalist thus makes a profit, first, on the wages, and secondly, on the raw materials advanced to him*”²⁸ (Marx and Engels, 2011). However he also adds that, “*The greater the human share in a commodity, the greater the profit of dead capital*” which is an assertion that labour is at least the major source of profit. In *Wage, Labour and Capital*, Marx developed the explanation that labour is paid its cost of subsistence, yet its work extends beyond the time required to reproduce those means of subsistence²⁹ (Marx, 1975).

According to Marx, the difference between the value of labour power, and the value the labourer can create when set to work, is the explanation of surplus, and hence profit³⁰. This implies the more the commodification of labour by the capitalist the more the profit.

For Marx, labour is the only commodity which can create value. This is because for machinery and raw materials, *the maximum loss of value that they can suffer in the process, is plainly limited by the amount of the original value with which they came into the process, or in other words, by the labour-time necessary for their production. Therefore, the means of production can never add more value to the product than they themselves possess independently of the process in which they assist*³¹.

²⁸ Marx and Engels, (2011) *Economic and Philosophical Manuscripts of 1844*. Page 11.

²⁹ Marx, (1975) *Wage, Labour and Capital*, Chapter 6. Also, Marx, (1990) *Capital*, Vol 1. Chapter 10 and Marx, (1991) Vol. 3. Part 7; Chapter 49.

³⁰ Marx, (1990) *Capital*, Vol. 1. Chapter 1.

³¹ Marx, (1990) *Capital*, Vol 1. Chapter 1-8; Marx (1991) *Capital*, Vol 3, Part7; Chapter 49. Marx (2013) *Theories of Surplus Value*, Chapter 17.

Marx puts forward a proposition which could be called The Conservation of Value, i.e. that the value of the product is necessarily equal to the value of the inputs. The argument that labour preserves the value of the means of production is prominent throughout the *Grundrisse and Capital*. Labour does not reproduce the value of the means of production, but preserves it³². The capitalist thus obtains this preservation of the old value just as free of charge as he obtains surplus labour. . Marx was also explicit that the quantitative measure of a machine's contribution to production was its use-value, not its exchange value. Thus the contribution of the means of production to the value of output is their use-value. *“Fixed capital ... realises itself as value only so long as it remains in the capitalist's hand as a use-value... In this respect, then, fixed capital also includes ... coal, oil, wood, etc., which are completely destroyed in the production process, which only have a use-value for the process of production itself. The same materials, however, also have a use-value outside production, and can also be consumed in another way... They are fixed capital not because of the specific mode of their being, but rather because of their use³³.”*

The axiom that use-value plays no role in determining exchange value means that, in the sphere of consumption, use-value and exchange value are incommensurable in contrast to the neoclassical schema, which makes utility and price commensurable through the devices of marginal utility and marginal cost. In the sphere of production, he argues that the quantified use-value of the means of production is the same as their quantified exchange value. This is to argue that, in the case of the sphere of production, unlike the sphere of consumption, exchange value and use-value are identical (Marx, 1990).

To further analyse this argument that establishes that labour is the only source of value, it is argued that human labour is constantly being commodified under capitalism but only to a certain extent beyond which the capitalists' cannot commodify it as they can commodify other factors of the means of production. This is simply because *if they succeeded in commodifying labour fully as they can commodify other factors of the means of production then capitalism would die*. Man, would in that case, lose his creativity and unique human values based on free will, thus becoming equivalent to a machine. *Therefore, labour could never be fully commodified which is why labour is the only source of value and to identify*

³² Marx, (1990) Vol 1, Chapter 8; Marx (1975) Wage, Labour and Capital, Chapter 5. Marx, (1991) Vol3, Part III, Chapter 15.

³³ “Fixed capital can enter into circulation as value, however, only to the extent that it passes away as use-value in the production process. It passes, as value, into the product—i.e. as labour time worked up or stored up in it—in so far as it passes away in its independent form as use-value... its circulation as value corresponds to its consumption in the production process as use-value”. Capital (1992) Vol. 2, Chapter 8.

this is Marx's greatest contribution to political economy. Human value embedded in labour needs to stay this way so that the capital can accumulate the value it requires and for capitalism to remain as a system.

This concludes the analysis as to why labour, a radical indeterminate input is the only source of value. The neoclassical theory of growth aims for neat determinate solutions under closed system (controlled experiment) compared to Marx's theory of value which is based on radical indeterminacy of labour under open system (the uncertain, non-linear real world) which cannot yield neat determinate solutions(Varoufakis, 2013; Varoufakis, 2015).

The proposition that labour is the only source of value does not deny nature's contribution to the source of value in question. Use value is derived from both natural materials and human labour. However nature's materials are seldom useful until they are converted to useful form by labour (Engels, 2012). But then, since Marx regards humans as part of nature, under historical materialism, labour represents nothing more than nature working on itself to change its form (Engels, 2012). Therefore, he is claiming that labour is in fact part of nature (not above nature) and his position can be justified and verified by the natural law argument that Marx develops under his "syllogistic" framework of analysis in Capital. His analysis of the metabolic relation to nature is analysed below as one of the main contradictions of capital which is based on his man-nature dialectic, essential to further analyse climate change and poverty discourse in a comparative light.

3.7.3 Marx's Metabolic Analysis Framework: Man-Nature Dialectic

Marx holds that man and nature are not separate however the unity of the two is not of a phenomenological kind where nature is merely an extension of human consciousness, rather it comes about by the process of labour under his philosophy of historical materialism. For Marx, the most fundamental expression of man-nature interaction is through labour. Labour done with meaning and intentionality is the means by which man converts nature into forms useful to him and sustainable for him (Engels, 2012; Marx, Engels, Mandel, Fowkes, and Fernbach,, 1990). Man has to transform nature for subsistence and this transformation is a social one. The process of changing nature involves forms of social organisation which give rise to particular relationships among people. Man conceives in advance what he wants to produce and how he wants to transform nature. In doing so he requires foreknowledge of how

nature works, its mechanisms and laws. This knowledge enables him to produce for more sophisticated needs. In the process of knowing nature to transform it, he transforms himself to a higher intellectual level (Burkett, 2009). As Marx says, by acting on the external world and changing it, he (man) at the same time changes his own nature (Marx and Engel, 1986; Engels, 2012) and this statement sums up the dialectic. Different perceptions of nature correspond to specific historical stages of human development. This is what is meant by the ‘historicity of nature’ (Marx and Engels, 1986; Burkett, 2009; Harvey, 2007; Foster, 2000).

Marx’s conception of labour and production as a metabolic people-nature relation serves the following functions in his analysis. *First*, it highlights that all human forms of production including capitalism are subject to nature’s laws. As Marx indicates, ‘When man engages in production, he can only proceed as nature does herself, i.e. he can only change the form of the materials. Furthermore, even in this work of modification he is constantly helped by natural forces’ (Burkett, 2009). To this regard, Marx approvingly quotes the Italian political economist Pietro Verri:

‘All the phenomena of the universe, whether produced by the hand of man or by the universal laws of physics, are not to be conceived as acts of creation but solely as a reordering of matter. Composition and separation are the only elements found by the human mind . . . whether earth, air and water are turned into corn in the fields, or the secretions of an insect are turned into silk by the hand of maccoan, or some small pieces of metal are arranged together to form a repeating watch’³⁴.

Second, Marx’s treatment of labour and production as a socially organised exchange of matter and energy between people and nature enabled him to avoid energy-reductionism. This is because commodities, are products of both labour and nature, and because labour is itself a form of nature in interaction with another form of nature (raw materials), the production and exchange of commodity values is both of social (people-people) and of metabolic (people-nature) relation (Foster, 2000; Burkett, 2009).

3.7.4 Marx’s Metabolic Rift Analysis - it is also where Eco-Socialists position themselves

³⁴ Marx 1981, Capital, Vol. I, pp. 133-4.

Marx introduced the notion of the metabolic rift or the rift in the metabolic exchange between humanity and nature (Marx, 1990; Marx and Engels, 1986). The context was a robbing of the soil of the countryside of nutrients and sending of these nutrients to the cities in the form of food and fibre, where they ended up contributing to pollution (Marx, 2013; Marx and Engels, 1986; Engels, 2012). This rupture in the soil nutrient cycle undermined the regenerative capacities of the ecosystem. This point directly links to the analysis of modern industrial agriculture in relation to local organic agricultural methods in context of climate change and poverty, discussed in the previous chapter and it will be an important theme of analysis in the primary chapters of this study. Marx argued that it was necessary to restore the soil metabolism to ensure environmental sustainability for the generations to come (Marx, 2013; Foster, et. al. 2010; Foster 2001). Nature can be seen as a web or a fabric made up of innumerable processes, relations and interactions, the tearing of which ultimately results in a crash of the ecological system (Marx, 2013; Foster, 2011; Foster, 2014; Harvey, 2007; Harvey 2014). Metabolic analysis serves as a means to study these complex relationships of ecological degradation triggered by anthropogenic climate change and its implications for sustainability. Hence Marx's universal law analysis under his syllogistic framework of a metabolic rift is pivotal in context of the underlying explanation from a critical realist perspective behind the twin phenomenon of climate change and poverty.

Marx provided a materialist critique of modern agriculture³⁵, as agriculture sustains the rest of a given economy– the basis of the metabolic rift -describing how capitalist operations inevitably produce a metabolic rift as the basic processes of natural reproduction were undermined preventing the return to the soil of the necessary nutrients (Marx, 1990; Engels, 2012; Foster, 2011). This theme corroborates with the concept of green revolution discussed in Chapter 2 of this research study. Marx's main argument is that capital creates a rupture in the metabolic interaction between humans and the earth, one that is only intensified by large scale modern agriculture, long distance trade and massive urban growth. This argument also confirm Chapter 2 analysis of this study. The development of capitalism whether through colonialism, imperialism or market forces, expanded this metabolic rift to the global level as distant regions across the oceans were brought into production to serve the interests of capitalist core nations for the extraction of surplus value (Harvey, 2007; Marx, 2013).

³⁵ Marx, (2013) Capital, Chapter 15, Section 10, p. 352-353. Woodsworth Edition.

According to Marx, capitalist agriculture is not rational as it destroys land by the profit seeking bourgeoisie or corporate agribusinesses (Marx, 2013). The literal desertification of the developing South which has been a result of the importation there of Westernized mechanised agriculture draws analogy from the declining middle and long term fertility of the soil in the industrialised North (Schapiro, 2014; Kuffner et al., 2008). In the name of short term increased efficiency with regards to only food prices, ignoring social and environmental sustainable standards, nature is destroyed with, high inputs of artificial fertilisers, chemical pesticides, herbicides; intensive operations of farm machinery which produces eutrophication of rivers, water and land pollution with antibiotics used in animal rearing; deterioration in soil drainage and structure through over ploughing in wet conditions; loss of porosity through the destruction of worms by copper oxychloride pesticides; structural weaknesses due to the replacement of organic fertilisers by artificial ones; a long term pH decrease through increased use of nitrogen fertilisers and long term drainage deterioration due to lack of investment in drainage work (Long et al., 2006; Meier and Stiglitz, 2000). The costs attached to this destruction is in the form of externality, as analysed in section 3.6 and the primary chapters of this study

Marx's conceptual analysis of material basis proposes that ecosystems and natural processes are complex and exist in multiple layers ultimately serving as the determinants for life. For example, the cutting down of an ancient forest, home to numerous species compromises the integrity of the entire ecosystem. Attempts to substitute a mono-cropped industrial tree plantation for original forestland, is simply the replacement of a diverse ecological system with a relatively sterile human made environment. Such an industrial forest is all the more extreme because it is turned into a pure commodity (Newell, 2012; Burket, 2014; Foster, 2009). The ecological rift is essentially the product of a social rift: the domination of human beings by human beings (Stavrianos, 1981).

According to sustainable developers in the neo-classical tradition, the system as it is, can continue to expand by creating new sustainable capitalism bringing the efficiency of market to bear on nature and its reproduction (Stern, 2014). This tradition proposes that not only water offers new opportunities through its commodification for profiting on scarcity, this is also the case with respect to fuel and food. A move to a booming agro-fuel market, due to fossil fuel price hikes with a resultant shift in agriculture from food to fuel crops, has led to tremendous food scarcities. Food scarcities are then to be addressed by GMOs under neo-

liberal political approach instead of production and distribution of food by empowering organised organic farming methods and developing sustainable domestic market networks (Narain, 2008; Richards and Stavins, 2005). If the soil is effected, the entire regenerative capacities of the eco-system are effected (Foster, 2009). Similarly issues arise with respect to carbon trading schemes, ostensibly aiming at promoting profits while reducing carbon emissions – a strategy which is likened to commodification of air. These are just a few polished strategies for profiting from climate change (Kovel, 2007; Narain, 2008). According to Marx, this system sees wealth entirely in terms of *value generated through exchange – the exchange value* (Marx, 1990). In such a system, only commodities for sale on the market really count. External nature – water, air, plants, trees, living spaces – is viewed as free gifts (Stern, 2014) and labour is commodified (Foster, 2009). *Value generated through exchange causes ecological and social rift which are the underlying causes of climate change and poverty in the development process.*

The incorporation of the geoengineering (Weitzman, 2007) and technological fix of artificial nitrogen fertilizer has created additional ecological rifts and other environmental problems (Narain, 2008). The production of synthetic fertilizer produces air borne nitrogen compounds that aggravate climate change. Nitrogen compounds overloads marine ecosystems (with excess nutrients), which compromise natural processes that generally remove nutrients from the waterways (Foster, 2010; Schapiro, 2014). The increased concentration of artificial nutrients within the water causes eutrophication. This leads to oxygen poor water and the formation of hypoxic zones – otherwise known as dead zones because fish and crabs suffocate within these areas. All these economic solutions in pursuit of growth and profit potentially create an ecological rupture and social rupture which tend to lay the ground for the next generation of climate and social crisis (Narain, 2008; Harvey, 2007; Foster, 2014).

3.7.5 Further contradiction of capital: its exponential growth aggravating the metabolic rift and universal alienation due to rapid turnover time for consumption

The ecological rupture in the metabolism of a system occurs when the natural processes and cycles are interrupted (Foster, 2009). These metabolic rifts need to be historically contextualised. With the advent of Industrial Revolution two centuries ago, the concentration of carbon dioxide in the atmosphere has increased dramatically, overwhelming the ability of natural sinks to absorb the additional carbon (IPCC, 2007). This industrialism is placed in a

global economic system of capitalism. The movement from human motive power to water and wind to coal driven steam engines transformed capitalist production, increasing the scale of production by pushing up labour productivity to historically unprecedented levels and by deepening the exploitation of nature and labour to facilitate the accumulation of capital on an ever larger scale (Harvey, 2014; Harvey, 2010; Foster, 2010). According to the ecological economist Herman Daly, as a result of these developments, natural cycles have been overloaded and the life support services of nature are impaired (Daly, 2003). This pattern, just as the rift in the soil nutrient cycle continues, given the logic of capital of extracting surplus value (Harvey, 2007; Foster, 2009; Foster, et al. 2010).

Circulation of Capital – Three Circuits of Capital

Capital, according to Marx, is a process of value in motion undergoing a continuous expansion for the production of surplus value. The circulation of capital can be viewed in the following manner: surplus value originates in production and it is realised in circulation. The importance of understanding capital's circulation process is therefore as critical as understanding its production process. The capital that is not realised, is devalued (depreciated). All crises, for Marx, are crises of realisation (Harvey 2010; Harvey, 2007), as is the financial crisis of 2008. This devaluation can take different tangible forms: a) ideal money capital; b) unutilised productive capacity; c) unemployed or underemployed labour power and; d) a surplus of commodities. But capital will not invest in environmental development or social welfare. The reason is as follows:

Capital must expand to survive which is why it is constantly struggling to transcend the barriers, both social and natural such as the regulative laws of the natural cycles (Harvey, 2010; Kovel, 2007). It cannot operate under conditions that require the reinvestment of capital into the maintenance of nature or labour. Therefore, capital ignores two kinds of costs implicitly: a) environmental costs or externalities which has implication for nature; and b) social welfare costs which has implications for labour.

Dematerialisation of capital resulting in increasingly rapid turnover time of consumption leading to increasingly higher environmental loads:

The depth of Marx's insight is incredible because it provides comparative answers for dealing with climate change and poverty towards sustainable development solutions (Kovel, 2007; Foster, 2010; Harvey, 2010). Capital is quantitative in its core and imposes the regime of quantity upon the world; this is a necessity for capital. But capital also seems to go beyond the limits that it itself imposes and so can neither rest nor find equilibrium; it is self-contradictory (Harvey, 2007). Every quantitative increase becomes a new boundary which is immediately transformed into a new barrier. The boundary/barrier ensemble becomes a new site of new value and the potential for new capital formation which then becomes another boundary /barrier and so forth and so into infinity – at least in the logical schemata of capital (Harvey, 2007; Harvey, 2010). That is why a capitalist society is restlessly dynamic, i.e., that it introduces new forms of wealth and continuously makes the past forms obsolete. All the wealth of the last decade has not reduced global poverty or the drive to accumulate still more (Kovel, 2007). The pressure of capitalist growth therefore is exponential (Marx, 1973). Marx further elaborates in *Grundrisse* that in the regime of capital any original profit is only a starting point. If capital increases from a monetary unit of 10 to 100 the first time around, there will be a tendency for it to go to 1000 the second time around and so forth. Therefore capitalist production is not just expansionary but exponentially expansionary (Marx, 1973). As Marx comments in *Capital* 'the repetition or renewal of the act of selling in order to buy [C-M-C] finds its measure and its goal... in a final purpose which lies outside it, namely consumption, the satisfaction of definite needs. But in buying in order to sell [M-C-M] on the contrary, the end and the beginning are the same, money or exchange value, and this very fact makes the movement an endless one' (Marx, 1990).

Value is socially necessary labour time and what is socially necessary for capital to survive is accumulation and expansion for increased growth rates whereas non growth becomes a crisis. So capital needs to keep in motion and grow which is why it must refuse any boundedness. The rapid growth of capital is paralleled by the rapid rate of technological change, from the mechanical technologies of the early industrial period to the electronic technologies of the information age on to the biotechnologies and nano-technologies of the century now under way.

More capitalist production means that more natural resources need extracting and surplus labour is required. In chapter 12 of *Capital* Vol. 1, Marx analysis how technological change increases production but the value of fixed capital (c) goes down. The value or the organic

composition of capital (c/v) increases as production becomes more capital intensive (Marx, 1990). But technological changes bring about relative surplus value which is ephemeral. Technological innovation in search for *relative surplus value* creates a contradiction because labour is displaced out of production and with this there is a simultaneous displacement of the source of surplus value. Technological dynamism therefore is a potent source of contradiction within the capitalist system. To put it mathematically, the rate of accumulation is the independent variable whereas the rate of wage is the dependant variable. A simple version of the falling rate of profit would read as follows (Marx, 1990):

Profit (p) = $s(\text{surplus})/c+v = s/v$ (Rate of Exploitation)/ $1+c/v$ (organic composition of capital)

If s/v is constant than the tendency of increasing c/v gives a falling rate of profit. Technological changes can offset this tendency temporarily. But an internal contradiction of capital to technological and organisational change in search of increased surplus value emerges as the demand for labour diminishes, there is a production of surplus population. This means a high rate of exploitation s/v is now possible with labour intensive production which could lead to higher profits.

There exists a tension between technological innovation and surplus population. Inherent in capitalism is a kind of homeostatic tendency, a kind of adjustment mechanism which balances accumulation, technological changes and surplus labour. This is explained by Marx in his theory of relative surplus value, in chapter 12 of Capital Vol. 1 (Marx, 1990). The length of the working day matters less for the capitalists because they found another way to make surplus value, i.e., the relative surplus value, based on technological innovation for ephemeral profits. But the length of the working day problem is perpetual because the capitalist class will come back and demand more labour time.

Do capitalists command temporality which is the length of the working day?

For a capitalist, profit cannot be made unless the workers' time is commanded which means the intensity of the labour process. Political force redefines temporality in a way that advantages the capitalist class and that extracts value from the labour class. But capitalists have the tendency to push thing too far and to destroy nature and labour force, unless checked. Therefore, the capitalist class and the state have an interest in maintaining a healthy population which is a theme of Capital Vol 2 (Marx, 1992). This is where the reforms, based

on restructuring of the regulatory regimes of governance to correct the abuses of capital, enter the system. According to Marx in Capital Vol. 2, the coercive laws of competition let the capitalists act in a way as to destroy the capacity of their own reproduction. In the instance of reforms, workers come together to press upon reformatory laws, they actually save the capitalist class by preserving them instead of overthrowing them. Once wage is secured at a given level, capitalists in fact become better off (Harvey, 2013). Environmental movements similarly force capital in such a way which accommodates its concerns and also prevents capital from possible environmental crisis. But these movements only shift the crisis or delay it. The reason being that environmental reforms work within the capitalist system where extraction of surplus value through monetisation and commodification of labour and nature remains the priority.

In chapter 12 of Capital Vol. 1, it is analysed how with new technological breakthroughs and innovations, capitalists are looking for ephemeral surplus value where they gain a competitive edge for a small period of time and get the relative surplus value. Machinery produces surplus working population which displaces labour. Machinery allows the capitalist to regulate the intensity of the work and helps reduce the length of the day. This process has the tendency to discipline the workforce and this changes the nature of social relations where ‘workers become the appendages to the machines’ (Marx, 1990). So essentially *Marx’s analysis implies that technology represents the social relations underlying the economic system. The bourgeoisie in comparison considers machinery as neutral. Marx puts the technology relations of the society’s material basis parallel to the society’s relation to nature.* New technologies have huge social and environmental implications for the management of labour surplus and the management of the disposal of surplus capital into the world markets.

Speed of the circulation of capital and its increasing turnover time

Where Capital Vol. 1 presents the argument that capital is a continuous accelerating process, Capital Vol. 2 lays out the proposition that the speed of the circulation of capital and its increasing turnover time is important for accumulation and profit. Marx in Capital Vol. 2 explains the three circuits of capital – money capital; production capital; and commodity capital, through which capital circulates and it is the unity of these three circuits that leads to industrial capital generating surplus value. Production is where surplus value is produced. Circuit of capital proceeds in a way so that the various phases of capital circuits pass into

each other without delay. If capital comes to a standstill however, then such a scenario is identified as a point of blockage. There can be three of these blockage points against each circuit of capital (Marx, 1992):

- a) Money capital phase 1 – money capital forms into a hoard
- b) Production capital phase 2 – means of production ceases to function and labour is unoccupied
- c) Commodity capital phase 3 – unsaleable stock of commodities

These three points can become barriers in the continuous, accelerating flow of capital resulting in the hindrance of rapidly increasing turnover time. Grundrisse has similar language in terms of barriers to capital and crisis formation. In Capital Vol. 2, commodity capital circuit becomes more and more significant as Marx emphasizes on the use-value of the commodity. The material flow in relation to value flow becomes important (Capital, 1992).

Where the simple C-M-C circulation is exchange of equivalence, M-C-M circulation attempts to strike a balance between money as a means of value and money as a form of circulation. M-C-M leads to a change in M which is the surplus value. The difference between money and capital is important. Valorisation of capital is when the original intent of gaining more money is realised in M-C-M and this movement converts money into capital (Harvey, 2013). Parts 1 and 2 of Capital Vol 2, focus on the complexities of the circulation process at an individual level, i.e., individual capital as the movement of an autonomous part of the social capital. In part 3 of Capital Vol 2, it is the circulation process of the social capital. When taken as a whole in its entirety, this circulation process is a form of the reproduction process of the class relations (Harvey, 2013). Capital as a process can only be understood in money terms. Money is a universal representation of material wealth. For the capitalist, money is limitless because it is allowed to be accumulated in the M-C-M way as opposed to the C-M-C way which represents a process of circulation of commodities. The M-C-M way is well manifested in the growth rates around the globe since the 1950s, with all kinds of social and ecological consequences. All different forms of capital (merchant capital, finance capital, industrial capital) fall under the general rubric forming M-C-M (Harvey, 2013). This

monetary system as it escapes from the immediate constraints of socially necessary labour time as it is dematerialised due to the availability of credit money, then monetisation and commodification of almost anything becomes possible. The concept of commodity gives rise to, creditor (seller) and debtor (buyer). This leads to power relations (Harvey, 2010).

Marx sees this capital movement as a fluid process of motion. Capital, therefore, is value in motion and it is objectified in physical forms and these physical forms keep changing, i.e., from money to commodity to money and so on. It is not static. It is constantly renewed in such a movement therefore essentially capital by definition is a form of circulation that keeps on moving and expanding but it does not recycle. *This absence of potential recycling mechanisms in capital's movement sits at the heart of the socio-economic unsustainability and climate change.*

In conventional neo-classical economics, the longer circulation time is the basis of an increase in prices and so value can originate in such a circulation process. Marx, however, proposes the opposite. He shows through his analysis that shorter circulation time results in a speed up of turnover time of capital thus yielding higher value. In the event of rapidly increasing circulation time, Marx implies that the surplus value originates from this circulation process because the rate of surplus value is much higher in the case of rapid turnover time of capital compared to when there is an absence of this rapid turnover time. Reduction in the ratio of turnover time relative to working period immediately has an impact on capital advanced because it raises the profit rate, other things being equal.

For capital to 'grow', its realisation must speed up, this means a reduction in its circulation time, from the original investment at the point of production, to its release for the next cycle at the point of consumption. The significance of space and time for capital is closely tied to its rupture from nature (Harvey, 2007). Through profound shifts in temporality, capital changes a world regulated by complex and interrelated temporalities of ecosystems to one in which a single uniform and linear standard is imposed upon reality. These processes carry serious implications for sustainability. This is because as capital reaches out to new levels, as boundaries are surpassed and recombined, the de-synchronization between natural time and work time translates into a disarticulation of human beings/labour and nature (Kovel 2007; Daly, 2013). The compression of time is linked to the compression and homogenization of space and with time and space so prepared, capital's penetration of all aspects of the life

world of individuals and communities accelerates (Harvey, 2007). Time–space compression occurs as a result of technological and financial innovations that condense spatial and temporal distances. Today we are entering a space which is speed-space (Harvey, 2014) on a global scale. This new other time is that of electronic transmission, of high-tech machines, and therefore, man is present in this sort of virtual time, not via his physical presence, but via programming. Cultures and communities (whether of the developed countries or developing countries) are merged through time-space compression due to dynamic capitalist change, as layers upon layers of histories fuse together collapsing traditional spatial co-ordinates to shift the very understanding of what the identity of a "place" should be (Harvey, 2014).

In the early years, money was tied to material things such as gold, silver or the like so it has had more of an inertia than the present times where money has increasingly become dematerialised, moving about in an electronic form (Foster, 2014). Capital is increasingly looking to shed this burden to become even more dematerialised but as it becomes less material, its effects on ecology and society become greater (Marx, 1991³⁶). Dematerialisation of capital means that it spreads faster, further and draws more of the world in, re-structures production, exchange, circulation and consumption around exchange value to accommodate its ever growing expansion at the expense of labour and nature (Harvey, 2007; Kovel, 2007; Foster, 2014; Amin, 2013), causing a metabolic rift.

The above analysis shows the rapid turnover time for consumption due to capital's drive for exponential growth through space-time compression, through the dematerialisation of financial capital, high tech machinery and artificial intelligence based on advanced technology solutions collectively aimed at extracting surplus value leads to social and ecological rifts underlying climate change and poverty crisis.

In *Capital* Vol. 1, the interconnections between the growth of exchange, the rise of money form and the emergence of abstract labour as a measure of value, as explained earlier in section 3.8, are clear. But more importantly, a sufficient perspective is presented, on these inter relations to see that the way things appear in daily life, conceal as much as they reveal about their social meaning. This idea Marx captures in the concept of, 'the fetishism of commodities'³⁷. The act of exchange mediated by the capitalist market system reveals

³⁶ Marx, K. (1991) *Capital: A critique of Political Economy Vol. III*. Pages 70-90.

³⁷ Marx (2013) *Capital*, Chapter 1 Vol. 1, Section 4. Page 46.

nothing about the conditions of labour and conceals the metabolic relation to nature. The existence of money – the exchange value – conceals the social meaning of value itself (Marx, 1990). The role of money and credit system emerge as distinctive elements of the capitalistic mode of production in Marx's Capital Vol. III and play a very special role in the overall operation of capitalism. A detailed analysis of money and credit lies outside the premise set by this research study. This topic should serve as an important area of post-doctoral research project.

3.7.6 Toward an Eco-Socialist approach

To explore this radical solution, from Marx's perspective in Capital, it is important to understand the status of Marx' reproduction schema? How can we get the value relation right without effecting the physical aspect of it?

Capital Vol. 2 builds on a technical model in the form of the representative schemas as to how capital might accumulate in perpetuity (Marx, 1992). In these schemas of Capital Vol. 2, the consumption of workers takes a relatively decisive share because the schemas point towards the necessity to stabilise worker incomes in order to harmonise the relationship between the total output of the means of production and the total demand for the consumer goods. This contradict the thesis of Capital Vol. 1, where Marx envisages increased impoverishment of the working class as an inevitable outcome of free market system under capital. Capital Vol 2 hints the likelihood of uninterested workers to bring about a socialist revolution given how wrapped up they tend to become in capital consumerism. The consuming 'middle class' also provides general political support for a functioning capitalist democracy (Harvey, 2013).

In pursuing his enquiries, Marx in Capital Vol. 2, makes some dramatic simplifying assumptions to explore the dynamics of capital circulation and accumulation in their pure state. For example, the assumption that commodities exchange at their values abstracting from daily volatility of market price and that the circumstances of perfectly functioning legally defined competitive market exchange takes place. There is no role of credit even though he mentions it. He builds a model of the economy in its technological and organisational state and shows that crisis is inherent, necessary and endemic to the survival of a capitalist mode of production. The closer it converges to its pure state the deeper the crisis

will likely become and these crisis tendencies exist within this three circuit circulatory process of capital (Harvey, 2010; Harvey, 2013).

In part 3 of Capital Vol. 2, Marx assumes an economy separated by two departments. Department I produces means of production (raw material, machinery and fixed capital items) for other capitalists and Department II produces goods to be consumed individually by labourers and capitalists. Department II buys its means of production from Department I, whilst the worker and capitalists operating in Department I must purchase their consumer goods from Department II. Under simple reproduction model as examined in Chapters 18, 19 and 20 of Vol 2, the equilibrium condition for this economy would hold where the value of the means of production that flow to Department II is equivalent to the value of the consumer goods that flow to workers and capitalists in Department I. This equilibrium condition is based on the following restrictive assumptions: two class closed economy; turnover takes place on an annual basis only; capitalists consumes all their surplus value on wage goods and workers will spend all of their wages and not save; and technology is held as constant (Harvey, 2013). Marx produces his reproduction schemas in chapter 20 of Capital Vol. 2, where he establishes that the equilibrium condition occurs where the demand for constant capital from Department II equals demand for consumer goods from Department I (Marx, 1992; Harvey, 2013).

Moving on to the case of expanded reproduction where the equilibrium conditions for simple reproduction model as depicted in the reproduction schemas does not hold, how can capital rationalise capital flows? The expanded reproduction scheme is based on credit and hoarding of money (reserve fund) for capital accumulation. So, a realistic economic model of the economy for expanded reproduction cannot be arrived at without integrating the credit system (Marx, 1992; Harvey, 2013). As mentioned the subject of money and credit lies outside the scope of this study.

The question to consider here is whether the equilibrium condition between Department I and Department II holds true in material terms or value terms? For Marx, what matters is the value terms. Marx's schemas represent a flow model of the economy where he seeks to define necessary flows and balance between Department I and Department II. It is a model of input-output system where the schemas can be interpreted in use value terms (as Sraffa did) and they can also be interpreted in monetary terms (as do Keynesians) (Harvey, 2013).

Reproduction schemas are the foundations used to build the macro-economic frameworks of neoclassical economics. Harrod-Domer macro-economic models are based on Marx' reproduction schemas (Harvey, 2013). For a transition towards a sustainable economic system, whether it is eco-socialism or something else, can the schemas be set up or modified in terms of physical use values instead of value or exchange value? Marx is clear in Capital Vol. 2 that a circulatory process without the money circuit or exchange value based on non-capitalistic production is possible (Harvey, 2013).

The schemas show in principle how much new means of production are needed to expand the production of both the means of production and wage goods in order to establish balanced growth in a rationally ordered society. In an Eco-socialist society, coordination of this sort would have to be socially organised. In other words the schemas would have to be re-written in a purely use value and physical terms (as Leontiff later devised)³⁸ rather than being monitored by monetary flow and profitability considerations (Harvey, 2013; 2010). Freely organised 'associated labourer' to organise production is not enough on a collective basis because this alternative is at the level of the individual. What may be required according to Marx is to gain control and coordination of all three circuits of capital simultaneously and to subject them through social control across the various inter-related divisions of labour in society, as a whole. This implies regional-national institutions to legally enforce such requirement. These co-ordinations must avoid overproduction, lack of supply, bottlenecks in the physical flows which are required to reproduce daily life at the level of an acceptable material well-being and with an acceptable sustainable relation to nature. Department II should principally dominate Department I. This reversing the relationship would imply moving away from the objective of capital accumulation to satisfying consumer needs of the masses of people (Harvey, 2013).

The separation in material reality and human consciousness was to have disastrous ecological and human consequences manifested in what Marx called the '*irreparable rift between nature and society*'. According to Marx and eco-socialists therefore, to recapture the necessary metabolic conditions of the society-nature interaction to address climate change and poverty towards finding sustainable economic solutions what is needed is not simply a new social praxis but a revived natural praxis – which means a re-appropriation and emancipation of the human senses and human sensuousness in relation to nature. A society in which labour and

³⁸ Trigg, Andrew (2006) Marxian Reproduction Schema: Money and Aggregate demand in a Capitalist Economy. New York:Routledge.

nature are commodified under exchange value cannot achieve such an emancipatory project. In other words the use value of labour and nature is to be restored against the exchange value and since labour is the only source of value, its radical indeterminacy must be acknowledged for sustainable solutions. This is Marxist materialism which attempts to reconnect to the deep materialist roots of historical materialism where resources, people, products and institutions interact across space and time and therefore externalities and indivisibilities are common; and macroeconomic behaviour is not aggregated from microeconomic behaviour instead it depends on social interactions and group outcomes.

3.8 Conclusion of the Literature Review and Synthesis of the Main Findings

3.8.1 Main conclusions

The literature review based on chapters 3(I) and 3(II) utilized three main study tools for the analysis of the impacts of climate change on socio-economic factors in the development process. These study tools were: the theoretical analysis of the assumptions underlying economy wide computational general equilibrium models; an analysis of poverty impacts of climate change in climate sensitive sectors; and an assessment of past climate variability to identify patterns as to how they affect poverty, with the risks, complexities and uncertainties involved. The secondary data in chapters 3(I) and 3(II) brought evidence to establish the impacts of climate change on socio-economic factors leading to poverty and social vulnerability.

In order to analyse the impacts of socio-economic factors on climate change the main study tool employed under this research was to study the underlying social structures of the case study country Pakistan, in chapter 2. This study tool was indicative that socio-economic factors impact climate change, given the unsustainable economic practices embedded in the social structures of the society which eventually lead to a metabolic rift. Chapter 3(II) shows metabolic rift as one of the major contradictions of capital. Contradiction of capital framework employed in section 3.7 above analysed deeper underlying mechanisms of the social structures under capital. It brought forward the assessment that capital can survive its contradictions but at a major cost for the society and the environment. It also shows that the capitalist system of this day and age is different from the capitalist eras of the past. This is because, exponential growth of capital at 2.2 percent compound rate (Maddison, 2007)

combined with rapid turnover time for capital for increased consumption will inevitably lead to a major environmental crises in the form of catastrophic climate change.

This literature review further brings forward a comparison between the two competing schools of thought in terms of how they address sustainable solutions in context of the research questions. The main conclusion that comes out of this detailed literature review is that both paradigms measure welfare, consumption and production in the development process of the society very differently because both view 'value' in economics in a completely different light. This leads to both the traditions addressing the issues intrinsic to the economics of climate change, such as, discounting, ethics, distributional justice in the society as well as inter and intra generational fairness, differently.

Given the critical evaluation brought forward in this literature review, the following conceptual framework under an eco-socialist theoretical model is adopted for the purpose of answering the research questions.

3.8.2 An initial conceptual framework – an eco-socialist perspective

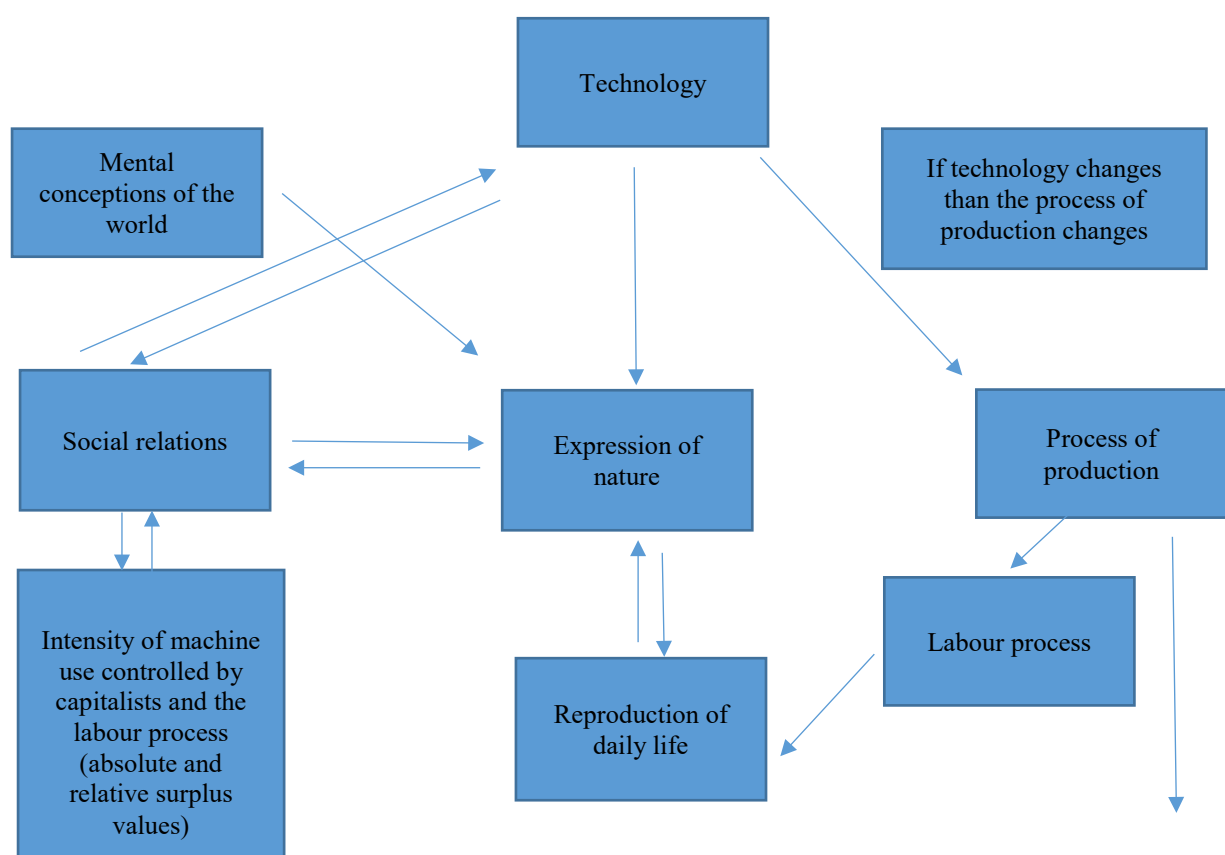
This study adopts its conceptual framework under the eco-socialist theoretical model based on the above review of literature to serve as a guiding framework to answer the research questions.

Marx's dialectics is an organic view of totality where elements are evolving in a dynamic set of possibilities under an ecological system with potential to bring about radical transformations. The question is how to utilise the possibilities that the capitalist system presents in its material base towards a sustainable society? How can eco-socialism make a radical move from the capitalist way of production? This research proposes that this can be done by engaging with the conceptual elements of the material basis of the society looking at the co-evolution process and the ensemble of relations involved.

By engaging with the conceptual elements of the material basis of the society, as the following diagram illustrates, this initial conceptual framework under the eco-socialist theoretical model aims to utilise the possibilities, in the co-evolution process that the capitalist system presents in its material base, towards a sustainable society through the following mechanism. For any radical set of sustainability solutions to succeed in dealing with the radical phenomena of climate change and poverty, it is first of all necessary to create

the political conditions by utilising the possibilities that the capitalist system presents in its material base which would lay the foundation for an emancipatory project envisioned by eco-socialism through radical reforms. Therefore, what may be needed is, to first and foremost, re-deploy existing institutions in a manner that reduce the ill-effects of the social and ecological crisis of capitalism. This restructuring of institutions may be necessary to bring about an acceptable level of socio-economic security before revising for longer term solutions for sustainability in the wake of the climate change crisis. Radical solutions on their own at this historical juncture are not feasible unless such socio-economic conditions are created whereby the severe contradictions of capital, facing us today, are attended to, to a certain extent so that the impacts of these social and ecological crises under capitalism, are minimised. This initial conceptual framework will be revised and developed in section 7.6.2 of chapter 7 with sustainability solutions.

Figure 3.1: Conceptual elements of material basis of society – a co-evolution model of the dynamics of capitalist society



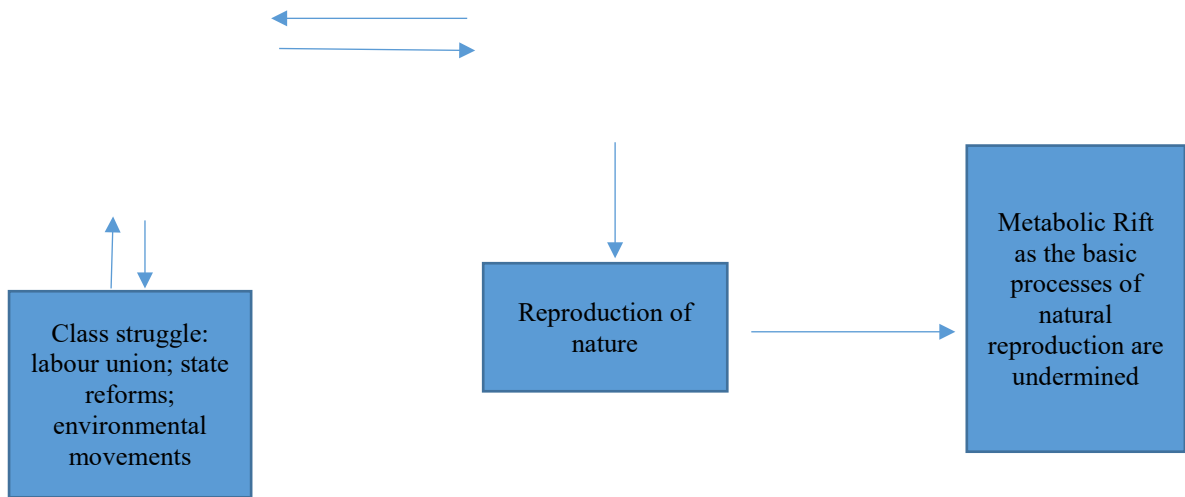
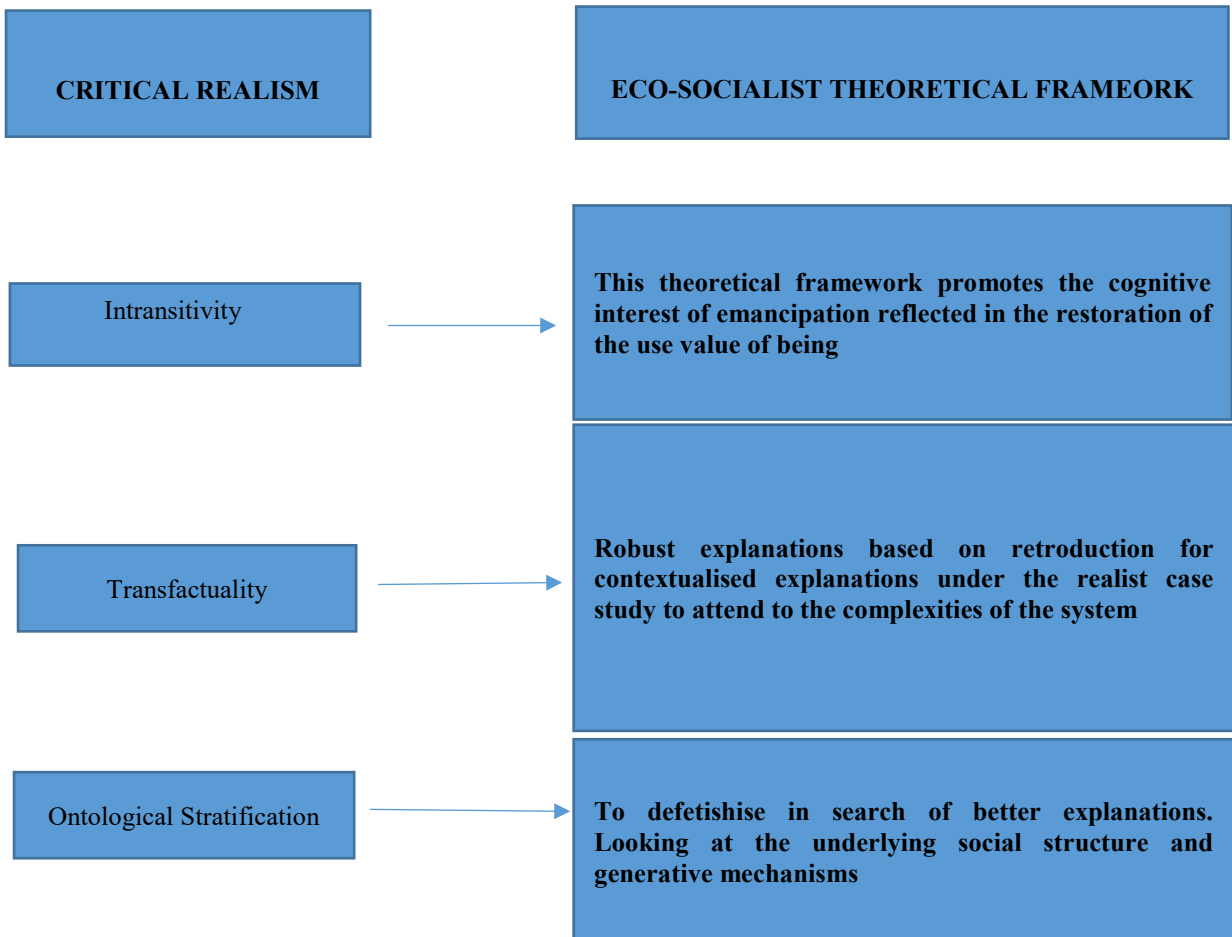


Figure 3.2: Link between critical realism and eco-socialism



3.8.3 Identification of gaps in the current literature - concluding remarks

This research under the methodological approach of critical realism identifies a major gap in the current literature regarding the issue of climate change and socio-economic factors in the development process.

The Intransitive: This desire to effect real emancipator change for ecological and economic sustainability by restoring use value as opposed to exchange value ensures the relevance of the project in the intransitive domain (Spencer, 2008). This desire of emancipation also underpin the ideological framework of eco-socialism.

The Transfactual: this literature review draws a distinction between open and closed systems. Open systems are characterised by uncertainties, non-linearities, multiple equilibria and risks. In a closed system as in the neoclassical approach, (experimentally controlled), there are constant conjunction of atomistic events under rational utility maximizing agents which is manifested in the Humean theory of causality, a lynchpin underpinning deductivism. Closed system presupposes that the world is fixed, repetitive and undifferentiated. For example, the world personified by the West is the same as the world personified by Bangladesh or India and that the world today is the same as it was, for example, in the 1850s. Such an approach will have difficulty in finding sustainable solutions. Critical realism as the methodological approach underpinning eco-socialism, in comparison, recognises Marx's organic view of totality where elements are evolving in a dynamic set of possibilities under an ecological system with potential to bring about radical transformations. This literature review made a modest attempt to show that in a closed system where policies are quantified in a controlled environment, one sided aspect of the market is taken into account which caters to capital. The other side of the market which conceals the social and ecological relations is not taken in account. Such an approach has implications for the economy and ecology, as shown in this literature review.

Ontological Stratification: The analysis of the underlying is what the science should be concerned with, according to Bhaskar, Habermas and Marx. (Bhaskar, 1998; Habermas, 1984; Marx, 1990) According to Marx in fact, if everything appears as it does on the surface than there is no need of science (Bhaskar, 1998). He proposes a science which is related to the world of underlying mechanisms and in order to get to that he defetishises³⁹ much of what he encounters in terms of the reality we live in, in our daily lives, i.e., the market which tends to be a certain way but it is concealing a whole set of social relations, as shown in section 3.8 of this chapter.

A modest attempt has been made in this literature review to critically evaluate the current literature and bring forward the empirical evidence based on secondary data in order to build a logical theoretical argument to answer the research questions in a reasonable manner. Care has been taken to develop each step in the argument effectively by linking the relevance of each part of evidence in order to develop the argument and to simultaneously show the gaps in the current literature with regards to the research questions. The next chapter, i.e., chapter 4, lays out the research methodological approach adopted under this research study which is that of critical realism. Important aspects of the research methods are elaborated in detail, primarily in-depth interviews and focus groups, demonstrating how the research philosophy adopted under this research, informs these particular research methods.

³⁹ Marx, (2013) Capital. Chapter 1, Section 4.

4 Methodology

4.1 Introduction

This chapter serves as a bridge between the literature review and primary data analysis chapters of the research study. Each chapter in the literature review has dealt with a comparatively autonomous body of knowledge in order to bring forward the analysis of the research topic from distinct angles. There is no single author, school or discipline which provides an observable, unifying epistemological consistency to the diverse explorations of the research so far. However the authors who provided most guidance through the research process are quite clearly situated within the discipline of economics.

This chapter starts with a detailed explanation of the research philosophical approach of critical realism adopted under this research study and the theory of interpretation of critical hermeneutics which serves as a methodological aid. Section 4.2 explains critical realism as the research philosophical approach with Roy Bhaskar as its main proponent and Outhwaite presenting further interpretation of Bhaskar's work. Section 4.3 presents critical hermeneutics as the theory of interpretation. It starts with Gadamer's hermeneutics followed by

Habermas's critical hermeneutic approach and the difference between Gadamer and Habermas is presented. Thereafter the rationale behind this research's critical inquiry is elaborated. This rationale is based on the premise that there is a coherence between Habermas and Bhaskar. Section 4.4. explains how critical realism as a research philosophy and critical hermeneutics as a theory of interpretation inform the case study methodology. Section 4.5 brings forward the rationale behind the case study research. Important aspects of the research methods are elaborated, primarily in-depth interviews and focus groups with the aim to demonstrate how the research philosophies adopted under this research inform these particular research methods. For the purpose of enhancing rigour, section 4.6 explains that triangulation is used by employing multiple sources of evidence converging on the same issues to operationalise for constructing validity. Section 4.7 summarizes the main arguments of the chapter, setting the stage for chapters based on primary data analysis.

4.2 Critical Realism as the Research Philosophical Approach and its compatibility with Critical Hermeneutics as a Methodological Aid

Realism points to a constellation of philosophies highlighting the ontological proposition that there is a reality quite independent of the mind and the epistemological position that this reality is to some significant extent, knowable (Proctor, 1998). Critical realism is a kind of realism which argues that what we experience are sensations and in order to understand what is going on in the social world, the researcher needs to know the social structures which have given rise to the phenomena under consideration. In other words, what we see is part of a bigger picture (Saunders, Lewis, Thornhill, 2009). Critical realism is adopted as the research philosophy under this research study because it provides an analytical approach which evaluates the emergent properties of social structures over time that helps to bridge potential in understanding the macro-structural and micro-cognitive aspects of the social processes concerned. These emerging social structures act as 'generative mechanisms' that shape, constrain and enable action which reflects the historicity of these social structures (Bhasker, et.al., 1998). The term mechanism is central to critical realism. A generative mechanism can be loosely defined as that which is capable of making things happen in the world (Outwaite, 1987). The 'generative mechanisms' or underlying structures are not directly available to

sense experience and have to be theoretically constructed and modelled (Bhaskar et al., 1998).

Bhaskar argues that, “positivism could sustain, neither the necessity nor the universality and transfactuality of laws; and for an ontology (1) that was irreducible to epistemology; (2) that did not identify the domains of the real, the actual and the empirical and (3) that was both stratified, allowing emergence and differentiated. This highlights three kinds of ontological depths which can be summarised by the concepts of intransitivity, transfactuality and stratification”(Bhaskar, et.al, 1998).

Critical realism defends a logic of reference in which knowledge has two dimensions: one transitive or artificial dimension constituted by the concepts we use as references to the world; the other intransitive and constituted by the world qua referent (O’Boyle and McDonough, 2011). So to describe certain objects or features as intransitive is merely to indicate that they exist at least in part independently of any knowledge claims of which they are the referents. These intransitive objects of knowledge need be no more fixed or enduring than transitive ones. According to Lawson (1988), for example, if I am studying the thought of a second person for example, her or his thought constitutes an intransitive object of my enquiry (Lawson, 1988: 222-3 cited in O’Boyle and McDonough, 2011). Transfactuality refers to the notion that the laws of nature operate independently in the systems in which they occur indicating *an open system* and the domain of the real is distinct and bigger than the domain of the actual and hence empirical. Failure to recognise this leads to collapsing and homogenising of reality – also called the fallacy of actualism (Outhwaite, 1987; Bhaskar et al., 1998), described below. The ‘stratified ontology’ of critical realism, articulates three levels of analysis: the empirical, the actual and the real (Bhaskar et al., 1998; Outwaite, 1987).

The guiding metaphors of realists are structures and mechanisms, not phenomenon and events. Intransitivity is referred to the Western Philosophical tradition that has anthropocentrically and mistakenly reduced the question of ‘what is’ to ‘what we can know’, or covering laws (Bhaskar et al., 1998; Outwaite, 1987). According to Bhaskar, the covering law under the empiricist approach (causal explanation as to why something happens is because, it always does) can only be explained by a pathological fear of ontology (Outhwaite, 1987). In empiricism, whether classical or in the logical form of Vienna Circle, social

sciences are devoted to the pursuit of explanations which take the form of general laws or covering laws (Outhwaite, 1987). The roots of this conception of explanation lie in Hume's theory of causation, according to which all we can ever observe is the 'constant conjunction' of events which is all we can know and all we need to know for empirical science to be possible (Outhwaite, 1987). This conception of laws and explanation is the central target of the realist critique (Bhaskar et al., 1998). It is also the central target for Marxist and eco-socialist critique. An explanation follows:

For Bhaskar (as for Marx and eco-socialists) to start from the experience of constant conjunctions is to combine three separate domains (Bhaskar, 1998; Outwaite, 1987):

- The real (made up of entities and mechanisms)
- The actual (made up of events)
- The empirical (made up of experiences)

Critical realism begins with the view that on the surface are the empirical events that form the basis of common sense observations, the focus of positivist studies. Below these events are those actual formations that shape meaning and understanding. However, such arrangements do not explain the nature of events (Bhaskar et al., 1998; Outwaite, 1987). The 'real' which is found in the causal mechanisms that produce the events is what critical realism is concerned with (Bhaskar et al., 1998; Outwaite, 1987). According to Bhaskar, these are three distinct domains. Events can occur, for example, without being experienced. Where empiricists are sceptical about philosophical claims concerning reality, realists believe that a philosophical metatheory is required to make sense of scientific activity, through reflexivity or otherwise science can be appropriated to serve vested interests (Bhaskar et al., 1998; Outwaite, 1987). In the absence of philosophical metatheory, all scientific theories are reduced to observational statements or complex constructs built on observational statements and logical mathematical relations (Bhaskar et al., 1998; Outwaite, 1987). Critical realism seeks to identify those deeper underlying mechanisms, which are taken to generate empirical phenomena. It is the engagement with mechanisms of deeper dimensions that distinguishes critical realism from other traditions (Bhaskar et al., 1998; Outwaite, 1987). It shares with positivism the interest in the objective world, patterns, generalisations, finding causalities but it also diverges from this tradition claiming that the study of the observable is too superficial as it disregards the unobservable mechanisms that produce the phenomena that positivists seek to measure and explain (Bhaskar et al., 1998; Outwaite, 1987).

Causal mechanisms operate largely independent from the mind and action of individuals and critical realists emphasize that reality as such is distinct from our conception of it (Saunders et al., 2009). Intransitive dimension is referred to, as an object of scientific inquiry and a transitive dimension is our conception of the object. The relevance of knowledge is dependent on the nature and mechanism of the objective reality.

According to critical realist economists, the central aim of economic theory is to provide explanations in terms of hidden generative structures (Lawson, 2004; Bhaskar et al., 1998). The critical realist approach views the domain of real causal mechanisms as the appropriate object of economic science as opposed to the observation of constant conjunction of events under positivism. Therefore, in this research's context, it is the real causal mechanisms of climate change and poverty that the economic science should be concerned with instead of mere observation of these events. In order to analyse the hidden meanings of the real causal mechanisms regarding climate change and poverty in context of the research questions, critical hermeneutics is chosen as the theory of interpretation. Generative mechanisms are located within the critical realist's stratified ontology which is conceived to comprise of three domains, in a manner such that:

- a) The empirical which is that of perception (a person's perception of climatic change)
- b) The actual which is one of the experiences (a person experiencing physical injury due to an extreme climatic event, such as, flooding)
- c) The real which includes mechanisms in addition to experiences and events These generative mechanisms are conceived to be real and distinct from the pattern of events that they generate, just as events are real and distinct from experiences in which they are apprehended (Elder-Vass, 2004; Al-Moudi and Willmott, 2011)

It is these generative mechanisms according to critical realism that are retroduced in the course of scientific study of the natural and social worlds (Boyle and McDonough, 2011). These are then subsequently subjected to empirical scrutiny and rational judgement vis-à-vis the claims of competing explanations proposed by epistemological relativism. The process of retroductive judgment by which generative mechanisms are identified is understood to be mediated by historically and culturally partial processes of interrogation. So the criteria employed for preferring one explanation or the other is at least in part dependant on the

historic-cultural community in which debates about competing claims are staged and social rationality is considered (O'Boyle and McDonough, 2011). Chapter 6 of this study analyses how this social rationality may be operationalised for responsible policy making taking into account the historicity and cultural identity of the community concerned.

In a Realist Theory of Science, Bhaskar distinguishes between three broad positions which are as follows (Outhwaite, 1987; Elder-Vass, 2004):

Classical empiricism: the ultimate objects of knowledge are atomistic events.

Transcendental idealism: the objects of scientific knowledge are models; ideals of natural order. The natural world becomes a construction of human mind or in its modern versions, of the scientific community.

Transcendental realism: it regards the objects of knowledge as structures and mechanisms that generate phenomena; and the knowledge as produced in the social activities of science. These objects are neither phenomena (empiricism) nor human constructs imposed on these phenomena (idealism) but real structures which survive independently of our knowledge, our experience and the conditions which allow us access to them. Therefore, even the best possible explanations, are in no sense ultimate but are provisional and must be subject to revision. In this research's context, transcendental realism is adopted.

The experience of constant conjunctions is both necessary and sufficient for classical empiricist analysis, and necessary but not sufficient for the transcendental idealist. For transcendental realism, by contrast, they are neither necessary nor sufficient (Bhaskar et al., 1998). Bhaskar illustrates a conception of scientific discovery when (Outhwaite, 1987):

- 1) an effect is identified (relates to a above)
- 2) a hypothetical mechanism is postulated which, if it exists, would explain the effect (relates to b above)
- 3) the attempt is made to demonstrate the existence and operation of the mechanism: positively through free experimental activity and negatively by eliminating alternative explanations (relates to c above).

Taking the example of climate change, on the positivist covering law model, explanation and prediction are symmetrical: the same law sustains either. But according to realists,

deducibility from a general law is not an explanation but a regularity which needs to be explained by demonstrating the existence of a mechanism, which produces that regularity. And even though if we have a pretty good set of explanatory mechanisms as in climatology or meteorology, the system may be too open to give us any basis for more than the most tentative predictions. Therefore, in transcendental realism scientific claims must basically be justified within the open ended practise of science. These scientific claims do not have a permanent right of abode, but merely offer a residence permit until further notice (Outwaite, 1987). However, transcendental ontology is necessitated by the empirical practise of science. What science is concerned with is not truth or falsity in absolute sense but with a relative degree of falsity, adequacy or inadequacy, better or worse knowledge, to analyse the necessary conditions of a specific social activity (Bhaskar et al., 1998; Outwaite, 1987). The ontological character of realism means that it shares with neo-pragmatism a critique of the predominantly epistemological stress on much recent philosophy (Proctor, 1998).

The study of the underlying structure of the society of Pakistan to analyse the reality of the research phenomenon is crucial. According to Bhaskar, societies are irreducible to people (Outwaite, 1987). The pre-existence of social forms of societies establishes their autonomy as possible objects of scientific inquiry and their causal powers establishes their reality. So societies are both ever present conditions (material cause) and the continually reproduced cause of human agency (Bhaskar et al., 1998; Outwaite, 1987). Bhaskar proposes and that people in their conscious activity for the most part unconsciously reproduce and occasionally transform the structures governing their substantive activities of production (Outwaite, 1987). For example, people do not work to sustain the capitalist economy, yet it is however the unintended consequence of their activity (Bhaskar et al., 1998; Outwaite, 1987). The abstract model of social reality is compatible with wide variations in the degree to which particular actions are structured. Therefore, Bhaskar establishes three ontological limitations on a possible naturalism:

- 1) social structures, unlike natural structures, do not exist independently of the activities they govern.
- 2) social structures, unlike natural structures, do not exist independently of the agents' conceptions of what they are doing in their activity.
- 3) social structures, unlike natural structures, may be only relatively enduring so that the tendencies they ground may not be universal in the sense of space-time variant.

Point one refers to possible actions governed by the structure (e.g., power structure). These may be negative possible actions. Second point broadly highlights that while agents have some conception of what they are doing yet they need not be conscious of the implications (of their actions) in the structure such as that of the capitalist economy, which nevertheless governs their actions. So, on the one hand, there is a causal interdependence between social structures and human representations of them, unlike natural sphere. Yet on the other hand there is an existential intransitivity – the domain of the unobserved- ‘which is an a priori condition of investigation and applies in the same way in the social, as in the natural sphere’ (Bhaskar et al., 1998; Outwaite, 1987). Both conditions are necessary for a realist social science.

Given this research’s object of inquiry, i.e., identifying the reciprocal impacts of climate change and poverty in the development process and proposing comparative policy solutions, my aim is to identify the contexts of meanings and patterns of interpretations in the everyday life world and language of the research participants and to bring out the complexity of the situation in the system through a dialectical process. This complexity is an outcome of a multiplicity of interacting tendencies. Rationalisation of the system is to be counterbalanced by the rationalisation of the life world. This means that contexts of meaning, patterns of interpretations, creation of norms and social interaction are characterised by critical thinking and reflection. Social engineering and expert led handling of society’s various inadequacies are not taken blindly, rather the authenticity of various social imperatives is demanded through reasonable arguments in terms of certain well considered needs and preferences. For the purpose of this research then, reasoning is critical, dialectical with a dialogue stimulating faculty. It seeks to counter images to provide meaningful contrasts; it may be possible to make interpretations in which empirical phenomena are elucidated in the state of tension between the established order and the transcendental; it is about making the familiar foreign; about problematizing the self-evident or the dominant interpretive patterns; and pointing out that future realities need not be a reproduction of what exists today (Alvesson and Skoldberg, 2009),

Critical realism highlights that there is both a mind dependent aspect of the world, which reaches to understand the mind independent world, placing much greater value on correct conceptualization of problems as a necessary first step in solving them. Such an approach

leads to seeking higher order, structural truths to help explain the empirical situation of interest (Outwaite, 1987; Proctor, 1998).

4.3 Critical Hermeneutics, the theory of interpretation, as a methodological aid

This research aims to combine Gadamarian hermeneutic interpretive and critical approach of qualitative research inquiry – known as the critical hermeneutic approach following the tradition of Habermas, which reveals the mediated processes of all human understanding and is inherent in qualitative research (Kinsella, 2006; Kogler, 1999).

4.3.1 *Gadamarian hermeneutics*: Pertinent to this research, hermeneutics questions the limitations of positivist approaches to research as Gadamer writes "And yet, over against the whole of our civilization that is founded on modern science, we must ask repeatedly if something has not been omitted ..." (Kinsella, 2006). This "omitted" something, is what both the project of hermeneutic thought and the project of qualitative research set their attention towards (Gadamer, 2006; Thompson, 1981; Dieter, 1990; Carter and Little, 2007). Hermeneutics starts from the presupposition that a bond links the interpreter to the interpreted. This presupposition does not signify the abolition of the "other" from the self. On the contrary, it is the condition of possibility for the appearance of "otherness" (Gadamer, 2006). Hermeneutical reflection merely uncovers the conditions under which understanding operates – as a 'preunderstanding'– in conditions which take place when one concerns him/herself (or oneself) to understand the assertion made by a text by bringing one's own presuppositions into play. Thus hermeneutics "is based on a polarity of familiarity and strangeness... [The tension] is in the play between the traditionary text's strangeness and familiarity ... The true locus of hermeneutics is this in-between" (Gadamer, 2006).

Gadamer warns that there "constantly arises the danger of 'appropriating' the other in one's own understanding and thereby failing to recognize his or her "otherness" (Ricour, 1984; Kaufmann, 2010). During the process of qualitative textual data analysis, it may be trivial to ask whether the self overpowers the other (text) or the other (text) overpowers the self in the fusion of the horizons, for a crucial aim of Gadamer's hermeneutics is to unfold a certain oneness, a certain medium, or "the shared life," within which both the self and the other constantly gain new meanings and determinations (Gadamer, 2006; Thompson, 1981; Kinsella, 2006; Dieter, 1990; Ricoeur, 1992). There seems to be an implied respect for

particularity of the other, which is for Gadamer of a potentially decisive nature. According to Gadamer, we understand only if we understand differently. For example, as an interpreter, I would understand a text when I fall into conversation with it and allow it to speak to the question posed by the case at hand. Rather than adopting a subjective attitude of dominance over the text by charting in advance the lines of inquiry, I would suppress my subjective aims and attend to “the saying” of the historically effective text as it is revealed in a particular context. This reveals the most important feature of Gadamer’s model of conversation which clarifies his rhetorical focus (Mootz, 2008). This rhetorical dimension of Gadamer’s philosophical hermeneutics provides the basis for the development of critical hermeneutics (Mootz, 2008).

For the purpose of primary data analysis under this research, it is important to understand this rhetorical dimension. This rhetorical dimension means that historical distance renders a text foreign to us as researchers/interpreters and thereby provokes us to pose new questions to the text that can illuminate our prejudices (as researchers/interpreters). Gadamer also expands that historical distance is not the only distancing “otherness” that we, as researchers, can seek out. Further confrontation with other contemporary cultures can also expose one’s unproductive prejudices (Gadamer, 2006; Thompson, 1981). Superficial banter and social pleasantries do not generate critique, nor does discussion among those who are locked within the same prevailing ideologies. Understanding is enriched by the sustained confrontation with the other in a rhetorical exchange in which the other seeks to persuade one of something that one does not already accept (Mootz, 2008; Kaufmann, 2010). The ineradicable and necessary distance between time periods, cultures, classes, races, or even between persons, constitutes a more than subjective [trans-subjective] moment that imparts life and tension to each understanding.

One can describe this process as follows which is important for data analysis under this research: the interpreter and the text each possess his, her, or its own horizon and every moment of understanding represents a fusion of these horizons (Gadamer, 2006). The text merges with the interpreter’s own questions in the dialectical play, which constitutes this fusion of horizons (Kinsella, 2006; Littau, 2002). The primary task of hermeneutics as a philosophical theory of interpretation lies in showing that it means integrating all knowledge one has in the sciences into the ‘personal knowing’ of the individual ‘experience’ by retrieving the linguistically mediated content of utterances along with the whole treasure of

historical experience that they contain (Gadamer, 2006; Thompson, 1981; Kogler, 1999; Osborne, 1991).

4.3.2 *Critical hermeneutics*: The themes which preoccupied the Frankfurt school theorists serve as a point of departure for the work of Habermas. Habermas's work has been largely concerned to justify critical social science as a valid form of knowledge in its own right by distinguishing three different forms of knowledge, mentioned below, with different purposes and justifications (Bakan, 1983; Thompson, 1981). Since the Enlightenment, knowledge has been based on reason and rationality. In fact, the spectacular success of natural science culminated in the idea that the only valid knowledge was that which matched the canons of the scientific method, i.e. universal laws based on objective and value-free empirical testing (Thompson, 1981). This premise was refuted by Habermas, Bhaskar and Gadamer as well as Marx.

Difference between Habermas and Gadamer: Supplementing the productive insights of Gadamer, critical hermeneutics has been highlighted by many who work within the hermeneutic tradition and who seek to extend the boundaries of hermeneutics (Bakhtin, 1981; Caputo, 1987; Derrida, 1989; Kearney, 1988, 2003; Kogler, 1996; Gardiner, 1992; Jardine, 1992; Ricoeur, 1981; Rorty, 1991; Wallace, 2000 cited in Kinsella, 2006). Habermas critiques Gadamer's hermeneutics because according to the former, the latter ignores the crucial dimensions of power, the notion of "owning up to the fix we are in" or acknowledging our "vulnerability" (Kinsella, 2006; Thompson, 1981). This is because, according to Habermas and rightly so, Gadamer brings to consciousness the inherent reflexivity of ordinary language and its unity which is dialectically restored in the context of tradition but overlooks the fact that language itself is dependent on social processes which are not wholly linguistic in nature. In other words, the domains of technical control and political power are not addressed by Gadamer (Thompson, 1981; Bakan, 1983). This reasoning touches on Foucauldian spirit of inquiry which illuminates a commitment to constructionism, but differences remain between the two traditions (Minger, 1991; White, 1986; Macdonald, 2002).

The main difference between Habermas and Foucault is that the former insists on a critical theory which must try to formulate an idea of progress that is subtle and resilient enough not to let itself be blinded by the mere appearance of emancipation. Habermas disagrees with

Foucault's totalistic critique of modernity. Although Habermas (White, 1986), sees in modernization a growing "colonization of the lifeworld" by the imperatives of the administrative political and economic subsystems, yet he argues that the phenomenon of modernization must be separated from certain more basic characteristics of "modern structures of consciousness" that together constitute "cultural modernity" (White, 1986). He argues that "'cultural modernity' establishes a "potential for reason" that has not been given full play, but rather has been utilized in a one-sided way in the process of Western modernization' (White, 1986). In short, Habermas is arguing that "the resources of cultural modernity are adequate for illuminating the problems that have accompanied modernization" (White, 1986). These problems can be worked upon through the tradition of critical hermeneutics.

4.3.3 Rationale behind the research study's critical inquiry: Habermas argues that there are different domains of knowledge, with each having their own criteria of validity. This he justifies by showing that knowledge is never 'pure', for itself, but always serves some deep-rooted interest stemming from the survival of the human species. The particular interest leads to or constitutes the form of knowledge in a particular domain. That is captured by the term 'knowledge-constitutive interests' (Habermas, 1984; Thompson, 1981; Kinsella, 2006).

Habermas identifies three such interests: the technical interest in the control and manipulation of the physical world; the practical interest in communicating with and understanding other people; and the emancipatory interest in self-development and freedom from false ideas. These have developed, Habermas argues, through the biological evolution of the species. The need for physical survival and manipulation of the environment has led to the development of technical knowledge, the purpose of which is prediction and control. This has been supplied by natural (or empirical-analytical as Habermas calls it) science which is fundamentally instrumental (Habermas, 1984).

Reason behind rejecting the empirical-analytical or positivist approach under this case study research: Lawson highlights the main inconsistencies within mainstream economics based on positivism⁴⁰ on three levels: at the level of method; at the level of social theory and at the

⁴⁰ Positivist approach was developed in the early nineteenth century by the philosopher August Comte. There are two underlying aspects of a positivist methodology that influence social science research today: the Popper Hempel 'hypothetico-deductive' model of scientific explanation and a reliance on the Humean notion of causality as a constant conjunction of events.

level of methodology (Lawson, 2004). His critique that has been sustained for well over a decade focuses on the failure of orthodox economics which can be traced to the persistent application of methods of explanation that are inappropriate to the object of their investigation (Lawson, Latsis and Martins, 2007). More specifically Lawson claims that the economic mainstream is best characterized by its use of deductivist methods and that these are singularly inapplicable in the social domain (given the existence of open systems and intentional agency) (Lawson, Latsis and Martins, 2007). This is a methodological inconsistency between the method of explanation on the one hand (presupposing closed systems for its applicability) and the object of investigation on the other (being inherently open) (O'Boyle and McDonough, 2011). Every method is underpinned by some philosophical analysis; and in the case of economic mainstream, it is a positivist epistemology, rooted in Humean theory of causality as a constant conjunction (Boyle and McDonough, 2011; Bhaskar, 1998). "If such an ontology is to be sustained it can only be on the basis that reality is exhausted in a series of isolated and atomistic events; and if this is the case, the only possibility for building up reliable knowledge is through the recording of event regularities or constant conjunctions of empirical phenomena" (O'Boyle and McDonough, 2011), which in the case of this research would be observing climate change and poverty at the surface indicating observation of the observables.

As explained earlier, constant conjunction of events or event regularities do not capture the underlying unobservable entities and causal processes that bring them about. The difference can be best seen when contrasting statistical methods such as a survey that asks, 'who', 'what', 'how many' type questions as opposed to the more in-depth 'how' and 'why' questions posed by a case study research strategy (Smith, 2006; Yin, 2003). While statistical techniques depend on sufficient samples to establish the existence of constant conjunctions, explanatory theories can be gleaned from only a few or even one case study (Smith 2006; Yin, 1984; Yin, 1989a). The purpose of this case study is to draw causal conclusions from a properly done single case study instead of running experiments to reveal regularities.

Reason behind rejecting the interpretivist⁴¹ approach under this case study research: In humans, the development of language led to the possibility of communication and the

⁴¹ At the turn of the 20th century, the first wave of German sociologists formally introduced sociological positivism, proposing research should concentrate on human cultural norms, values, symbols and social processes viewed from a resolutely subjective perspective. Marx Weber argued that sociology may be loosely described as a science as it is able to methodically identify causal relationships of human "social action".

cooperative coordination of action (Thompson, 1981; Kinsella, 2006). In this domain of practical activity, the fundamental need is for understanding and making sense of what others mean and through discussion and argument, reaching agreement and consensus. This provides a foundation for the interpretive or cultural sciences such as hermeneutics (Kinsella, 2006). Interpretivist studies are characterized by the prioritization of subjective meanings and social-political as well as symbolic action in the process through which humans construct and reconstruct their reality (Brown and Brignall, 2007; Smith, 2006). There is also a stated rejection of the positivist notion of causality and scientific method. The positive goal of explanation and prediction is rejected in favour of subjective descriptions and understanding the diverse meanings of stakeholders (Brown and Brignall, 2007). This belief is inherent in the strong constructionist position that “all knowledge and beliefs are equally valid and there are no correct or incorrect theories but there are interesting and less interesting ways to view the world”. In other words, there is a rejection of any rational basis to decide between competing theories. Such an ontological position of the interpretivists is termed generally either as, ‘internal’ or ‘subjective’ realism, that view reality as a personal construction (Smith, 2006) and it is not clear, by what standard one interpretation is judged to be better than another.

Reasons why a critical realist approach is undertaken by this case study research revealing the coherence between the philosophies of Habermas and Bhaskar: In an ideal world, the above two knowledge domains would be sufficient. However, Habermas argues that both of them have been distorted by the socio-political environment in which they have developed (Thompson, 1981; Kinsella, 2006; Dieter, 1990). The instrumental rationality of natural science has been illegitimately applied to the social realm, and our language and communication are constantly undermined by the power structures of society and the lack of free and open discussion (Thompson, 1981; Kinsella, 2006; Dieter, 1990). There is thus a need for a third type of knowledge—a critical inquiry—which aims to reveal these illusions and distortions (Thompson, 1981; Kinsella, 2006; Dieter, 1990). Such an inquiry is adopted by this research study under critical realism.

Crotty (1998) in the Foundations of Social Research lays out what he views as the four main components of social research: epistemology, theoretical perspective, methodology and methods while explicitly excluding an in-depth discussion of ontology. Bhaskar turns this

four column schema upside down. The starting point for critical realism as a philosophy of science is ontological, not epistemological. According to Habermas, much like Bhaskar, positivism transformed epistemology, the theory of knowledge into mere methodology of science. Furthermore, much like Bhaskar, he did not totally refute positivist account, he only wanted to limit its intrusion in the realm of social science (White, 1986). Bhaskar has consistently championed the need for emancipation, much like Habermas, based upon structural change and he advances his philosophy as an essential aid in its eventual achievement. This desire to effect real emancipator change ensures the relevance of the project in the intransitive domain (Spencer, 2008).

Bhaskar addresses the question of political and ideological control much like Habermas. For Bhaskar the starting point is that any adequate account must simply accommodate both transitive antecedent theoretical materials and the intransitive object that exists outside of the consciousness of persons (Bhaskar, 1998; O'Boyle and McDonough, 2011). For once we accept that knowledge is our creation it allows us to bring all manner of extra-theoretical considerations into our understanding of how it is that knowledge not only gets produced but also gets institutionalised, disseminated and conducted by the academic community and by the society at large, subject to all manner of political and ideological infiltrations (Collier, 1989 cited in O'Boyle and McDonough, 2011; Demeritt, 2001)

The process of science and technology is viewed as historically emergent, political and incomplete by Bhaskar as well as Habermas. These limitations imply that our theories are fallible (fallibilistic realism) (Smith, 2006). The problem for realist science then is to, "use its method to improve our perceptual measurement processes... and thereby generate the most accurate possible description and understanding of the world" (Smith, 2006). Theories generated must be accepted critically, for example, through the process of critical hermeneutics or dialectics and tested according to an objective scientific rationality (Soderbaum, 2000), as explained in section 4.2.

4.4 How does critical realism as a research philosophy and critical hermeneutics as a theory of interpretation inform the case study methodology and the research questions of this research project

Critical questions regarding this case study research need to be clarified. For example, "How

do I know that what I write as a case study analysis represents the ‘truth’? How can I justly claim that I know in some fundamental sense, what it is that I have researched? This is because making truth claims based upon such seemingly limited data is clearly a daunting prospect. To answer these concerns, it should first be clarified that the above judgements are partially due to the dominance of the epistemologically positivistic underpinnings of most academic research in development and economics (Easton, 2010). Clearly the sample size in any case study research project is never going to be large enough to qualify for statistical inference (Easton, 2010).

A single case study must be able to stand on its own (Yin 2004; Yin, 1993). The key focus this case study has to offer is to understand the phenomena of climate change and poverty in the development process, in depth and comprehensively by studying the underlying structures. Research questions are definable in terms of the question; who, what, where, how and why (Yin, 2004; Yin, 2003 cited in Easton, 2010). Case studies are more suited to how and why questions which can be explanatory in nature. This is because such questions deal with operational links needing to be traced overtime, rather than mere frequency or incidence (Yin, 2004; Yin, 2003 cited in Easton, 2010). The flexibility that case study allows in this respect is one of its great advantages and one that is not shared by, for example, survey based methods.

4.5 Rationale behind Case Study Methodology

The case study includes the following essential components:

- a) Pakistan as its setting;
- b) Participants involved are categorised in two segments: people in power involved in the development process of Pakistan in various capacities, for example, politicians, military generals, academics and bureaucrats and the poor end of the society living under the poverty line;
- c) Exploring the structural causes of events and mechanisms related to poverty and climate change and the costs of such events to the society;

The focus here is on an attempt to convey a balanced, multidimensional representation of the context, participants, and reality of the situation. Yin (1994), notes that case studies can be

used for both, theory testing or theory building. Regardless of how it is used, for either theory building or theory testing, it is a process of scholarly inquiry and exploration whose underlying purpose is to create new knowledge (Seale, Gobo, Gubrium and Silverman, 2007; Silverman, 2001; Dooley, 2002; Yin, 2004; Yin, 2003; Gillham, 2000). The possibility of generating new theory increases with case study research. This is because of the application context in which research is being conducted and because “creative insight often arises from the juxtaposition of contradictory or paradoxical evidence,” and “this constant juxtaposition of conflicting realities tends to unfreeze thinking” (Seawright and Gerring, 2008). Creation of knowledge requires critical analysis and this case study goes beyond the mere ‘thick description’ of a situation, which emphasizes emic issues, i.e., concerns and values recognised in the behaviour and language of people being studied (Geertz, 1973 quoted in Yin, 2004; Gillham, 2000). The general methodology of this research harbours upon the subjection of the phenomenon to successive questions and interrogation through critical use of concepts and empirical data in a deliberate attempt to find new kinds of questions about climate change and poverty in the development process along with new and satisfying ways to answer them.

According to Yin (1993), a case study can be recognised as a scientific method if certain quality criteria which follow the general criteria of objectivity, reliability and validity are fulfilled (Yin, 1993). This case study research attempts to use the following quality criteria which would exhibit its independent critical thought and internal validity, by shifting theoretical perspective under its conceptual framework through constantly engaging with theory (Yin, 1984; Yin, 1994; Yin, 2004).

4.6 Triangulation

For the purpose of enhancing rigour, triangulation is used by employing multiple sources of evidence converging on the same issues to operationalise for constructing validity, i.e., data collection and interpretations through the use of in-depth interviews and focus groups, official documents and direct observations.

4.6.1 In-depth Interviews

The aim of the interviews has been to identify and describe the way in which the ecological and economic environment is understood in Pakistan by a wide variety of actors involved in the development process of Pakistan. The interviews were carried out with experts – influential people who occupy positions of power in the country. These in-depth interviews which lasted for approximately two hours each. Access to the senior level participants was gained through reliable professional contacts, in Pakistan, working within the government, in opposition of the government, the army senior cadre comprising of serving and retired Generals, bureaucrats along with high ranking academics and officials from prominent think tanks.

Interviews are the central resource through which contemporary social science engages with issues which concern it (Silverman, 2007; Silverman, 2004; Seale, Gobo, Gubrium and Silverman, 2007). Silverman's identification of the premise that the local and collaborative element of the interview manifests in the production of accounts regarding experiences, emotions, identities, knowledge and opinion does not deny that the interview talk is reflexively situated in the wider cultural arena and embedded in a broader social norm (Seale, Gobo, Gubrium and Silverman, 2007; Silverman, 2004). This premise reflects the philosophical position undertaken by this research study, explained earlier in the chapter.

The qualitative research interview is a construction site of knowledge (Kvale, 1996) and given the rich diversity of information obtained from such a dynamic mix of senior level participants, through in-depth interviews on the research topic, warrants a process of scholarly inquiry and exploration, in pursuit of knowledge creation. By means of conversations which have a structure and a purpose the interviewer can initiate a process of new understandings and insights through a reflection on previously natural seeming matters in the subjects' culture (Kvale, 1996). The purpose of this research's in-depth interviews is to obtain descriptions of the life world of the interviewees with respect to interpreting the meaning of the described phenomena of climate change and poverty. The intentions of the conversing partners give way to what Gadamer calls 'the law of the subject matter' (Kvale, 1996). This means that when one enters a dialogue with another person and is then carried further by the dialogue, it is no longer the will of the individual person that is determinative (Kvale, 1996; Yin, 1989a; Yin, 1994).

How did the Interview conversations point towards the conclusions reached by the research, how was the research organised and on what basis the participants spoke

The elite research participants were contacted through the researchers' own contacts within the policy making circles of the case study country, Pakistan. These contact were chosen because of their high ranking positions, having dealt with, areas directly relevant to the research topic, in their professional capacities.

Each interview began with a brief reiteration of the aim of the interview and the indication of the expected length of the interview. The opening was followed by a 'warm up' question pertaining to the interviewees work or institutional experience and promptly onto the body of the interview schedule consisting of the main topics, themes and questions. The interviews were carried out on the order of the following six points, to allow for participants to speak in depth where considerable scope was allowed for free elucidation of views and ideas within this general framework, according to the particular interest and ardour of the interviewee. This six point guide which, is not shown to the interviewee is as follows:

1. The incidence that triggered a personal discernment and awareness regarding the significance of a sustainable environment.
2. Junctures in personal, intellectual or professional life which gave direction to this interest and development of expertise.
3. Understanding of the term 'underlying social structures' and 'climate change'.
4. Understanding of the constraints and prospects of the current economic model to deal with climate change and sustainability.
5. Major ecological and socio-economic problems of the country.
6. Relations between the ecological and the socio-economic problems of the country.

Each interview question was analysed with respect to both a thematic and dynamic dimension, to facilitate interpretive listening. Thematically questions relate to the theoretical conceptions at the root of the research investigation, whereby the participants' concepts based on their experiences about a given phenomena are captured. Dynamically an interpersonal relationship is developed to promote interview interaction for spontaneous descriptions of the lived world of the participants and potential future behaviour patterns. Taken together, these dimensions can open up the horizon of possible meanings, involved in the interviewees' statements. The interviewees spoke on both fronts.

The findings from this comparative, reflective analysis of primary data were also triangulated with the findings of the extensive literature review. These synthesised findings under the conceptual framework of eco-socialist tradition led to the specific conclusions under this research study, as brought forward in section 7.6 and chapter 8.

4.6.2 Focus Groups

In addition to one to one in-depth interviews, this research held focus group sessions aimed at the section of society living under the poverty line. Focus groups are a form of group interview that capitalise on communication between research participants in order to generate data through asking questions, exchanging anecdotes and commenting on each other's experiences and points of view (Kitzinger, 1995; Seale, Gobo, Gubrium and Silverman, 2007). Detailed attention to language is crucial here because it relates to a much wider political context. Gaining access to such variety of communication is useful because people's knowledge and attitudes are not entirely encapsulated in reasoned responses to direct questions, as used in various other research methods. In this sense focus groups reach those parts that other methods cannot reach, revealing dimensions of understanding that often remain untapped by more conventional data collection techniques (Brien and Meadows, 2007; Thomas, 2008).

The strength of focus groups lies in the fact that it allows for participants to conceptualize the research topic within their own cultural frameworks through group interaction and discussion, feeding back their considered inferences to the researcher, who in turn is able to decide whether prior research constructs are shared and therefore adequately formed for operationalization in the research context (Seale, Gobo, Gubrium and Silverman, 2007).

According to Silverman, a thorough analysis in qualitative research interview would require an extended sequence of interviewer-interviewee talk. The participants' judgements, perceptions, interpretations and justifications regarding the research questions cannot be seen in isolation from their social context (Silverman, 2007). What is being said and how it is being said, is a mutually constitutive process. The point is that proximal and distal aspects of social contexts are always reflexively at play and to emphasize one and diminish the importance of the other is to obviate the possibility of understanding the way context comes

to bear on social experience, hence undermining any nuanced understanding of the given phenomenon (Silverman, 2007). A critical hermeneutic theory of interpretation affords a space for repressed voices to speak out, and neglected texts to get a reading (Kinsella, 2006). Although the situated nature of interpretation is recognized, the possibility of engaging a self-critical thinking consciousness and of transcending the insights of the present context, is always there (Kinsella, 2006). Furthermore, since every individual's perspective is always partial and objectivity tends to lose its grasp, texts are considered through the historically and culturally situated lens of the researcher's perception and experience (Littau, 2002; Dieter, 1990).

Participants were selected on the criteria that they fall below the poverty line, in Pakistan and therefore shared common characteristics that relate to the topic of research. As a moderator of the focus groups, my role as a researcher was slightly different compared to the, one to one in-depth interviews because the focus group sessions place communication and interaction between group members at the centre of the research process. As a facilitator, I therefore ensured that the group discussion and debate stayed within the boundaries of the main topic and themes. My focus has been to generate and encourage discussion whilst not leading the group towards certain opinions.

The population sample for the purpose of the focus groups was obtained from Benzair Income Support Program (BISP) initiated by the Government of Pakistan which constitutes data on 40% of the poor living below the poverty line, in Pakistan. Participants were selected on the basis of their income level, those living under the poverty line, using non probability sampling techniques which provided the opportunity to select the sample purposively and to reach difficult to identify members of the population. Once chosen through the statistics provided by BISP, the participants were contacted through their respective union councils which are a part of a particular district subdivision. Union/village councils form the last tier of the three tier system of the local government. The territory represented by a village council usually comprises a large village and surrounding areas, often including nearby small villages.

Where the sampling strategy is pre-assigned for projects under quantitative methodology, the sampling strategy for qualitative research develops during the study (Yin, 1993). Qualitative sampling is concerned with information richness, for which two key considerations would

guide the sampling methods, under the research: identification of appropriate participants, being those who can best inform the study objectives and adequate sampling of information sources (i.e. people, places, events, types of data) so as to address the research questions in a manner that develops a full description of the phenomena under investigation (Jonker and Pennink, 2010; Yin, 2004; Yin, 1993; Stake, 1995; Dooley, 2002; Gillham, 2000; Saunders, Lewis, Thornhill, 2009; Hamel et al., 1993).

Extent of reliability of Focus Groups for generalisation of results

The focus group questionnaire is based on ten specific domains employed by the multidimensional poverty assessment tool (MPAT, 2010) which are: Food and Nutrition, Domestic Water Supply, Health and Care, Sanitation and Hygiene, Housing, Clothing and Energy, Education, Farm Assets and Non-Farm Assets, Exposure and Resilience to Shock, Gender and Social Equality. The questions based on these multidimensional issues are broad enough to be applicable in most rural contexts so that the results coming out of these focus groups reliably reflect the opinions of the people in the villages affected by similar circumstances. Therefore the results from these focus groups are in a position to be generalised on the MPAT framework for the population, defined as poor. Generalisations can occur when the mix, of social, political, cultural, economic, ethnic and gender circumstances and values, is similar across settings (Guba and Lincoln, 1994), as is the case of focus groups participants under this study. The appropriate criteria for judging the quality of an inquiry are its historical situatedness, i.e., (that it takes into the social, cultural, economic, ethnic and gender antecedents of the studied situation) and the extent to which the inquiry provides a stimulus to action, i.e., to the transformation of the existing structures (Guba and Lincoln, 1994).

4.6.3 Research Design

- i. **Review of literature:** To justify and initiate the research, an extensive review of literature to answer the research questions, set in section 1.4.1 of chapter 1, was conducted. This review of literature corroborated the need for the present research and provided a basis for the initial conceptual framework.
- ii. **Initial Conceptual Model:** An initial conceptual framework, based on the review of literature to serve as a guiding framework for the research, was designed.

- iii. ***Data Collection and Analysis:*** The primary data for this research study was gained through multiple sources, as explained under section 4.4 and 4.5, of this chapter.
- iv. ***Data triangulation and key findings:*** The data collected from various sources was compared and corroborated. The key findings in the form of sustainability policy solutions to address the research questions are presented.
- v. ***Enhancement of Conceptual Model:*** On the basis of the research findings, the initial conceptual framework is revised and enhanced.
- vi. ***Final Conclusions and Discussions:*** All the research findings are then presented in the conclusion chapter.

4.7 Conclusion

The usefulness of critical realism as a research philosophy and critical hermeneutics as an applied method of interpretation under this research is that it structures the complex task of analysing the reciprocal effects of climate change and poverty in the development process of Pakistan in a sense that aids the composition of rich comparative interpretations, of the research questions. Bhaskar and Habermas ground their arguments in terms of the nature of our interest in social phenomena. Habermas differentiates three cognitive interests: control, communication and emancipation. The interest relativity of alternative descriptions in this case does not conflict with the realist postulate of a reality made up of intransitive objects which exist independently of these descriptions (Outhwaite, 1987). In fact, comparative, dialectical and reflexive analysis is necessary to analyse from a critical realist's perspective to try and understand the intransitive. The hermeneutic process to repeat Gadamer's metaphor is not the replacement of the interpreter's horizon by that of the object of study but a dialogic process in which the two horizons are fused together (Alvesson and Skoldberg, 2009). Such a dialogic framework leads to an intersubjective conception of science. Even as the interpreter, if I feel constrained to reject the participants' view as totally off beam, it remains relevant that the participants have that view and that I am able to describe it accurately. Moreover, it is important to recognise the importance of practical consciousness which refers to the tacit stocks of knowledge which participants draw upon in the constitution of social reality as opposed to discursive consciousness which participants show on the level of discourse (Kvale, 1996). The production and reproduction of social structures is a matter of interpretations given to them by the participants but also what Durkheim called 'deeper

causes which are opaque to consciousness' (Outhwaite, 1987). This shows juxtaposition of Bhaskar and Habermas.

By combining critical realism as the research philosophy with hermeneutics as the theory of interpretation, facilitated by in-depth interviews and focus group sessions, this research aimed to make people the co-creators of social logic. The real gauge of this methodological approach's adequacy has been its potential for increasing the understanding of sustainable development by bringing forth a comparative reflective analysis of the phenomena of climate change and socio-economic structures with implications for poverty in the development process, to answer the research questions.

5 Elite Interview Analysis

5.1 Introduction

This chapter reports interview evidence regarding the understanding of Pakistan's political and non-political elite on the extent of climate change and poverty, their reciprocity and the underlying links between the two issues. Relevant secondary data and information from other reputable sources in Pakistan and other developing countries have been used to triangulate the interview findings. The software tool Nvivo and word processing program MS Doc have been used for the purpose of analytic aid for primary data analysis along with the researcher's dialectical methodological approach of critical hermeneutics as a methodological aid of critical realism for primary data analysis.

5.1.1 The process of manual qualitative data analysis - critical hermeneutics as a methodological tool under the critical realism philosophical approach to analyse this research's primary data of chapters 5, 6 and 7

For the purpose of manual qualitative data analysis with the help of critical hermeneutics, the methodological framework consists of a dialogic model with two dimensions: ethical and epistemic. Both dimensions must be demarcated in order to avoid any reductionism to power. The process is as follows:

Ethical dimension: It is important that the researcher takes into account the research participant's concrete self-understanding and ethical vision to allow for a culturally grounded pluralism of forms of self-realisation. Critical hermeneutics correlates these concrete visions with contextual practices of power. Thus, far from research defining power as the only ground of social life, critical interpretation aims at an analysis that can bring forward the costs that the existing social and symbolic constellations have for the most deprived subjects, which stands in accordance with the epistemology of the critical realists (Kogler, 1991).

Epistemic dimension: To develop a theory of critical interpretation, a comprehensive analysis of the hermeneutic presupposition of understanding is required (Thompson, 1981). Every

interpretive act is made possible by a largely implicit pre-understanding (Gadamer, 2006; Kinsella, 2006). For the purpose of analysing the focus group sessions and in-depth interviews, the pre-understanding can be differentiated in three background spheres: symbolic sphere (beliefs, assumptions); practical sphere (habits, practices); subjective sphere (experiences, events) (Kogler, 1999). The three dimensional conception reflects how social power structurally influences belief formation and how such influences can be called into question through critical interpretation. For the purpose of this research, it is important that I distinguish the practical sphere from the symbolic sphere because the practical sphere can highlight how social power structures, rooted in social practices and institutions, leave their mark on particular symbolic forms that define reality for the subjects independently of their awareness of the social influence. As these symbolic forms provide the background horizon of intelligibility for the research participant who is oriented in his or her experiences towards entities in the world as opposed to the structural levels of meaning formation, the influence of power on meaning remains hidden from the subject himself/herself (Kogler, 1999; Mootz, 2008; Thompson, 1981). These holistic frameworks of meaning provide a social space for pre-understanding. The reconstruction of the basic symbolic forms is done through hermeneutics and then linked to the social practices. Critical hermeneutics lays out a concept of reflexivity in interpretation that allows the researcher to distance herself from the taken for granted background of symbolic assumptions and social practices. In order to combine a contextual and pluralistic conception of meaning with a critical analysis of power, a dialogic reconstruction of the interpretive effect of such a self-distanciation is required whereby the 'other' becomes the point of departure for critical insights (Kogler, 1999; Thompson, 1981). The reconstruction of this 'other' through transcribed text and of its symbolic background serves a critical foil from which to become, as it were, one's own other. Such a dialogic approach avoids reductionism to power (Kogler, 1999).

During the interviews, the research subject internalises the perspectives of the researcher/interpreter in the form of theoretically informed self-perception. The researcher/interpreter incorporates the perspective of the subject and relates the reconstruction of the subject's symbolic practical context to her own lived experience. Ultimately critical hermeneutics lead to a distanciating fusion of both perspectives under one theme (Kogler, 1999; Thompson, 1981). By opening the gap between reflexivity (distanciated self) and situatedness (situated self), critical hermeneutics unfolds its transgressive power – *the dialectic between oneself as a product of autonomous self understanding and oneself as a*

social product is kept open without reducing it to one side or another. The significance of the dialectic in an open-ended sense of dialogue between polarities, i.e., the researcher and the interviewee and later the researcher and the text, is important in a critical hermeneutic tradition. An open ended dialectic is similar to a dialogue in that there "always remains the possibility of a sudden shifting of polarities, surprising reversals and transformations, inexpressibly complicated crossovers, overlappings and imbrications—none of which we can ever fully anticipate, or exert complete control over" (Kinsella, 2006) as opposed to the shared agreement about the subject matter, under Gadamer (Thompson, 1981; Mootz, 2008; Outwaite, 1987). The final movement in the dialectic of interpretation culminates in an act of understanding whereby the interpreter researcher appropriates the reference of the text thus expanding her conscious horizons by incorporating the world that the text unfolds.

Figure 5.1: Critical realist methodological approach underpinning the following conceptual framework under the Eco-socialist theoretical model

<p>Transfactuality is about the open system; non-linearity; multiple equilibria; uncertainty and risks</p>	<p>To capture transfactuality to a reasonable extent we need decisions based on social rationality to deal with uncertainty (Bhaskar, Habermas Marx/Eco-socialist)</p>	<p>This primary data looks for better explanations based on retrodution to give contextualised explanations by explaining the generative mechanisms</p>
<p>Intransitivity: antecedent theoretical materials+extra-theoretical considerations of how knowledge gets produced</p>	<p>Going beyond the cognitive interests of control and communication for real emancipator change (Bhaskar, Habermas, Marx/Eco-socialists)</p>	<p>A reflective comparative approach is presented in search for emancipatory solutions</p>
<p>Ontological stratification The empirical; the actual; and the real.</p>	<p>It is the 'real' that the science should be concerned with (Bhaskar; Habermas and Marx/Eco-socialists)</p>	<p>The data attempts to bring forward the underlying social structures; the generative mechanisms of the case study country</p>

5.1.2 Organisation of the chapter

The rest of the chapter is set out in four sections. These four sections, which are based on the following four main themes, directly link with the four categories of the policy level questionnaire. These themes are:

- a) Impacts of climate change refer to questions 1 till 12.
- b) Sector specific economic policies of Pakistan refer to questions 13 till 33.
- c) Legislation on climate change to date in Pakistan refer to questions 34-38
- d) Comparison of capitalist and non-capitalist economic models in context of climate change with implications for poverty in the development process refer to questions 39-42.

As explained in the Methodology chapter, this study carried out 36 elite interviews. All interviewees have influential positions within the policy making circles of Pakistan. These were face to face in-depth interviews exploring the research questions in detail. Every interviewee approached the research questions within the context of their own professional backgrounds and their unique ideological leanings reflecting their own social conceptualisation of climate change and poverty in the development process of Pakistan. This exercise resulted in securing valuable data for the research analysis.

A clear divide emerged through the interview process between the research participants. This divide can be sectioned in two broad groups; one group comprised of the government and pro-government elites with reformatory solutions towards sustainability and the second group consisted of political and non-political anti-government elites proposing more progressive solutions towards sustainability. The concerns and suggestions of both these group participants are analysed under the interpretation aid of critical hermeneutics, as explained above⁴².

5.2 Impacts

The interviews opened up with every participant defining and explaining the concept of climate change, the causes of poverty and their place in the current sustainable development discourse. The most general definition of climate change emerged as a change in the statistical properties of the climate system when considered over periods of decades or longer, regardless of cause. However there was a unanimous understanding between the

⁴² It is made clear at the outset of this chapter that the interview analysis of this chapter and focus group discussion analysis of chapter 6, are not produced verbatim but are near verbatim.

research participants that the term nowadays is used to refer specifically to climate change caused by human activity. For example, they agreed with the United Nations Framework Convention on Climate Change definition of climate change, "*a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.*" It was also a common understanding that climate change is synonymous with global warming which is the increase in the average temperature of Earth's near-surface air and oceans since the mid-20th century and its projected continuation.

The understanding that despite the fact that Pakistan contributes only 0.43 per cent of the world's total GHGs yet it is faced with severe climate changes and that Pakistan is among the countries which will be hit hardest by effects of climate change even though it contributes only a fraction to global warming, is shared by all the research participants. *The research participants belonging to some prominent NGOs and the PMD officials believed at large that Pakistan's vulnerability to climate change is due to the impact of rising temperatures which will cause sea levels to rise and will change the amount and pattern of precipitation. These officials described impacts of climate change on Pakistan presenting visual imagery of melting Himalayan glaciers, glacial lake outburst flooding (GLOF), sea level rise and the possibility of tipping points leading to 'catastrophic climate change'.*

According to the pro-government officials interviewed, *warming would be associated with continuing retreat of glaciers of Pakistan and its subsequent effects on the Indus water system threatening its food and water security. Other likely effects include changes in the frequency and intensity of extreme weather events, species extinctions and changes in agricultural yields.* According to this group of experts, as research participants, *extreme climatic events such as floods are caused by the excess water coming from glacier runoff and snowmelt and the projected recession of glaciers in the Northern mountains... this is mainly the result of direct carbon deposits on the glaciers. The black carbon is the result of trans-boundary pollutants coming from neighbouring countries heavily dependent on coal-based industries.* These views remain in harmony with the IPCC reports and other empirical findings as detailed in the literature review of this study.

According to one NGO official, *"Temperature warming has caused changes in the timing of spring events and the length of the growing season. Mangroves are large tropical evergreen*

trees that grow on muddy tidal flats and along protected ocean shorelines. They absorb 70-90% of wave energy and effectively stop sea encroachment in deltaic region. In the event of disappearing mangroves, the sea has encroached in Indus delta of Pakistan spoiling vast area of land in districts, Badin and Thatta. The fragile ecosystem of its coastal belt is under risk of being inundated, flooding the homes of millions of people living in low-lying areas.” Flood casualties in Pakistan have not only risen but have also resulted in inter-provincial migrations within Pakistan according to the above officials interviewed. These findings are also confirmed by the mainstream NGO findings such as LEAD (LEAD, 2008; LEAD 2015), IUCN⁴³ and CDKN⁴⁴. The following interrelated questions were put to the interviewees to determine whether the officially recorded estimates of poverty in Pakistan were realistic for these officials and whether or not climatic events have in any way affected the poverty rate, given the changing socio-economic realities due to climate change.

- a) What is the percentage of poor in Pakistan?
- b) How have climate change impacts affected this percentage?
- c) How have climate change impacts intensified socio-economic vulnerability for the poor?
- d) Does the socio-economic vulnerability of the poor lead to unsustainable economic practices?

The anti-government elite section perceived poverty in its multidimensional forms, as compared to the pro-government elite section who perceive it in monetary terms. In comparison to the latter, the former see it as a condition in which a person is deprived of or lacks the material or social essentials of life to secure a minimum standard of well-being. They view poverty in relative terms where income or wealth disparities are seen as an indicator of poverty and the condition of poverty is linked to questions of distribution of resources and power. The credibility of this latter anti-government elite group's understanding on poverty is verified by their perception of the sharply increasing numbers of poor people in the country which according to them currently stands at almost 75%, after the climatic disasters are taken into account, a figure much above what the national figures claim. A survey of 104 developing countries by the Oxford Poverty and Human Development

⁴³ IUCN (2015) Available at: <http://www.iucn.org/content/iucn-pakistan-fpcci-sign-mou-promoting-sustainable-development-pakistan> (Accessed: 5 October 2015).

⁴⁴ CDKN (2014) *EVENT REPORT: The IPCC's fifth assessment report: What it means for a stronger and more inclusive Pakistan - climate and development knowledge network*. Available at: http://cdkn.org/2014/09/report-ipcc-ar5-what-it-means-for-a-stronger-and-more-inclusive-pakistan/?loclang=en_gb (Accessed: 6 October 2015).

Initiative at the University of Oxford measured the incidence of poverty using overall living conditions for households. According to this survey, the percentage of poor in Pakistan is 51% compared to 17% to 22% poverty rates cited in the official statistics (OPHI, 2010). Pakistan's rank is 31st from the bottom among these developing countries. No official statistics on poverty have been available for Pakistan since 2006. Moreover, this set of elite respondents also question the official methods to determine poverty line based on Consumer Price Index (CPI). One of the research participants, who is a senior academic and economist, rejected poverty estimates based on the official methodology, because according to him the rate of CPI has been manipulated to indicate a higher decline in official poverty figures.

A strong perception emerged from this elite group as opposed to the government officials that poverty increased in Pakistan since 2010-2011 due to a decline in GDP growth as a result of climate affected sectors which consequently led to a lowering of the output per capita, as inflation remained high. This finding corroborates with the literature review finding of chapter 3(I). This research through the process of its interviews and focus group session discussions is in a position to make a generalised observation that almost all of the poor households hit by floods or other extreme weather events such as draughts since 2010 have been further pushed into poverty. This finding is consistent with the data presented in the literature review which analysed the impacts of climate change and poverty.

According to the pro-government elite group, *poverty is impacting natural environment because it forces many farmers to cultivate marginal lands continuously, without fallow periods, thus crippling it. Therefore, there remains an urgent need to break this cycle by offering sustainable livelihoods through poverty reduction schemes to these small farmers thus regaining traditional land management techniques.* It is believed by the anti-government elite group however that *the divorce of social policies from overall development strategies as a consequence of IMF economic plan and in the absence of a viable domestic economic plan, the poverty reduction schemes such as cash transfers be it in the form of BISP or micro credit financing which address the consequences of poverty not the cause of it will not alleviate poverty, let alone eradicate it.*

For all the research interviewees the link between climate change and poverty has been evident in Pakistan's rural and urban areas alike, in recent years. The following thematic table has been produced from the responses of the research interviewees which highlights the main

vulnerabilities of the poor, caused by the impacts of climate change. This table is a useful framework for integrating objective and subjective information about different livelihood vulnerabilities experienced in poverty, which when interact with each other pose themselves as threat multipliers.

Figure 5.2: Socio-economic Vulnerability Framework provides a link between climate change and poverty

Socio-Economic Vulnerabilities as experienced by the poor	Underlying Socio-Economic Factors	Does Socio-Economic Vulnerability experienced by the Poor show a link between Climate Change and Poverty
Vulnerability to outcome	Households are vulnerable due to their social, political and economic relations and low level of endowments. Extreme climate events become disasters when entitlements fail. Therefore the root cause of vulnerability is related to the dynamics of socio-economic system like production, accumulation and marginalisation.	Yes

Vulnerability to Hazards	Apart from the macroeconomic effects of natural disasters which lead to a fall in the real income level of vulnerable populations leading to poverty, the other major element that increases vulnerability of the poor in context of climate change is the lack of key policy interventions to expand decision capacity through preparedness and response.	Yes
Vulnerability to less resilient physical infrastructure	The poor tend to live in more disaster prone areas; they have less resilient infrastructure, less access to sanitation, education and medical facilities. Their livelihoods are often reliant on natural resources that are susceptible to climate change impacts. Poor families and communities are also less able to bounce back after a disaster which leaves them less able to cope with the next disaster – making them more and more vulnerable each time crisis strikes.	Yes
Vulnerability to accessing water and land	Privatisation of water and land both adversely reinforce poverty and climate change. Lack of access to land or land ownership by the poor and lack	Yes

	of water rights for small farmers and poor households alike for domestic or farm use is the underlying cause of poverty and it affects the environment as the poor communities are entirely reliant on increasingly fragile ecosystem for their livelihoods.	
Vulnerability to accessing financial instruments	Their vulnerability is reinforced because they have fewer assets, almost no access to insurance and credit markets to compensate for income losses and consumption needs. Poor are forced to live in marginal areas due to lack of endowments and very low income levels.	Yes
Vulnerability to accessing basic energy requirements	Energy vulnerability or inaccessibility creates poverty and reinforces climate induced poverty by lowering per person production capacity and their economic resilience.	Yes

Source: Author

All participants agreed that the socio-economic dimensions of vulnerabilities mentioned in the above table and elsewhere in this chapter that are experienced by the poor inevitably show a link between poverty and climate change. This link is further refined in chapter 7 to show its reciprocity based on the analysis of primary and secondary data.

According to another interviewee, an economist, *“The vulnerabilities caused by climate change add another dimension to the standard vulnerabilities experienced in poverty, potentially changing the basic definition of poverty and the methodology of poverty measurement. With climate change in picture, the concept of poverty is not just an individual and social construct it is also a natural environment construct weighted against safe and sustainable natural environment.”*

5.3 Sector Specific Impacts and Policies

As explained in the introduction section of this chapter, this section explores the sectoral specific policies of Pakistan and is linked with questions 13-33 of policy level questionnaire: *A common emerging view of all the interview research participants regardless of their professional and ideological backgrounds was that despite its multi-disciplinary character, climate change is ultimately a development issue. All participants agreed that apart from its global socio-economic impacts, the effects of climate change weigh disproportionately on the poorest, and on women and children. This viewpoint verifies the literature review findings and it also compliments the focus group findings.*

Another common understanding that emerged within the research participants’ was that where the possible impacts and consequences of climate change are clear to members of society at different levels, the magnitude of these impacts are not clear and this makes climate change a very uncertain phenomenon. This reinforces Weitzman’s Dismal Theorem analysed in the literature review⁴⁵.

In Pakistan floods followed by earthquakes have been the major disasters in terms of human casualties and infrastructural damages followed by draughts, storms and heat waves. According to one interview participant, *“the Federal Flood Commission has advised provinces and federal agencies to mobilise resources to repair damaged infrastructure and streamline procedures to manage future floods and disasters. But there is no mentioning of an integrated approach for disaster management in the Pakistan Planning Commission economic growth framework which aligns important allied sectors including health for disaster preparedness and response strategy... Urban flooding which can be addressed by*

⁴⁵ As explained in Chapter 3(II) section 3.6.5, Dismal Theorem is a critical scale parameter reflecting huge scientific uncertainty, regarding catastrophic climate events, which is used as a multiplier for converting aggregated GHG emissions – an input mostly reflecting economic uncertainty – into eventual temperature changes (Weitzman 2009; Weitzman, 1998).

effective management strategy of otherwise poor land use (agricultural), insufficient water storage capacity and improper building codes (urban infrastructure) in an integrated targeted manner, as a future disaster management strategy, is not forthcoming”.

5.3.1 Water Sector Policies in context of Climate Change

The importance of water can be gauged by the mere fact that it is the driving force not just behind the country’s agriculture, its energy and industry, it is quite simply the driving force behind human and ecological life. *In the policy making circles it is believed that Pakistan is seriously water stressed and fast becoming a water-scarce country with significant gaps between water requirements and available resources.* According to one water expert, *“currently Pakistan has 13 million acre feet of capacity to store water. However every year 34 million acre feet water is getting wasted by being run into the sea”.* There is a strong perception in the government elite circles that the water economy will run dry leading to severe water crises and therefore all of them agree that in order to be able to avert this situation, Pakistan needs to readjust investment priorities and realign strategies to optimize its water productivity. According to one research participant who is a senior think tank analyst:

“Humans are using water not only for their drinking and domestic use but water is being used intensively for agriculture and manufacturing such as in textiles or electronics/micro-chips to drive capital for economic growth....to make one micro-chip, 30 litres of water is required.”

“Pakistan’s water storage efficiency is 9% as compared to 40% of the world average.”

Main areas of concern identified by the Government officials interviewed were:

a)Water scarcity and inadequate storage capacity; b)Poor operation & maintenance of irrigation system; c)Excessive groundwater pumping leading to inefficiencies; d)Poor measures for rainfall harvesting; e)Un-safe disposal of industrial drainage effluent; f)lack of private sector participation; g)lack of coordination among research institutions.

Usage of water can be divided in three parts: a) consumption; c) land irrigation; and c) industrial and commercial use. Out of it 80 million hectares of geographical area, 22 million hectares is cultivated and out of this 19 million hectares are irrigated. According to the

Pakistan Planning Commission, the irrigated land supplies more than 90% of agricultural production and food. It contributes approximately 25% to GDP and 50% to labor force (Ministry of planning, development & reforms, 2016)⁴⁶. This is further confirmed by Pakistan Agriculture Research Council⁴⁷.

According to the international NGO officials and government officials interviewed, Pakistan is highly dependent on melted water originating from large scale glaciers' reserves for irrigation in agriculture as well as livelihood in Indus basin. Thus, Pakistan is prone to climate change and, therefore, climate change impact on glacier behaviour is extremely crucial for the agriculture in Pakistan. Pakistan has one of the world's largest glaciers reserves in the Karakoram- Hindukush-Himalaya ranges. More than 65 % of the fresh water resources originate in these ranges during summer and supply water to the Indus River System, the world's largest irrigation system. The irrigated land approximately accounts for 84% of the total 23.39 Million Hectares (Mha) of cropped area. With global average temperature rising, glaciers, ice caps and ice sheets melt and release water which contributes to the increase of sea levels, threatening the populations of low-lying nations and islands... ancient seasonal patterns are shifting due to climate change.

According to one interviewee, “Humans adapt to nature, it is a natural process. But our climate change of today's day and age is anthropogenic... .” Adaptation to accommodate this phenomenon driven by a major human element requires a focused proactive risk management approach which covers a broad range of potential actions, including: early-response systems, strategic diversification, dynamic resource-allocation rules, financial instruments, infrastructure design and capacity building (Osgood and Hellmuth, 2010). In addition to avoiding adverse outcomes, climate risk management should seek to maximize opportunities in climate-sensitive economic sectors through improved resource management. According to the above participant, underpinning these activities is the provision of robust information regarding the return periods and probabilities of extremes. The degree of uncertainty as to whether observed climate changes are due to human activity or are part of natural system fluctuations remains a major stumbling block to effective adaptation action and climate risk management. However many scientific studies including those carried out by

⁴⁶ Ministry of planning, development & reforms (2016) Available at: <http://www.pc.gov.pk/> (Accessed: 23 April 2016).

⁴⁷ PARC (2013) Pakistan agricultural research council Official Website. Available at: <http://www.parc.gov.pk/index.php/en/> (Accessed: 23 February 2015).

the IPCC link today's climate change with human action (IPCC, 2007). Climate risk assessment to deal with uncertainty is analysed in chapter 7, under legislation.

As opposed to the information gathered by the interviews of prominent NGO's working on climate change in Pakistan such as LEAD, IUCN and CKDN, the International Water Management Institute (IWMI) has recently published a study named *Glacier Systems and Seasonal Snow Cover in Six Major Asian River Basins: Hydrological Role under Changing Climate*, authored by Oxana S. Savoskul and Vladimir Smakhtin which claims that the hydrological role of the melt-water resources in six major rivers e.g. Indus, Ganges, Brahmaputra, Syr Darya, Amu Darya and Mekong of the Hindukush-Himalayan region (HKH) has been comprehensively assessed for the first time on a basin scale. This report draws some interesting conclusions regarding the role of glacier and snow melting for six river basins which includes three major rivers basins of India and Pakistan. (Savoskul and Vladimir, 2013; Raina, 2009; Hewitt, Wake and Young, 1989; Eriksson et al. 2009; Fowler and Archer, 2005).

A question these authors have attempted to answer is that *whether or not the contribution of glacier melt to the runoff increased in any of the basins in the recent decade?* The answer of this study is, *no*. This analysis stands in contrast to that of the IPCC and NGO officials interviewed for this study where the answer has been, *yes*. *The research participants belonging to some prominent NGOs described impacts of climate change in Pakistan presenting visual imagery of melting Himalayan glaciers, glacial lake outburst flooding (GLOF), sea level rise and the possibility of tipping points leading to 'catastrophic climate change'*. Their observations signified awareness on an empirical level of the stratified ontology under critical realism because these observations are based on perceptions.

According to the pro-government officials interviewed, *warming would be associated with continuing retreat of glaciers of Pakistan and its subsequent effects on the Indus water system threatening its food and water security. Other likely effects include changes in the frequency and intensity of extreme weather events, species extinctions and changes in agricultural yields*. According to this group of experts, as research participants, *extreme climatic events such as floods are caused by the excess water coming from glacier runoff and snowmelt and the projected recession of glaciers in the Northern mountains... this is mainly the result of direct carbon deposits on the glaciers. The black carbon is the result of trans-boundary*

pollutants coming from neighbouring countries heavily dependent on coal-based industries. These views remain in harmony with the IPCC reports and other empirical findings as detailed in the literature review of this study.

Moreover, the IWMI study states that “*the impact of climate change was found to be more prominent on seasonal rather than annual water availability.*” In Pakistan’s case this analysis stands firm, as during the monsoon season the impact of climate change is most prominent given the destructive floods of 2010, 2011, 2012, 2013, 2014 and 2015. This led to one of the most important questions of the interview:

Since a few years now, Pakistan is being inundated with floods during monsoon season whilst there is no stable effective response from the government. Every year it is as if the nation has been caught unaware leading to widespread socio-economic destruction and deaths. What is the government doing?

Whilst the pro-government response was mainly listing down the constraints of physical infrastructure of the water sector as mentioned, the anti-government elite’s response was different.

The water governance starts with the Indus Water Treaty in Pakistan. The pro-government view is that *the Indus Waters Treaty between Pakistan and India has held for over 50 years and that the treaty has also survived the claims that India is not only stealing Pakistan’s water but that it is also behind the recent destructive flooding in the Chenab. Regarding the calls for doing away with the existing IWT and negotiating a more effective one to protect Pakistan’s interests the government officials interviewed think that getting rid of the present agreement will create an uncertain environment regarding the sharing of waters between Pakistan and India. What may be required is altering the treaty in a way that serves the interests of both countries.* However anti-government interviewees opined that *IWT is not being practiced in spirit anyway so there will be no purpose served*⁴⁸.

As per the Indus Water Treaty India was given Sutluj, Beas and Ravi and with that Pakistan lost 26 MAF water on annual basis, as confirmed by the officials interviewed. According to

⁴⁸ This is also corroborated by Jamal, N. (2014) Available at: Sound bytes: ‘Scrapping the water treaty is no solution’.

one interviewee, *“The land of Cholistan which was a heartland for agriculture for Pakistan ran barren when India stopped 2.8 million acre feet of water from Sutluj, Bias and Ravi, with the implementation of IWT.”*

According to another interviewee, a water expert and an engineer by profession, *“Due to internal political agenda and lobbying, the strategy within Pakistan is not to build dams. During the monsoon floods approximately 30 million acre feet of sweet water goes into the sea annually. This amounts to US\$60 billion gone waste. If only one dam, for example Kalabagh, is built, which is still in planning stages, due to political lobbying against building dams, it can stop 6.5 million acre feet of water from wastage.”*

According to the same interview as above, *“It is a fact that 2/3rd water is wasted in distribution due to unsustainable farming methods which is why water conservation at every level is important and agriculture/irrigation needs to be reoriented for optimum water use. Building dams is a matter considered urgent by all policy experts but the political dynamics surrounding the dam issue hinders severely the physical construction of these dams.”*

He further said,

“... in advanced countries one cubic meter of water fetches US \$30; in emerging economies one cubic meter of water equals US \$8; and in a country like Pakistan one cubic meter of water extracted earns US \$0.5. This is because Pakistan severely lacks in its water storage capacity.”

The same water expert further said, *“At the time of partition water availability was 5000 cubic meter per person and now the water availability per person has gone down to 1000 cubic meter per person”*. This fact is corroborated by the Asian Development Bank’s report (ADB, 2009).

According to a think tank analyst and a former Army General, *“Storage capacity of water in Pakistan is for 3 weeks at best whereas to draw a comparison US has a storage capacity of 365 days. Furthermore, another big concern emerged as whatever is available is contaminated and polluted by chemicals and industrial wastes and not recycled contrary to how it should be done as it is done in western countries.”*

Following are some of the direct quotations from the research participants which provide empirical evidence that unsustainable economic practices of poverty struck unequal society with severe mismanagement of development funds along with its inadequate governance result in *poverty impacting climate change*.

“In most villages the occupations vastly depend on agriculture. These farmers use agricultural pesticides which percolate through soil and with the use of tubewells these chemical elements enter the drinking water causing health problems. Dirty water contaminates the food chain affecting human health and eventually the ecosystem.”

“Filtration system in Pakistan is outdated. Recycled water is not a norm. 70% water used in Karachi is thrown in the sea which could be easily filtered. Furthermore, this used water can also be used to generate electricity... lack of water recycling is suggestive of unsustainable economic practices with direct impacts for climate change”.

“Out of the total water capacity in the world, 97% is considered salty water and it is not fit for human consumption till it is turned fresh by recycling. Lack of fresh water is not only a cause of war between nations but also within nations. For example, provinces within Pakistan are at loggerheads for this reason, reinforcing social unrest and economic inequalities leading to ecological disasters.”

According to the water expert quoted above:

“There is a lacuna in IWT. Currently, India is building another dam on Chenab river which would measure 91 meter length and 28 meter height and it will be the 172nd project undertaken by India. The Indian Water Commissioner’s letter is circulating within the Pakistani water related elite circles but no action is being taken by the Pakistani leadership. If the concerned institutions within Pakistan don’t react within three months of issuance of this letter from India then their case expires and India is then free to continue with its constructions of dams.”

Accordingly, if there is a dispute between Pakistan and India which could limit the flow of Pakistan’s waters from IRS, as it is the lower riparian, then the dispute is taken to the Indus

Water Commissioners of both the countries and if that doesn't work also then Pakistan can appeal through involving a neutral arbitrator. The common perception in Pakistan is that in cases of Kishanganga (2013) and Baghlihar (2007) dams, the foreign neutral arbitrators in both cases gave their decisions in favour of India without recognising the constraints on India to build these dams on Pakistani rivers which resulted in serious loss of Pakistani water. According to one interviewee, *“Pakistan’s Neelum Jhelum project’s potential is already reduced to 27% with the construction of Kishanganga dam. With the construction of Kishanganga dam India’s 330MW hydroelectric project would affect Pakistan’s 969MW Neelum Jhelum hydroelectric project to the extent that Pakistan would lose 700 million units of power, reinforcing energy poverty, a loss which is more than \$544 million a year. Neelum Jhelum project is designed to produce 5,178 million units of electricity each year”*. A grave concern as mentioned by quite a few elites was that *if India plans to construct 10 more hydropower upstream Wullar Lake that would inflict even more damage to Pakistan’s water economy which will have implications for the country in terms of poverty and climate change*.

Another emerging theme from the interview analysis established another growing trend regarding the country’s water which rests on the premise that big water multinationals have bought the water of many countries, hence the trend of large scale water privatisation⁴⁹. Even the rain water is being privatised in many countries. Rain water is important because unlike river water and ground water, it does not need to be treated. According to a research participant, a senior analyst of an established think tank:

“Only 20% of people in Pakistan are drinking safe water while 80% of people are prone to unclean water. Water is the basis for life and every human has a basic right to it. Under Islamic law, water, air and fire (oil, gas, coal) cannot be privatised⁵⁰. When water is commercialised and privatised as it is under the IMF rules and regulation then it does not remain a basic right of the human beings. It becomes a right of those who can afford a bottle of water. An ordinary citizen of Pakistan has to pay Rs. 50 for a litre bottle of water sold by Nestle where the true/actual cost of this water should be nothing as it is simple treated ground water, a basic right of all, according to the constitution of Pakistan. The government, instead of having put tubewells and filters for every village in every tehsil of every district in order to provide water free for all citizens, has instead sold off the basic water rights to

⁴⁹ Hoekstra and Hung, 2005.

⁵⁰ Bagader, 1983; Bagader, 1996; Faruqui, Biswas, Bino and International Development Research Centre, 2001; Morony, 2002.

MNCs like Nestle.... Two big French corporations, Vivendi and Suez-Leonnoise have bought 40% of the world's water."

To summarise this sub section, following aspects were identified with regards to water sector and sustainable policy making in context of climate change and poverty:

Apart from the Indian issue on IRS and IWT, which must be resolved through intense negotiations, there was strong consensus amongst the interview participants on both sides of pro and anti- elite sections was that Pakistan is also wasting its own waters because it has almost no storage and limited dam capacity. According to them it means that apart from limited water availability for domestic and commercial use it also means severe lack of indigenous hydel resources for electricity generation. Therefore the following solution were proposed by the interview participants which were endorsed by all interviewees:

- a) rain water harvesting or conservation;*
- b) surface or ground water which is contaminated by industrial and urban domestic waste critically needs proper recycling;*
- c) with regards to underground water through tube wells, water charging must take place by small farmers as to not to affect the underground water table;*
- d) Pakistan must expand its water storage by building thousands of small dams from Gilgit Baltistan to Karachi on the numerous lakes, streams, tributaries and watercourses; rivers and their tributaries should be dug deeper to make deeper lakes in order to not only build small dams on them but also to divert flood waters into these deeper lakes and watercourses, especially during the monsoon. In the words of one research participant, a senior analyst, "... Turkey, for example, has made almost 4000 small dams in this manner on its waterways, lakes and streams. Karachi and Islamabad already get their water from small dams, this concept must be replicated on a country level for every city and district. On a larger level making of bigger dams is critical for hydel power generation but with consideration given to such development projects that do not affect the ecology."*

5.3.2 Agriculture Policy in context of Climate Change:

There appeared a general consensus between the interviewees that agricultural sector is the backbone of Pakistan's economy. This corresponds to the literature review findings that

agriculture contributes approximately 25% to the GDP of Pakistan, that approximately 50% of labour force is from the agricultural sector and that the value of its total exports from agriculture is approximately 60% (Zaidi, 1991; Viqar and Amjad, 1984; Naqvi, 2002).

Shortage of water as explained above has also hit agriculture to the extent that now Pakistan has had to rely on imported food such as wheat which is one of its main crops and grants from US in the form of grain shipment because its yearly agricultural output fell short as compared to its yearly agricultural demand as also explained in the literature review of this study (Bernstein, 2004; Bernstein, 2001; Zaidi, 1999). An important question arose as to whether this was due to climate change or the global economic recession? The two sets of opposing elites gave very different perspectives which generated a comparative discourse under critical realism.

The government officials confirmed that *the government initiates its agricultural policy actions through various documents like 5 year national plans, annual development plans, Mid Term Development Framework and it also relies on receiving technical assistance on agriculture sector strategy development by the World Bank, ADB and UNDP. According to the National Agriculture Policy 1991⁵¹, agricultural development goals are: a) self-reliance in food with social equity; b) sustainable agricultural practices; c) enhanced productivity; d) promotion of agricultural institutional development and agricultural research; e) focus on small farmers and barani areas; and f) increased growth in agriculture and associated sectors for export orientation.*

A major concern raised during the interviews was that the agricultural policy is not being implemented in spirit because the ground reality is considerably different than the agricultural goals, the agriculture policy is set to achieve.

According to one interviewee, a senior analyst, *“The topic of property rights and protection of vulnerable and poor members of the society through the availability of agricultural credit and land reforms is theoretically well placed in the manifestos of all political parties but when these parties come in power and it is time to change these party strategies into government policies, the action on ground is severely lacking. A comprehensive climate change plan of action for climate disaster management is not part of any political party*

⁵¹ Ministry of Agriculture (2014) Available at: <http://par.com.pk/tag/ministry-of-agriculture/>

agenda or policy manifesto.” However the international agencies such as the ADB aim to incorporate climate change in all their core agricultural and water projects that they intend to undertake in Pakistan (WB, 2005); all IPCC reports document the impact of climate change on the poor of South Asia amongst other parts of the globe (SAR, TAR, AR4 and AR5); and the 2010 World Bank report documents the state of far reaching agricultural consequences with climate change given its disproportionate impacts for the world’s poor (WDR, 2010; Skoufias, Rabassai and Olivieri, 2011).

All interviewees showed agreement on local research experts who go out in the fields and attempt to educate small farmers on better seed varieties and advanced agricultural techniques/technology but at the end of the day the landlord decides whether progressive farming should be implemented on his land or not; and that the local agricultural policies work against small farmers in Pakistan. In the words of one of the research participants, a government official, *“The optimum maintenance of the canal system and irrigation network can help improve per acre yield but it is not forthcoming due to lack of government attention as well as lack of private land lord interests.”*

In the interview carried out with the senior leadership of the opposition party it was stressed by a high ranking research participant, *“... to give the small farmers their basic rights through policy reform and enactment would be the starting point towards dealing with the curse of poverty. If the farmer is given an enabling environment whereby he or she can successfully practice sustainable farming right from the purchase of agricultural inputs to selling their commodities in the market, it will not only alleviate poverty but also help address climate change policies in a proactive manner.”* Interviewees who comprised of Army Generals also endorsed this view.

In response to the above issue according to the government officials interviewed, in order to ensure food security and to improve the productivity of small farms, the government has initiated a phased ‘Special Program for Food Security and Productivity Enhancement of Small Farmers’ which will start by covering 1,012 villages in all four provinces and other areas and extend to 13,000 villages by the year 2015. This program aims to enhance the crop productivity of small farmers. According to these pro-government participants, *the government is aiming to bring an additional area under the plough and narrowing down productivity gap between progressive and subsistence farmers. This would be done by*

subsidizing fertilizers with an upfront subsidy of Rs. 32 billion and agriculture credit, to the mark of Rs. 250 billion.

In the interview with the head of Pakistan Planning Commission, “...*the Planning Commission has reviewed the water situation and its impacts on agriculture and has devised various strategies for combating predicted water shortages to meet agricultural needs. Other South Asian countries, such as Nepal, Bhutan and India, and neighbouring China, have already sounded alarm bells on the rapid recession of their glaciers*”.

It was agreed by all research participants that global climate change can affect the growing season length of crops due to higher temperature, it can reduce soil moisture and it can alter the stages of plant growth. The quality and quantity of agricultural crop yield will be affected by climate change in three ways according to all 36 interviewees and these findings corroborate with the literature review findings: *a) direct effects from changes in temperature, water balance, CO₂ concentrations and extreme events; b) indirect effects through changes in distribution, frequency and severity of pest and disease outbreaks, incidence of fire, weed infestation, or through changes in soil properties, and c) rise in temperature and reduction in rainfall could increase the net irrigation water requirement of crops, thereby forcing farmers to make changes in cropping patterns to adjust to climate change.* According to one interviewee, an academic by profession, “*40% or more food is wasted due to inefficient farm to market channels*”, implying weak infrastructural facilities resulting in inefficiencies. In other words bad infrastructure leaves unsustainable economic burdens and puts pressure on land and natural resourcing productivity eventually leading to a metabolic rift.

Pakistan’s 5-year plans, strategy documents, and the Medium-Term Development Framework generally overlook the debate on climate change and are thus seriously deficient in this respect. Where they do mention climate change, it is often unclear how climate change is included as a cross-sectoral issue that impacts all aspects of agriculture enterprise, i.e., production, marketing, processing and transportation. Agriculture policy currently does not address climate change issues amongst farms, agribusiness entities, producers and consumers by providing information and know-how on finding ways and means to adapt to changes by shifting to new crops, crop rotations, disaster risk management strategies in case of extreme climate events; and maintenance strategies for livestock species, fisheries and forestry that ensure sustained growth on the farm systems. The effects of the first round of green

revolution in 1960s were described by the interviewees as devastating for the ecology and long run sustainability of the economy which corroborates the analysis presented in chapter 2 of this study.

According to one landlord interviewed endorsing Pakistan's agriculture and water policies with respect to climate change in a report published by IUCN, "*Climate change has caused a shift in the advantages of certain productive enterprises especially in agriculture. It is time now that national policies on agriculture should be developed through stakeholder participation and special attention should be given to provincial governments' viewpoints*"⁵², which is now possible with the 18th Amendment to the constitution. This legislation is analysed in section 7.4.

5.3.3 Industrial Sector Policy in Context of Climate Change

The 8th Five Year Plan (1993-98) was the first which incorporated environmental concerns and urged that environment be made a key criterion in the selection and development of the development model. However there was no implementation on ground because during 1990s Pakistan then restructured its tariffs to aid liberalisation and decentralised free market policies under SAP. The result was increased production but at the cost of poverty and environment due to unsustainable agricultural methods and heavily polluting industrial activity with an oversupply of primary products which reflect higher environmental loads, as analysed in chapter 2. According to an interviewee, "*no industrial estates have been formed with integrated environmental management infrastructure. Factories remain unaware of their environmental obligations and lack the capacity of treating industrial waste. Industrial wastewater discharges in public sewers without any prior treatment is one of the main causes of severe environmental degradation causing health problems. This air and water pollution varies from nitrogen oxide to ammonia gas to a variety of toxic chemical compounds and heavy metals leading to ground water contamination, marine life contamination and heavy air pollution.*" With respect to Punjab, more than 90 per cent of industry uses underground water which is accessed by installing tube wells (information confirmed by Director Industries Punjab and Water and Sewerage Authority [WASA]). There is no water charge as such, but a tax has recently been imposed by the local government on aquifer extraction.

⁵² IUCN Pakistan (2009). Policy Gap Analysis. IUCN Pakistan, Islamabad, Pakistan.

Data about the ambient impact of industrial and other source emissions in Pakistan are scarce. The most recently published data show high levels of air pollutants, usually exceeding WHO standards, around industrial complexes within the country⁵³. Traditionally air pollution was considered to be an urban phenomenon. More recently, with the expansion of industry in the rural areas, penetration of transport into rural areas, and the growth of brick kilns, air pollution is fast becoming a rural problem as well. In addition, rural areas are turned increasingly into peri-urban areas and it would be difficult to find an uninhabited stretch of more than five miles along the GT-road between Lahore and Islamabad. According to the interviewees, to all intents and purposes, such areas have become urbanized, with the consequent environmental problems. Vehicular emissions alone contribute significantly to the degradation of ambient air quality. In this category, diesel vehicles emit 2.8 times more SO₂ and 5.8 times more suspended particulate matter (SPM) over the same distance as gasoline engines. The vehicle fleet is increasing at the rate of 10 per cent a year, the increase being concentrated in urban area. As a result, the emission loads per kilometre travelled are high, reflecting high vehicle densities and low speeds. In Lahore city vehicles are the dominant emissions source, contributing about 96 per cent of CO₂, 76 per cent NO₂ and 28 per cent of SPM₂ (Faiz et al, 1992; Sanchez-Triana et al. 2014, NCCP, 2012).

According to the head of Planning Commission, one of the research participant's, *the need for industrialisation for Pakistan is imperative*. This view is shared by mostly all the research participants. However, the process of achieving economic growth based on industrialisation under current economic system remained a point of contention between many.

The framework of economic growth proposed by the Planning Commission under this interviewee's guidance focuses on fast economic growth and its protection from climate risks and costs by climate proofing economic sectors through adaptation measures particularly green low carbon technology. According to him, "... *environmental degradation is costing Pakistan in terms of low GDP growth. In order to reverse this phenomenon a total restructuring of economic sectors is required with a focus to improve the total factor productivity (TFP). To overcome problem areas of politicised public sector development projects; underutilisation of existing infrastructure; institutional lag and energy crisis*

⁵³COMM (2014) *European commission*. Available at: http://ec.europa.eu/index_en.htm (Accessed: 23 June 2015).

management issues, a vibrant private sector based on free market economy where government is seen just as a facilitator of private growth with limited regulations to exercise, is proposed.”

According to the Planning Commission head, “Government participation in the private sector in Pakistan has led to decreased competition; non-transparent business environment; biased industrial policies favouring some sectors and a handful of industrial elites which are given untargeted biased subsidies; barriers to entry; and impediments to innovation which reinforces inefficient economic and ecological behaviour”.

According to the senior chairperson of the opposition political party, *“When government officials themselves become traders and industrialists, any chance of competitive free market and transparent level playing field for domestic industrial growth is wiped out”.*

Both the above elite interviewees consider industrialisation critical for economic growth. But they both propose antagonistic strategies to achieve progress and innovation in industrialisation under opposing economic and political systems. Where the former is more focused on efficient market behaviour with faith in the ‘invisible hand of the market’ the latter is clear that efficiency without equity in the development policy will not be sustainable.

The five main waves of significant policy changes as identified by the research participants are as follows. These points corroborate with the literature review findings of chapter 2:

- a) India imposed a trade embargo on Pakistan in 1948. Pakistan was dependent on Indian imports before that so to counteract this, it encouraged investment in consumption goods and provided protection from external competition which increased domestic industrial output.*
- b) In the 2nd and 3rd Five Year Plans (196-65 and 1965-70 respectively) industrial licensing was employed to increase the diffusion of the ownership of industry and the government at the time drew on International Development Finance Companies such as IDBP to facilitate industrialisation. This resulted in the establishment of small scale units such as textile spinning and weaving.*
- c) Large scale manufacturing was focused on during the 1970s with a reorientation towards public sector corporations over private sector. The Board of Industrial Management (BIM) and Pakistan industrial Development Corporation (PIDC) both chose new projects based on political grounds. During 1980s this policy orientation*

was reversed from nationalised industrial unit back to private industrial sector playing a dominant role. Since 1960s however textile industry (LSM) has been protected in a regressive way that it did not diversify and concentrated on low value added textile production.

- d) 1990s was a decade of deregulation and privatisation. According to some research participants mostly academics and Army Generals, this was a decade lost in terms of sustainable development. Private sector economic gains according to these participants were short sighted based on political interests with short term planning. Another theme that emerged during the interviews was that Pakistan has been involved in exports of products geographically confined to EU and US so it is geographically concentrated in a few countries.*
- e) By 1999, private sector was very strong and because of the global economic boom the economic growth index of Pakistan remained strong but at the expense of decreased HDI and increased poverty. The latter was soon compounded by the impacts of climate change, the first major extreme climate event occurred in 2005 with the Kashmir Earthquake with a magnitude of 7.6.*

A strong sense that permeated through almost all the anti-government elite interviews was that *macro-economic goals are not anchored with microeconomic understanding and analysis in Pakistan. The national institutions have not been apace with the changing realities of the deregulated financial markets since the 1990s. This deregulation of financial markets, global trade patterns and privatisation policies combined, not only increased inequality and poverty within the country but they also caused severe ecological problems for Pakistan. According to the anti-government elite, Pakistan is traditionally seen as successful, export-oriented economy showing a healthy GDP growth rate but it is in fact suffering significantly from unrecorded economic and ecological losses. A common consensus emerged within the elite circles through the interviews that most factors hindering Pakistan's sustainable growth are to do with its outmoded institutions, policies and distribution of finances rather than a shortfall of finances and therefore a development policy shift based on deep reforms is critical now more than ever. The actual experience of current policies has lead to the changing view that the concerned development policy needs serious revisions.*

It was further pointed out in the interviews that *Pakistan's National Industrial Policy published by Ministry of Industry and Production (MoIP)*⁵⁴ *favours a protectionist regime for indigenous broad based industrialisation and opposes free trade whereas the Pakistan Planning Commission, which follows a development scheme akin to the IMF program, along with its Growth Framework is grounded in its endogenous growth theory, opposes the salient features of the draft industrial policy formulated by MoIP, and favours deregulation of industry, liberalisation of trade and privatisation of national asset/resources.* Unlike the Planning Commission, the premier institution of the Government of Pakistan under Ministry of Industries and Production (MoIP) is SMEDA which was established in October 1998 to take on the challenge of developing Small & Medium Enterprises (SMEs) in Pakistan for sustainable domestic industrial growth. And yet there is the IMF program that Pakistan has been following and still is following.

There is a general agreement within the interviewees at large that *significant national organisations and institutions are resource constrained in Pakistan and are also not in sync with each other regarding their development policy objectives.* According to a senior political leader interviewed, *“Policies fail if domestic institutions are weak and not in sync which is precisely the case with Pakistan. Also, if individuals or a group of individuals politically become powerful than political institutions become weak. Privatisation is healthy only to the extent that institutions (public and private) remain strong... accountability of the concerned private investors/owners and transparency of private resources is a starting point towards establishing strong institutions and hence governance.”* With regards to government, the general consensus amongst the interviewees emerged that, *its primary role is to provide an enabling environment for a free market system to work on competitive grounds which includes necessary regulation in the form of enacting fair and legal contractual obligations between parties behind market transactions.* The domestic industrial growth is important for any country with strong domestic institutions because it provides an underlying level of socio-economic resiliency to that country. If a country is economically resilient than it can drastically reduce negative impacts of climate change or poverty.

These findings are confirmed by the literature review finding and study carried out by Sayeed, 1995, as mentioned in chapter 2 (Sayeed,1995).

⁵⁴ SMEDA (no date) *Sector briefs*. Available at: http://www.smeda.org/index.php?option=com_phocadownload&view=category&id=28&Itemid=139 (Accessed: 23 October 2014).

5.3.4 Energy sector policy in context of Pakistan

Currently Pakistan's fuel mix for electricity generation revolves around WAPDA, KESC and IPPs which is economically and ecologically taxing on the country. The current country requirement of electricity is 18,000 MW and the current generating capacity of the country is 10,000 MW which means a serious shortfall of 8,000 MW. *According to the political leadership's senior leadership, "...half of Pakistan does not have electricity connections and those who do suffer from the severe energy shortfall, almost two out of three Pakistanis have income less than \$2 a day and the mortality rate can be gauged by the fact that one out of eleven children will die due to poverty before they reach the age of five. This is the degree of the development challenge facing Pakistan and for the kind of development which requires us to come out of poverty, we need a lot of energy."*

The opposition leadership and non-political elites, all stressed upon *the kind of energy sources for power generation based on indigenous resources. According to them it is critical that Pakistan gets rid of its energy import bill which is costing the ecology and economy alike; it is increasing the country's debts and the current account deficit.* For these set of interviewees, *economic growth cannot happen sustainably with imported energy.*

As reported earlier, one of the main concerns of the elite interviewees was the mismanagement of water resources domestically by a critical shortage of dams and as part of the water management policy failure to protect its waters in the region further means that Pakistan has no short to medium term prospect of generating energy through indigenous hydel resources. But Pakistan has the solution to fill the gap of 8000MW and produce even more energy which can be used to export hence slashing its draconian imported energy bill of furnace oil. This solution is proposed by Atomic Energy Commission Scientist, interviewed.

It was generally agreed by all participants some of whom are experts in the area of energy including high ranking Army Generals that *Thar has close to or above 175 billion ton of coal equivalent to 50,000 MW electricity annually running at all time for the next 500 years. If this resource is realistically tapped then not only Pakistan can be energy sufficient getting rid of its current US\$9 billion cost of imported oil annually but Pakistan could start exporting diesel with sustainable technological prowess.* According to some interview participants, *the*

Thar coal power project Block 5 which started under Dr. Samar Mubarakmand in 2010, successfully ended in 2011 but due to lack of funds released from the government the successful running of the gassifier has been stalled. One gassifier capacity as measured by the technical team is 30,000 MCF daily. According to the technical team the quality and quantity of gas improves with the passage of time but the energy produced thus far is being lost in the desert as in a flare instead of this energy reaching people domestically and businesses commercially within Pakistan because the government funds have been cut off for the technical team of experts at Thar Block 5, so that they are completely hindered from completing this perfectly viable project. In the words of one interviewee, “Coal gasification has taken place with the funds of approximately Rs.490 million advanced by the Planning Commission but for gas purification and actual power generation the remaining funds are stopped.”

The general consensus amongst the elite interviewees was that Dr. Samarmubarakmand’s team successfully proved Thar’s capacity and significance for Pakistan by sustainably finding Thar coal strictly with indigenous technology and knowledge with the end result of producing considerably clean energy. However lack of coordination between the Ministry of Finance and The National Bank has resulted in funds being stalled whilst the whole of Pakistan is suffering from 12 hours of power cuts on average daily. Furthermore, it was stressed in the interviews that neither the federal government nor the provincial government of Sindh especially after the 18th Ammendment has taken any initiative to help release the funds for this pilot project of such high significance for sustainable economic development with implications for climate change and poverty. This proves according to the nuclear scientist interviewed that *the energy crisis is not technical, instead it is purely political*. He further explained that *for a 100MW plant of this pilot project Rs. 9 billion are required which is not a huge sum of money for the government. It costs Rs. 4 per unit to make the electricity from underground gasification, the government can then put this onto the national grid and charge the consumer Rs. 8-10 per unit which will fetch a profit of Rs. 2.8 billion annually. In 4-5 years, the investment of Rs. 9 billion is paid off. If this scenario materialises which it can, given the funds are released to the technical team at Thar Block 5 then Pakistan will be able to compete with China where the cost to produce electricity is Rs. 3 per unit.*

The above research participant further said, *“In Pakistan, per unit cost of electricity is Rs. 10-12 which is produced by WAPDA, KESC, with existing hydel, gas and coal power plants.*

For, Rental Independent Power Plants (IPPs) per unit cost of electricity is Rs. 15-17. If electricity is imported from Iran then the cost per unit of electricity is Rs. 8. In comparison, electricity produced by underground coal gasification (UCG) from Thar, is Rs. 4 per unit of electricity.”

He added:

“Apart from electricity, diesel can also be made from underground gasification at a cost of US\$17-20 per barrel compared to the current international market diesel price of US\$250 per barrel (and crude oil at US\$80 per barrel).”

At the Planning Commission, a visit from WB officials raised concerns on the environmental damaging effects of mining coal on climate change. According to the Planning Commission officer interviewed, *this concern where understandable only stands valid to the extent if the carbon is emitted in the air whilst exploring coal, a practise, according to him, widespread in Pakistan’s neighbouring countries. But the methodology of exploiting coal undertaken by Pakistan’s Thar team at Block 5 is that of underground gasification which is environmentally friendly.* Here is how the interviewee explained the process, *“When coal gas escapes and burns in this process it is ten times less potent than when coal is burnt and it escapes in the air. In the process of underground gasification, the carbon particles are very low and the escaped carbon dioxide is captured and injected back into the gassifier well, which implies that no CO₂ escapes into the air.”*

He added, *“Following up on the scientific theoretical framework prepared by the technical team involved, where no Transfer of Technology took place, instead through super-computing using indigenous resources, Pakistani scientists made theoretical mathematical models for practical on ground work to take place. The UCG (Underground Coal Gassification) technology requires putting 600 feet deep pipe underground where coal is burnt and turned into gas to generate electricity. The gas underground, once broken down to hydrogen and carbon monoxide, can also be used for fertilizers and various other economic purposes such as ammonia, urea, gasoline and methanol, the latter being the precursor for many chemical industries.”*

He further said, “When compared to coal mining, UCG is not environmentally damaging. Whilst drilling in Thar for coal which was set deep underground the biggest challenge was that coal has a lot of water. The Block 5 Thar team used indigenous technology to fire up the coal in order to expel the water out of it through high pressure air, once that happened coal was fired up again to turn it into gas. This gas is 20% less in cost than Sui Gas, btu to btu energy wise. This gas can be used in gas turbines, gas boilers and in combustion engines to generate electricity.”

The above statements were corroborated by a combined agreement on them by other interviewees mostly army Generals, journalists and water experts whose combined analysis showed a structural level understanding of meaning formation which means that the influence of power, was not hidden from these interviewees.

According to one media journalist interviewee, *“Out of the 6 Blocks in Thar desert, coal in Thar Block 5 is estimated to be 170 metres underground on an area of 64 km². This area is estimated to have 1.4 billion ton of coal which equals 1.4 billion barrels of oil and is sufficient to produce 10,000MW of electricity annually for 40 years. The entire Thar region comprising of all 6 Blocks is an area of 9000 km² where coal is estimated to be much more than the Middle Eastern deposits of oil. It is estimated to be enough to provide for the next 500 years to come with 50,000 MW annual electricity generation.”*

In conclusion, the energy solutions proposed by high ranking opposition elite political and non-political, interviewed are: a) Thar coal energy with UCG technology or with CSS technology readily available now to be retrofitted on existing coal fired plants to avoid anthropogenic climate change and aid poor at the most economical price; b) hydel energy which is totally seasonal not all year round must be developed with building of dams for water storage and undertaking of water conservation methods to avoid inefficiency of water use; c) solar energy and solar lantern energy/home system for every village; d) tidal energy catering all coastal areas from Karachi to Gwadar with turbines in the sea; e) geo-thermal energy; f) bio-fuel energy – for example, ethanol, biogas, gasoline – to be used to generate small energy projects in every village; g) micro hydro projects with small projects worth 25MW for example on thousands of canals in all the provinces of Pakistan. These solutions are in stark contrast to the government solutions which is on a tangent importing fuel furnace oil to make electricity which is costing the country in terms of deteriorating Balance of

Payments due to increased debts and it is costing the consumer due to their sheer economic inability to pay their huge electricity bills under the burden of circular debts, caused by inefficient IPPs. As one interviewee who is an academic said, *“The problem of circular debt in the energy sector of Pakistan is best addressed by correcting the underlying reasons for the inability of the consumer to pay, through strict accounting and transparency practices of energy providers and a structural realignment or a sustainable shift of domestic energy production policy to match the costs of the country’s energy consumption.”*

He further said, *“Pakistan’s energy problem is not an energy scarcity issue, it is purely a political and an institutional issue. Unfortunately the national institutions such as WAPDA that are entrusted with dealing with the energy crisis are not technical, they consist of staff who are primarily bureaucrats and journalists.”*

According to one senior anti-government political leader in his interview, *“The devolution of authority to the union council level... where all cities, towns, tehsils, zilas and union councils aim to make their own energy through their own mix of small projects is critical and these initiatives must be well integrated within provinces and well co-ordinated between provinces.”*

In order to undertake such local level and intra-sectoral policy initiatives towards a sustainable economic framework as discussed above, the environmental legislative framework of Pakistan needs to be analysed.

5.4 Climate Change Legislation

This section analyses the environmental and climate change legislation in Pakistan, to date and is linked with questions 34 till 38 of the policy questionnaire. Until the 1980s development policies were formulated irrespective of environmental considerations. A variety of environment-related acts and ordinances existed, but the Pakistan Environmental Protection Ordinance 1983 (PEPO) was the first attempt to tackle environmental problems systematically (Government of Pakistan, Ministry of Law and Parliamentary Affairs, 1983; Hassan, J., 2006). It created a legal basis for comprehensive environmental policy making, the establishment and enforcement of standards, environmental impact assessments and the inclusion of environmental considerations in development policies. But the monitoring and

enforcement capacity foreseen by the Ordinance was inadequate, and the emphasis on penalizing entrepreneurs rather than supporting them in adopting less polluting processes and technologies made the Ordinance unpopular. However, its objective was “to provide for the control of pollution and the preservation of the living environment” in Pakistan (Government of Pakistan, Ministry of Law and Parliamentary Affairs, 1983; Nareen, 2009; Ahsan and Khwaja, 2013).

The 18th amendment to the constitution of the Islamic Republic of Pakistan passed in 2010 makes profound changes to the legal and environmental regime of Pakistan. Prior to this, the subjects of ‘Environmental pollution and ecology were found in the Concurrent Legislative List allowing both the provinces and the federal government power to legislate on the subject. One of the interviewees who is an environmental lawyer explained, *“The 18th Amendment in the Constitution of Pakistan abolished the Concurrent Legislative List and downgraded the responsibilities of the federal government towards decentralisation of power to the provinces and now the subjects of environmental pollution and ecology are areas that the provincial assemblies alone are competent to legislate on and form policies upon.”*

Since the 18th Amendment there have been no structural reforms and no coordination between provinces on National Environment Quality Standards (NEQS). PEPA 1997 is now PEPA (Punjab Environment Protection Act) 2012 and BEPA (Baluchistan Environment Protection Act) 2012. According to one government official during her interview said, *“Devolution of power can essentially go either way. Lack of resource capacity, i.e., educated labour force and updated technology, of provincial governments along with the handling of additional responsibilities, has led to administrative and governance gaps which in turn leads to uncertainty about local level governance. But the alternative is that with the empowerment to legislate with the 18th Amendment, the provinces should seize the agenda, form appropriate policy frameworks and govern with a clear concise vision which successfully integrates climate change and development goals.”*

She further said, “A lot depends on stakeholder dialogue... from corporate responsibility for their local areas down to communal participation in both conservation and development... , availability of accurate data and research as well as appropriate funds for informed policy implementation of viable projects.”

And

“The 2010 floods should have been the wake up call for the authorities concerned, yet Pakistan experienced floods in Sind in 2011 and in Punjab in 2013 and 2014, depicting the frequency and intensity of extreme climatic events causing socio-economic disruptions...”. In 2010, Government of Punjab constituted a Judicial Flood Inquiry Tribunal that submitted its report on the causes of the major breaches in River Indus during these floods. It also identifies absence of Flood Plain and Hill Torrent Management along with the lack of integration and coordination between government departments as the main causes of breaches on regulations concerned (The Judicial Flood Inquiry Report Pakistan, 2011⁵⁵). The extensive encroachment in the floods plain was identified as the most important factors obstructing the natural river flows; allotment of land in ‘Katcha’ areas by Sind administration resulting in the growth of housing settlements to meet the housing needs of the population but without the necessary planning and building regulations in place. According to another interviewee, an academic by profession, “This flood risk assessment was not operationalised in any concrete adaptive measure, so that the vulnerability of the poor against the probability of yet another extreme climate event remains reinforced.”

Section 12 of PEPA 1997 prohibits all development projects from operation or construction unless they have submitted to the relevant EPA (Environmental Protection Agency) and IEA (Initial Environmental Assessment) and where the project is likely to cause an adverse environmental impact, then the project concerned will be called off. Most large development projects are subject to IEE and EIA regulation whereas vast majority of smaller to medium scaled projects are not regulated (Pakistan Environmental Protection Act, 1997⁵⁶). According to the environmental lawyer who participated in the research interview, *“IEA and EIA focus on environmental impacts not social impacts: legislation needs to consider both social and environmental impacts of projects for timely and sustainable processing and operation of these projects. For example, Land Acquisition Act 1894 should be supported by resettlement policy in case land acquisition is challenged which can result in delayed projects. Furthermore, a Cumulative Impact Assessment of, for example, hydro power development project both dam based and run of the river, would result in a holistic environmental*

⁵⁵ Staff Report (JFIT). (2011). *Judicial Flood Inquiry report on Canal and Spur Breaches in Punjab*. The Judicial Flood Inquiry Tribunal (JFIT).

⁵⁶ Naureen, 2009; Hassan, 2006; Alam, 2010; Alam, 2009.

approach.” Environmental Protection Acts in the purview of 18th Amendment are being revised and where needed, developed in order to align with the present ground realities. The capacity for integration of environment and development planning at federal and provincial levels is being developed through the National Impact Assessment Programme (NIAP) being jointly implemented by the Planning Commission, Ministry of Climate Change (Pakistan Environmental Protection Agency), Provincial Departments of Environment and Planning & Development and IUCN Pakistan. Overall objective of the programme is to contribute to sustainable development in Pakistan through strengthening of Environmental Impact Assessment (EIA) process (Ministry of Planning Pakistan; International Union for Conservation of Nature; National Adaptation Disaster Management Authority).

It is a common understanding between the research participants that *adaptation projects will not reduce climate change, they will reduce vulnerability to climate change and because of this very fact, they can prevent many from joining the ranks of the poor... but sometimes faulty assessment for adaptation purposes can trigger off an environmental disaster which inevitably causes socio-economic and ecological upheaval.* This is confirmed by the focus group discussions. Hence the importance of Environmental Impact Assessment (EIA).

According to the interviewees of a legal background, *with regards to the responsibility of domestic and foreign businesses towards climate change, the legal framework for CSR in Pakistan exists but since the General Order and Guidelines do not constrain companies to undertake environment related CSR initiatives, action is not forthcoming... In Pakistan, the Securities and Exchange Commission has issued the Companies (CSR) General Order 2009 that is applicable on all public companies from the beginning of the financial year 2009.*

According to one lawyer interviewed:

“...Pakistan government should introduce a financial transactions’ tax, or stamp duty proportional to the size of corporate balance sheets as part of CSR... the revenues generated should go in climate and poverty mitigating or/and adaptation projects... ”.

5.5 Discussion and Analysis of Dominant and Alternative Economic Paradigms

This section focuses on the capitalist and non-capitalist models to analyse which paradigm best accommodates climate change and poverty in the development process of Pakistan and is linked with questions 39 till 42 of the policy questionnaire.

All participants agreed that *the risks and vulnerabilities associated with climate change are seen as real and serious requiring detailed risk and disaster risk management frameworks tailored to the needs of different local regions of the country.* However unlike the pro-government participants, the anti-government participants/elites believe strongly that *these goals set in the risk and disaster management frameworks within the policy papers proposed by the Planning Commission and Pakistan government in collaboration with national and international environmental organisations, are framed through the lens of UNFCCC and the Kyoto Protocol portraying that this maybe the only way forward.* For them *climate change should not be reported through the language of catastrophe and peril as if it is the greatest problem faced by humanity because such reporting detracts and diminishes the many other ways of thinking, feeling and knowing about climate change for decision making which can have negative implications for poverty and sustainable development.* One possible outcome of growth with equity is reduction in poverty. In the absence of rent-seeking society, space becomes available for spending on public education, health and other long term development variables. *Therefore according to the opposition political elite interviewed and army Generals interviewed, the growth which is shown on macro-economic curves is the growth of a small but powerful class of people and not of the whole country... The poor are not active stakeholders in policy making.* This point becomes an important theme of analysis in Chapter 6, under the concept of social rationality.

The anti-government elite participants *questioned the way in which traditional investments are made, markets are run and profits are made based on traditional CBA, as analysed in section 7.6.2 of chapter 7.* For these elites *putting a price on carbon, air and water is not a sustainable way of dealing with climate change. Ownership rights to emit CO₂ is auctioned and allocated between entities alongside the operation of the market which prices and regulates carbon as opposed to precautionary action to avoid a disaster.*

The anti-governmental participants thus advocate an alternative schema of governance. *They want to take climate change policy making out of the realm of conventional welfare based calculation methodology to a claim of rights-based approach where first and foremost, the*

current generation must have the right to benefit equally amongst themselves. After that, the right of future generation must be considered so that they can also benefit from the same basic natural assets and functions as their predecessors.

A comparison between opposing economic paradigms is brought forward in tabular form, in answering the following questions, in chapter 7 section 7.6 of this research study. Main questions asked were:

- a) What are the costs of limiting CO₂ in the atmosphere to 450ppm?
- b) What would be the effect on Pakistan's economy of introducing a carbon tax of Rs. 3000 per ton of carbon?
- c) How best is it to measure welfare, consumption and production as these are the key economic concepts that have implications for climate change?
- d) How best is it to compare the costs and benefits of climate change policies?
- e) How should the future be weighted in such comparisons?
- f) How is economic reasoning possible when we don't know the exact risks associated with the climate change of today's day and age which is anthropogenic?

There emerged a clear divide between the interview participants with the government and pro-government elites supporting the mainstream solutions of reforms whilst the anti-government elites supporting the solutions based on deep reform for climate change and poverty.

One important question asked was: risks, present and future welfare and uncertainty are inbuilt in the discourse of the economics of climate change. What maybe the most appropriate way to deal with these? The divide within the participants was clear on this question as well. In the first round of interviews most politicians and Army Generals did not consider climate change and its uncertainty as crucial a challenge as many other developmental challenges as poverty. By the second round of interviews it was clear that climate change had surfaced as a priority issue and it was now easier for the participants to link it to poverty in the wake of devastating monsoonal floods. It was agreed by all the research participants that the precautionary, reactionary and emergency based policy portfolio with active involvement of poor stakeholders who are the direct victims is the most practical way forward in the face of such severe climate change events. To this regard, climate change

legislation and prompt policy implementation was seen as critical. However for policy implementation funding becomes important.

The anti-government elite showed deep concern on the government's approach of securing foreign aid for development and climate change projects. According to one senior defence analyst who's view was in cognizance to the study carried out by Varoufakis, Holland and Galbraith, 2013⁵⁷:

“For funding of our national development projects and policies there is a critical need of a home grown investment stream. This can be done by setting up a neutral technocratic caretaker government selected by the State itself... this technocratic setup must work on war footings for emergency funding given the widespread socio-economic damage in the country... by utilising the existing natural resources such as gold, coal, gas, land and water through public-private partnerships... or by issuing a fully collateralized bond on the international capital markets against the current value of these assets to raise approximately \$30-40 billion or the like.... The raised amount can be invested in developing and restructuring the socio-economic and ecological public assets under its management for long term sustainable development. The plan could envisage an investment program of 4-5 years. This, in turn, would induce proportional increases in tax revenues, thereby contributing to restructuring of domestic markets and institutions on truly sustainable grounds. These tax revenues must be enhanced by progressive taxation to invest in green technologies and low carbon innovative infrastructures... In this scenario, the primary surplus (which excludes interest payments) can be used to recapitalise banks, to get rid of their non-performing loans and start lending for productive domestic economic projects... Such home-grown investments will help counter the recessionary impacts of the punitive IMF fiscal policies... moreover renegotiating with IMF on the terms of its loans with the aim of getting off the IMF list should be another main priority of this technocratic caretaker government.”

This mechanism of recycling capital from the international and domestic savings into the domestic markets for domestic socio-economic restructuring and institution building to address climate change and poverty sustainably serves as a rich insight. In the words of another research participant:

⁵⁷ Varoufakis, Y., Holland, S., Galbraith, J.K. (2013). Modest Proposal for Resolving the Eurozone Crisis, Version 4.

“The contradiction at the heart of all of the economic analysis of climate change is the presumption of continued economic growth as measured by conventional GDP which negates the expositions proposed by the government officials of scarce or depleting natural resources and climate risks facing future generations... GDP is outdated what we need to measure our progress as a nation is data based on a variety of non-monetary metrics to show some quality of life... .”

With regards to the discussion on carbon economy, the government and pro-government policy making research participants understood that *for the carbon economy to have traction for the policy makers and other social agents, emissions of CO₂ and any related information should be treated as commodities. Whilst the other set of elite participants had concerns putting a price on carbon.* For the pro-government elite interviewees sustainable development is reconciled with economic growth measured by GDP through a market dominated economy which adequately prices the goods and services including climate. The anti-government elite questioned this way of policy making, showing an understanding of the generative mechanisms at work, as shown by the following two quotes:

, “... if the underlying cause of climate change is the unsustainable material consumption of market economy then carbon trading simply reinforces the reach and power of such artificial markets”.

Furthermore,

“It is often advocated by the dominant system that the solutions to climate change is rooted in choices of our lifestyles that we should adopt a low carbon footprint... and this is all well and good... but these insights into living a low carbon lifestyle oppose the conventional growth oriented economic system and consumer lifestyle... .” This view reflects the theme of exponential growth of capital, analysed in chapter 3(II), across space and time which translates into rapid turnover time for consumption. This implies that capital needs a consumption oriented society for it to grow which negates low carbon lifestyles.

Where local and regional climate change effects are critical to asses, according to the elite interviewees it is important to understand that the defining feature of the climate-change

problem is *intrinsically global in nature*. Greenhouse gases tend to disperse themselves uniformly around the globe. As a result, the climate consequences of a ton of emissions of GHGs does not depend on the location of the source, either within or across national borders and shifts in emissions across locations do not change global climate impacts. Under these circumstances, economic efficiency principle calls for making market-based systems as geographically broad as possible. It supports regional cooperation and international coordination over idiosyncratic domestic responses. Having highlighted this very intrinsic climate change fact, it was agreed by all research participants that intelligent domestic policies to address climate change impacts in the development process are nevertheless critical for sustainable development.

5.6 Conclusion

This chapter was based on the policy level questionnaire prepared for this study to answer the research questions. The four main categories of the questionnaire link to the four main sections of analysis brought forward in this chapter. Section 5.2 presented an analysis of the reciprocal impacts of climate change and poverty in Pakistan and whether a link can be established between these two phenomena within the development process. Section 5.3 explored the economic development policies of Pakistan's main economic sectors which are not only impacted by climate change but can have direct implications for climate change and poverty depending on the way they are managed. Section 5.4 presented the legislation so far carried out in Pakistan on climate change with implications for development. Section 5.5 focused on the comparative economic paradigms to analyse which paradigm best accommodates climate change and poverty in the development process of Pakistan according to the elite officials interviewed. To answer the research questions set out in section 5.5, a comparative analysis of these economic paradigms is brought forward in section 7.6.2 of chapter 7, under this research study.

6 Focus Groups Analysis

6.1 Introduction

The purpose of this chapter based on the focus group sessions has been to deliberate clearly upon the socio-economic vulnerabilities experienced by the poorer section of the society which are aggravated by climate change. It also analyses such socio-economic factors embedded in the system that could impact on climate change through a metabolic rift. As mentioned in chapter 4, participants are selected on the criteria that they fall below the poverty line or suffer from borderline poverty in Pakistan and therefore share common characteristics which is one of the important pre-requisites to answer the research questions.

The focus group questionnaire is based on ten specific domains employed by the multidimensional poverty assessment tool (MPAT) and these domains are arguably, fundamental to human well-being as opposed to income or economic growth which alone does not provide a reliable proxy measure of poverty. MPAT covers ten dimensions central to rural livelihoods highlighting critical areas that can help assess poverty levels. These ten areas are: Food and Nutrition, Domestic Water Supply, Health and Care, Sanitation and Hygiene, Housing, Clothing and Energy, Education, Farm Assets and Non-Farm Assets, Exposure and Resilience to Shock, Gender and Social Equality. The questions based on these multidimensional issues are broad enough to be applicable in most rural contexts, but precise

enough to act as quality proxy measures for the components they represent (International Fund for Agricultural Development, MPAT User's Guide, 2014⁵⁸). Discussions generated from these questions are analysed to build new ideas for analysis and these discussions are also used to identify, compare and build upon key themes that emerged from the in depth interviews.

The main findings of the focus group analysis follow in detail after the explanation of the sampling methodology.

6.2 Sampling Methodology

For the purpose of the focus groups under this research study, each province was sub-divided into three regions on the basis of heterogeneity in their socio-economic and geographical characteristics. Punjab province has 36 districts. The districts situated in the south of the Province mainly comprise of deserts and mixed characteristics of desert and plains which together formulate South Punjab region. The districts with prime characteristics of plains are jointly addressed as Central Punjab region and those districts that are situated 350-900 meters above the sea level formulate the North Punjab region. Similarly KPK which comprises of 24 districts, Sindh which comprises of 23 districts and Balochistan which comprises of 27 districts, were all divided in North, Central and South areas for the purpose of this study with household representatives chosen from all these areas. It was decided to collect data from approximately one third of the total districts (i.e. 36/3; 27/3; 23/3; and 24/3) to make it a representative sample of the districts so that Punjab was represented by 12 districts; Sindh was represented by 7 districts, Balochistan was represented by 9 districts and KPK was represented by 8 districts. This district-level ranking corresponds largely to zone-level estimates of poverty. Most of these districts were also worst affected by the monsoonal floods starting 2010 till 2014 (GOP, 2010; GOP, 2011).

All together 28 focus groups were conducted over the course of this research study with research participants' number varying from 12-15 for each group. Each participant

⁵⁸ IFAD. 2014. The Multidimensional Poverty Assessment Tool: User's Guide. Rome: International Fund for Agricultural Development.

represented their own household, under the jurisdiction of their respective district. Altogether 390 households participated in this research study. The following table lays out the number of households who participated in the focus group research study from each district of study from the four provinces. Most of the research participants in the focus group were small farmers, peasants, fishing community members, daily wage labourers in construction or industry and junior level commercial and domestic workers.

Table 6: Sampling

PROVINCE	DISTRICT	NUMBER OF HOUSEHOLDS
Punjab	Attock	11
Punjab	Chakwal	29
Punjab	Mianwali	20
Punjab	Jhelum	17
Punjab	Sahiwal	3
Punjab	Shiekhupura	2
Punjab	Khushab	29
Punjab	Lahore	30
Punjab	Bahawalpur	3
Punjab	Rawalpindi	8
Punjab	Faisalabad	2
Punjab	Sargodha	9
KPK	Abbottabad	11
KPK	Havelian	4
KPK	Charsada	19

KPK	Chitral	8
KPK	Gilgit	7
KPK	Malakand Swat	23
KPK	Haripur	2
KPK	Peshawar	10
KPK	Kohat	8
Balochistan	Dera Bugti	14
Balochistan	Gwadar	6
Balochistan	Kohlu	6
Balochistan	Quetta	11
Balochistan	Khuzdar	5
Balochistan	Kalat	9
Balochistan	Ziarat	13
Balochistan	Sibbi	2
Balochistan	Zhob	7
Sindh	Badin	18
Sindh	Hyderabad	5
Sindh	Karachi	27
Sindh	Thatta	3
Sindh	Tharparker	2
Sindh	Mirpur Khas	8
Sindh	Jamshoro	3

A detailed analysis follows based on the responses of focus group participants to the research questions.

6.3 Analysis of the extent of Socio-Economic Vulnerability from Climate Change for the Poorer and Vulnerable Section of the Society

The flood victims interviewed showed deep concern and hopelessness as recurrent disastrous flooding has occurred since 2010 yet the government has not prepared any operational climate resilient disaster management strategy to protect the poor/vulnerable population from the yearly recurring monsoonal flooding which is now showing a pattern as proved by the empirical evidence, resulting in more severe collateral damage thus reinforcing poverty.

According to one small farmer, voicing the concern of many others in his condition, *“nothing is expected out of the government so we have to do something ourselves to face the climate threat despite low government support, by providing better shelters for our households and livestock and diversifying crops as well as seeking alternative livelihoods in response to unpredictable seasons. We do not believe in government welfare schemes, we don’t receive money from BISP.”* Most women participants repeatedly said that they find it necessary to supplement their household income to make ends meet. An important observation that emerged from this point of discussion was that those communities that felt informed about their environment with some ownership of land or livestock assets and community support were considerably confident to cope with extreme weather. However, those without access to resources, relevant information or community support said that they felt helpless.

From the focus group discussions it became clear that *the poor felt the need of strong secure tenurial rights of land to be given to the local rural communities for example as primary stakeholders of the natural resources. The rationale behind this simply is that such land rights would enhance their capabilities making them economically secure and sustainable.* Moreover, the indigenous knowledge based on generations of experience integrates natural resource management with changing climate based on a harmonious regenerative nature-labour relationship. *According to forest dwelling tribes, communities and forests are inseparable., “the colonial rule ignored this basic reality which resulted in the alienation from the forests and the land of our indigenous communities. Given the post-colonial rule, the old colonial legislations are still in place as opposed to learning from the rich traditions of our forefathers where conservation is an essential part of tribal life... .”* The implication here is that even amongst this section of the society the ecological awareness is profound. In fact they appear more close to nature than the non-poor or elite. The modern conservation approaches advocate exclusion rather than integration with the natural environment. The indigenous knowledge, especially found with the older generation of farmers, reflects a profound ecological awareness that is ultimately spiritual. Such elements of self-transcendence and self-organisation through the development of human faculties related to human consciousness are concepts which stand in contradistinction to determinism where an organisation is externally imposed, as has been the case with the colonial and post-colonial legacy.

The main vulnerabilities of the poor accentuated by climate disasters as seen by the focus group participants included the complete absence of health insurance for cost effective health care or credit facilities for climate resilient capacity building. In case of disease and disasters, health insurance and climate insurance respectively can build resilience by helping low income poor people absorb shocks and diversify risks. The absence of such measures have direct implications because it increases poverty and vulnerability. This finding is further corroborated by a study carried out by Schapiro (2014) as also identified in the literature review. On a national level, it has been observed that GDP of countries with low insurance penetration also falls after natural catastrophes (Schapiro, 2014). Compulsory social insurance can fulfil the following: assess and price risk; create more certainty for the poor especially by reducing financial volatility; incentivize loss reduction and resilience building activities, and provide timely finance to recompense damage, in particular to the poor who are worst hit by climate disasters (Schapiro, 2014)

Apart from the discussions of the focus groups, many trips down to the villages for the purpose of this research, on part of the researcher, clarified the different conditions of how households went about their normal ways of life. Villages in and around socially better off districts, like in Khushab, Jhelum, Chakwal, Rawalpindi, Faisalabad, Lahore, Abbottabad, Haripur, Peshawar or Sargodha, have a better socio-economic life, with hustling and bustling local market activities, police stations, libraries, active health and school facilities as well as recreational sporting activities. The houses are mostly made of different grades of bricks and cement depending upon the wealth of households and communities but on the whole the living conditions remain considerably resilient to harsh weather conditions and socio-economic shocks. In these districts where there is local government presence, the community based socio-economic dealings are strong as the locals tend to have more access to resources including natural resources, market information and engage in social interactions. However there are pockets of poverty and extreme poverty within these districts which are hit hard with extreme climatic events reinforcing their poverty permanently under the current socio-economic system. With regards to very poor districts such as Tharparker, Badin, Jamshoro, Zhob, Kholu, Gwadar and Kalat amongst others, the poor suffer from extreme poverty conditions to start with, in terms of food and water security; personal living, i.e., household equipment and household building materials; and communal living in terms of the absence of health, education and other welfare facilities. When a natural disaster hits such areas as the

floods from 2010 till 2014 and the drought in Tharparker, then in the absence of any rescue or disaster damage management plan on behalf of the government institutions, these village communities sink deeper into poverty because of their already highly vulnerable socio-economic positioning in the system.

All households as represented by the focus group participants described themselves as poor. The participants of districts from Punjab and KPK were marginally better off than participants from Sindh and Baluchistan because they had comparatively better access to natural resources (land, forests and water). This emerges as a very important finding which corroborates findings from the literature review. Most participants apart from those representing Punjab described the physical infrastructural capacities of their tehsils (roads, transports, buildings) and their social welfare systems as being in a bad shape. Approximately 80% of the focus group participants were unaware of the number of tehsils in their respective districts or average amount of villages in their respective tehsils whereas most of them were aware of the average amount of households in their respective villages. This lead to an important insight that the poor may be well connected at an immediate community level but are disconnected from their local administrative policy making structures and procedures which affect their socio-economic positioning in society and hence the extent of the understanding of their rights as citizens.

In 2005 earthquakes, entire villages were wiped out. The devastating consequences of monsoonal flooding since 2010 have had similar large scale socio-economic implications spanning from the north of the country to the south. *All (100%) of the participants showed deep concern when asked what coping strategies they have if they were to get hit by another climatic disaster. Most showed little hope to survive if a severe climatic scenario were to unfold yet again in the absence of any rescue and response strategy from the government. Floods, earthquakes and droughts followed by cyclones and sea level rise, are considered the main climate events that have now become a worry for the vulnerable population as threats not only to their socio-economic well-being but to their household's lives. Approximately, 40% of the focus group participants were environmental refugees (IDPs) who never had the chance or opportunity to return back to their villages which were destroyed by recent floods.*

Focus group discussions on energy, fuel, water and food: *“Load shedding which started in 2008 takes place for over twelve hours a day and now the daily duration varies marginally*

from the standard twelve hours. It has disruptive implications for us domestically and for our agro-commercial activities.”

“Most households in our villages use wood, charcoal, or kerosene for their daily cooking needs which causes a lot of smoke and smell”. These particular fuels pollute the environment and pose serious health risks such as respiratory infections or even death as mentioned in the literature review. The women and children in the rural households bear the brunt of such unsustainable activities. While Pakistan does offer several clean energy sources which can be effective for rural based cooking, such as bio-ethanol fuel made out of molasses a by-product of sugar extraction; biogas for cooking through turning waste material into gas by putting it into a biogas digester; and/or solar energy amongst others, the market infrastructure for such sustainable products is still not developed. This causes their prices to stay high which means rural households using less sustainable but cheaper alternatives, such as wood, charcoal or kerosene, which ultimately lead to serious health problems. According to the women participants, to secure clean water for the household domestic chores and use, most often women folk especially in poorer regions have to walk miles to get their daily stock of water from a nearby stream or well. There is no mechanism of water storage or water harvesting or water recycling at the village level in most remote and economically worse off villages, save a few like Chitra Topi in Kashmir.

It became clear from the focus group discussions that *it is absolutely normal for a household to go hungry or without a meal in a day*. Most farming households produce their own basic food but it depends on the quality of their land and for landless labourers the income sources mostly come from the informal market in the form of their daily wage labour. *“Going hungry is very normal for us... it becomes a major concern when our children have to go without food.”* It is a fact that food insecurity is increasing in the world where 925 million people are undernourished. Out of them, about 900 million people are living in developing countries (FAO, 2010). More than 70% of these people live in rural areas and depend, directly or indirectly, on agriculture for their living. Usually, there are limited number of markets and less diversity and availability of food items in rural areas that affect food security of rural households (Morris et al., 1992). Pakistan clearly underinvests in its domestic agricultural sector and its rural indigenous small farmer community due to which its rural households are more vulnerable to price instability. As analysed in chapter 2 of this study, the main focus of agricultural investments since 1990s onwards remained on exportable crops to generate

foreign exchange at the expense of developing its domestic market and to provide food security to its population. Despite the fact that Pakistan is one of the largest producers of many agricultural commodities for the world, i.e., wheat, sugarcane, basmati rice and dairy products, over 26% of the population is undernourished (Bashir, et al. 2007; Bashir et al., 2012; FAO, 2010; FAO, 2011; IAASTD, 2008). Poorer households are the most vulnerable ones to suffer from food insecurity (Yasin, 2000). This fact as analysed in the literature review is further confirmed by the focus group participants, without establishing a set statistic.

Does climate change affect food security experienced by the landless households?

According to one research participant, an unemployed graduate, *“it is not climate change that is affecting our livelihoods and food security, it is the social and economic system which keeps us the way that we are, i.e., poor. If climate change was the cause of it then everyone – rich and poor – would get affected by it equally. But the richer part of the society can shield itself because they have resources to do so, the very rich are almost climate proof. The poor suffer simply because we have no natural or economic assets, no funds, no justice system, no means of protecting ourselves like the richer members of the society can.”* It is a very important response because it visualises climate change as not the cause of the real problem but as a symptom of it. Following this argument, according to some participants, *many displaced farmers and daily wage earners or labourers who did own some form of land, from the villages in Sindh and Punjab have found themselves in land disputes amongst themselves due to displacement caused by floods.* Observing from the interviews of the officials, the general perception in the country is that the courts (district and session courts at district level or magistrate courts at city level) are deeply entrenched in an inefficient bureaucracy and unnecessary red tape or official protocols which hinders provision of justice promptly. *According to a focus group participant, “... if a poor person takes his case to the court, he may have to wait for years before his case is heard”.* These farmers have cast serious doubts over government claims that flood-ravaged irrigation infrastructure will be repaired to a great extent to ensure supply of water. The residents of these flood struck villages are struggling to deal with the havoc wreaked by the floods many months onwards. According to these participants, *the infrastructure that was destroyed in these areas has not been fixed by the government authority concerned and there is no financial compensation given to this flood struck poor population, as a social safety net measure. There have been NGOs and*

International Medical Corps apart from Pak Army who managed to provide immediate relief and rescue in the form of daily food, clothing and tents for the displaced population but beyond that according to the research participants there has been no attempt on the part of the government to rebuild the villages totally destroyed by the recurrent flooding during the past few years.

The above analysis shows the socio-economic vulnerabilities, of poor households sampled for the purpose of this research. These vulnerabilities combined reinforce environmental vulnerabilities. In other words, socio-spatial vulnerability which comprises of: sensitivity of the individuals and communities; extent of exposure of their physical environment to climatic events; their ability to prepare by taking proactive actions at community level; their ability to respond to a climatic event; and, their ability to recover from a climatic event, brings together aspects of place and time with personal, social and environmental factors resulting in the geographical expression of the degree to which an external event may convert into losses their personal or communal well-being.

6.4 Analysis of Agriculture, Water and Energy Sectors under Climate Change – A Sector Specific Assessment of the Focus Group Discussions

The following themes cumulatively emerged as the leading concerns of the poor: *impacts of climate change on crop yields and land productivity affecting food production; availability and management of water; food and water pricing; loss of livestock; deteriorating human health and lack of ownership of land by the poor.*

Over the Green Revolution period in the 1960s, production intensified due to input intensive mechanised agriculture and irrigation. The tendency to locate high input agriculture on the most suitable lands for cropping relieved pressure on land expansion and limited encroachment on to the forest lands in the urban areas for a couple of decades. But in the rural regions of Pakistan - away from mechanised precision agriculture practices for commercialisation of food and industrial crops - insecure land and water rights, lack of incentives in rural areas due to weak policy making in terms of land, agricultural inputs, technology, credit and lack of access to domestic commercial markets resulted in a reinforced vulnerability of the poor.

The areas of concern identified by the research participants of the focus groups can be listed as follows:

- a) imbalance in the allocation of natural resources (land and water are their basic concerns);
- b) regulation which in most cases has been biased towards the big capital farmers;
- c) unsustainable and outdated rural infrastructure including roads, transport mechanisms, technological support, irrigation schemes, storage and marketing chains, distribution channels and ultimately a lack of market access for their products/crops.

The underlying reason for the above areas of concern point towards a policy bias and a lack of adherence to the constitutional provision under article 18(c) of the constitution of Pakistan⁵⁹. Since gaps within the legislation need to be filled through strengthened land and water institutions for land and water rights for small to medium sized farmers, common property systems can be adapted to provide secure land tenure by legal recognition and protection according to articles 23 and 24 of the Constitution⁶⁰. Water and land security has three dimensions:

- a) physical dimension when the supply falls short of demand leading to high prices for food and water.
- b) institutional constraints when the legislation fails to provide equitable supply and rights of water and land to citizens.
- c) infrastructural dimension when the infrastructure become obsolete and inadequate for a sustainable social and economic performance.

According to the participants of the focus groups, except from Punjab, Green Revolution of the 1960s was characterised by an increase in poverty due to the negative distribution of the benefits received which were highly inequitable and biased towards the big farmers and capitalist farming. This confirms the literature review findings and interview analysis.

According to the research participant's from Badin, fishermen were severely affected due to receding water in the river and increased saline water. The number of fish caught by these fishermen drastically diminished and the vanishing fish species resulted in a decreased

⁵⁹ The Constitution of the Islamic Republic of Pakistan [as Modified Upto the 20th April, 2010]

⁶⁰ The Constitution of the Islamic Republic of Pakistan [as Modified Upto the 20th April, 2010]

income for the fishermen some of whom were forced to leave their profession to find other ways of generating income. Many fishermen lacked other skills and ultimately failed to secure sufficient food for their families. Being a coastal area of the Arabian Sea, as Badin was hit by the floods and the intensity and frequency of the seasonal flooding increased, it drastically affected the livelihood of the local residents. On the other end of the country, in the mountainous region of Gilgit Baltistan, increased frost in the fields and melting glaciers are becoming impediments in the yield of crops making marginalised and small farmers vulnerable to food security.

A few fisherman community members from a village called, Ketu Bandar near Gwadar, one of the richest port in the region of the coastal belt of Pakistan, revealed a few important issues regarding the research questions. The former port facility bordered both shores of the Indus River delta but have become submerged as a result of coastal erosion, leaving only a narrow strip of land. There was a time when it was known to be an area thriving on mangroves ecosystem, rich with agriculture and boasting a busy seaport. Now the landscape is barren with poor infrastructure. Water logging and salinity is its major problem and the encroaching sea has almost inundated the nearby villages. Thousands of peasant families and fisher folk community already had to migrate to other areas in search of livelihood.

According to the research participants, *the situation is so grave that cyclones on the coastline have become a re-occurring phenomenon and their intensity has increased many times more. Poor peasant and fisher folk communities are always hit hard by these cyclones.* The coastal area is said to be most vulnerable to climate change with rising sea surface temperatures and atmospheric water vapor causing an increase in cyclone intensity and rainfall (IPCC, 2007). As poor families struggle to survive, environmental degradation is likely to be more pervasive. For example, increased use of wood for fuel, unsustainable use of land and water resources, in the form of overgrazing, over fishing, resultant depletion of fresh water in the absence of recycling mechanisms and desertification are common in rural areas of Pakistan, which eventually effect the carbon cycle due to the metabolic rupture, *giving evidence of the impacts of poverty on climate change.*

The focus group analysis also highlights another side to this argument. Poor families in the northern areas of Pakistan have found a sustainable way of harvesting rain water through tin roof top (e.g., Chitra Topi Kashmir project discussed in chapter 5). The implication is that

equipped with basic knowledge, basic resources and basic technical support, the vulnerable show enterprise and capacity to adapt to climate change events in a proactive and sustainable manner turning their vulnerability into resiliency. The sustainability component of the livelihood approach is achieved by helping people build resilience to external shocks. Effective responses to livelihood issues generally emerge from policies and approaches that target the needs of individual groups or subgroups rather than those that view the poor as a homogeneous group.

Decreased livestock, declining production of crops and decreased numbers of fish resulting from recurrent natural catastrophes such as the floods have locked the already poor population into a vicious circle of poverty. On the contrary, despite the planning carried out at the policy level to help the poor adapt to the changing climate, there has been no legislative implementation of planning policies on ground level *due to severe lack of funds*, as discussed in chapter 5, thus making survival difficult for the poor. The focus group participants confirmed this assessment.

Broadly conceived climate resilient poverty reduction strategies will entail four elements upon which all focus group participants showed satisfaction: *ownership of fertile land for domestic and commercial use, availability of fresh water for domestic and commercial use; re-cycling facilities/plants for water; and provision of cheap and clean energy for domestic and commercial use*. These strategies call for a structural change.

Another important theme that emerged under the focus group sessions was that *the income generating potential of agricultural water management is directly related to the degree to which small farmers are integrated with input and output markets. Impacts are greatest when small farmers can access a range of complementary goods and services for the production and marketing of crops. Furthermore, when these goods and services are aligned along specific commodity value chains, a synergistic effect is created. Thus agricultural water management interventions are most effective where market linkages already exist or could be created*. The focus group participants confirmed that apart from investments in agricultural water management, complimentary investments are also critically needed in education opportunities, health, culture, infrastructure, capacity building, and supportive institutions.

The implication of such economic investments may require a holistic and integrated assessment of targeted local needs, through combined quantitative and qualitative research. This implies, collection of descriptive data and statistics as opposed to pure quantification of data based on GDP to give a sense of the underlying dynamics as to how the society is served by different policies. This finding corroborates with the interview finding where it was proposed that such data should be based on multiple socio-economic and cultural variables. Such a data collection exercise will help gain a series of statistics, for example, life expectancy; how happy children are when they come back from school; the consumption of books; how many people attend cultural festivals; the level of interest in sports; level of support at local health services, amongst a manual of other such variables for collecting descriptive data, to capture a whiff of the qualities of life for sustainable policy making as opposed to sustainable policy based on simple GDP money metric.

The key to climate efficient sustainability is understanding that the water cycle and land management are intimately linked, as analysed in detail in the literature review of this study and it is further confirmed by the research participants' rich insights. *Land and water are intricately linked for sustainable solutions - every land-use decision is a water-use decision. Improving water management in agriculture and the livelihoods of the rural poor requires mitigating or preventing land degradation*, according to the general consensus of the farmers within the focus groups. According to the farmer participants of focus groups, *erosion, pollution, nutrient depletion, reduced plant cover, loss of soil organic matter, and other forms of ecological degradation resulting from faulty agricultural land-use decisions that the poor are forced to undertake threaten ecosystems, change the soil nutrient cycle and have enormous negative implications for water productivity and quality*. This finding corroborates with the findings of the literature review. According to one indigenous farmer, a research participant, *chemical degradation of soil leads to nutrient depletion in agricultural soils*. Soil organic matter is integral to managing water cycles in ecosystems. As mentioned in the literature review, chapter 3(1), depleted levels of organic matter have significant negative impacts on infiltration and porosity, local and regional water cycles, plant productivity, the resilience of agro-ecosystems and eventually the carbon cycle.

These farmers who participated in the focus group sessions seemed to understand the harmony and balance that exists between sun, air, water and soil. Climate change is intricately linked to these four elements of nature: sun, air, water and soil. That is also the

case for the individual farmer who conjures food from these essential elements. Compared to the above scenario, GHGs are emitted at every stage of industrial scale food production. A team of scientists at Berkley documented a study showing significant spikes in emissions levels during the planting season when fertilizers are usually applied (Schapiro, 2014). Similarly tilling of the soil unearths natural occurring CO₂ and sends it into the atmosphere instead of keeping it in place for another millennium or two. Modern industrialised agriculture heavily depends on machines and fertilisers for planting, harvesting and feeding crops as well as imported water to sustain itself, not to mention aid funds and huge subsidies which are routinely given to large scale mechanised farmers in the developed countries. An annual \$38 billion powerhouse of large scale mechanised food industry feeds the world today (Schapiro, 2014; Schapiro, 2007). This area of research was analysed in the literature review of this study, chapter 3(I). The underlying mechanisms behind modern industrial agriculture generate the social and ecological rifts as discussed in chapter 3(II) which underpin the crisis of poverty and climate change.

Pakistan's agriculture is hit by three main climatic factors: longer season of extreme heat, shorter cold seasons and dwindling water supplies. *Shortage of water combined with water logging and salinity in the fields due to less water to drain it out – one set of phenomena cascades into the other and farmers realise that this cascading is changing the conditions of their growing food*, as reported by the focus group participants. This analysis confirms the analysis presented in the literature review on uncertainty in the economics of climate change proposed by Weitzman in his Dismal Theorem (Weitzman 2009; Weitzman, 2011). According to a water expert interviewed as part of the elite interviews, it takes more water every year to maintain the current salinity standards. The more the sea level rises, the less the water for farmers to use. For example out of 100 MAF water available, farmers will get 90 MAF and the rest of the 10 MAF will be used to repel the intruding sea salt.

A very important theme that emerged through the course of the interviews and focus group sessions is that the climate scare that has rippled through Pakistan after the string of seasonal monsoonal floods and droughts has led to the increasing recognition of the vulnerabilities of subsistence agriculture. This research draws a comparison of these vulnerabilities to those of the industrial agricultural system as a whole *which is also severely challenged by climate change*. The vulnerability of industrial agriculture is much more pronounced in nations such as the United States of America and others in the West, which are heavily dependent on industrial agriculture (Schapiro, 2014; Schapiro, 2007). The vulnerabilities to climate change

have shaken the system to such an extent that farmers and agronomists are starting to look back to some of the fundamental principles of agriculture before the onset of chemical era (Schapiro, 2014; Schapiro, 2007). The chemical era delivered monumental increases in yields over the past half century but the paradigm has started to shift because of climate change as evidence of its costs accumulates. The mass application of chemical fertilisers and pesticides degrades the quality of soils and drastically reduces their ability to generate the organic matter that allows them to absorb water. A thirty year experiment conducted by Rodale Institute of Pennsylvania⁶¹, ‘The Farming Systems Trial, Celebrating Thirty Years, which compared yields of conventional and organic wheat and cornfields – chosen due to those crops’ heavy reliance on chemical inputs – showed that over three decades the organic crops were far more able to withstand the stresses of drought due to increased water absorption from more organic matter in the soil with the yields and profitability being roughly equal (*The Farming Systems Trial, Celebrating Thirty Years, Rodale Institute*). Other shorter term studies have shown similar results primarily in showing that farms with a variety of crops are more capable of withstanding hurricanes and other extreme events than mono-cropped plantations where chemicals deplete the soils’ natural defences (*Conference on Trade and Development, Trade and Environment Review 2013*).

The above analysis implies that the yields from many crops dependent upon fertilizers and chemicals will decline simply because the ability of the agricultural system to rebound from environmental stresses diminishes. Therefore climate change adaptation is forcefully replacing the mechanised industrial agricultural practices with sustainable organic agriculture as a new paradigm (Shapiro, 2014). For example United States Department of Agriculture (USDA) that has been for years an agency that promoted intensive industrial mechanised agriculture reliant on large quantities of chemical inputs is now calling for, “*diversifying crop rotations, integrating livestock with crop production systems, composting soils, minimising off farm flow of nutrients and other sustainable agricultural practices which minimises the effects of climate change on agriculture*” (Schapiro, 2014). These practices are encouraged by the farmers of the focus groups. The question then arises as to what was the system before? Non-sustainable?

Many research participants who were small farmers by profession preferred *farming where artificial additions to the farming system (inorganic fertilizers and agro chemicals) are*

⁶¹ <http://rodaleinstitute.org/our-work/farming-systems-trial/farming-systems-trial-30-year-report>

avoided, and the role of nature is emphasized. They practise conservation agriculture, which combines non-inversion tillage, minimum or zero tillage in place of ploughing, with mulching or cover cropping and crop rotation to improve soil quality and reduce erosion and costs. These small farmers prefer integrated pest management, which uses ecosystem resilience and diversity for pest, disease, and weed control and they seek to use pesticides only when natural options are exhausted, as was revealed by the focus group participant who were farmers by profession. The implication of this finding is that through integrated nutrient management, these small farmers try to balance the need to fix nitrogen within farm systems to reduce nutrient losses through erosion control. Similarly through integrated livestock systems, especially those that incorporate stall fed dairy cattle, small stock, and poultry, they raise overall productivity, diversify production, use crop by-products, and produce manure. Through aquaculture, which brings fish, shrimp, and other aquatic resources into farm systems, these farmers irrigate rice fields and fishponds. In the light of the above, what is critically missing are incentives and appropriate legislation.

This then led to the question as to how should resiliency in agriculture be ensured on the farmer's level and on the government's level?

For the farmers in Pakistan, as was voiced by all the focus group participants, one of the biggest financial vulnerability comes from the lack of crop insurance and flood insurance. Climate change shifts the odds against the farmers because of the uncertainties they face in committing their labour, technology and inputs long before the revenues are realised, at the end of the growing season. In developed world farmers are hedged against the odds which can occur due to climate change but in the developing countries there is almost no concept of hedging the farmers with insurance, subsidies or tariffs. Compared to twenty years ago farmers are recognising that climate change is creating a lot more risk factors. According to one participant, *“the weather is changing rapidly, we are forced to take measures just in case but we are limited because of our poverty”*. And another, said, *“We are facing unpredictable yields as a result of the increasingly unpredictable rainfalls and draughts across the country. We are having more draughts and major flooding events with increased frequency and magnitude which leaves us very vulnerable especially in the absence of any lasting help from the government.”* A major lesson that has been learnt recently at both ground level and policy level as revealed in the primary research sessions is that the past climatic conditions are no longer reliable predictors of the future conditions. If this is the case then as analysed in

the literature review precautionary approach needs to be inculcated in climate change policy making. In Pakistan lately a high tech approach is now undertaken to understand agronomy and digitizing the relationship between crop yields, the climate and the environment through algorithmic analyses of the weather – meshing of satellite images with climate models (PMD, 2014).

Crop insurance for example should be considered very important as it is a country's investment in its farmers' ability to continue producing the country's food and staying economically viable. Furthermore, farmers are not subsidized by the government unlike the governments of the more advanced countries; they cannot hedge against declining prices by getting a certain coverage through insurance⁶².

There is a common perception that 'it is men who are the farmers'. Contrary to this perception, women in Pakistan produce more than 50 percent of food consumed in the house, as confirmed by the focus groups. During the FGS it became clear that women happened to be far more vulnerable to environmental damage, than men, regarding the indirect resource issues or migration as a result of climate change.

6.5 Focus Group Analysis of the Current Economic System

The majority of responses from the focus group participants with regards to the deliverance of the economic system in a climate resilient way were dismissive and pessimistic. The observations made from the discussions elucidate that the majority of the poor are clearly too consumed by their immediate poverty related concerns which prohibit them from making ends meet and as a consequence they are left with no physical or mental capacity to reflect upon how the dynamics of the economic system play out. The focus group participants hoped for immediate reforms of the economic system, through urgent disaster risk management. However there have been strong voices within the focus groups albeit in a minority who showed deep concern with the way the economic system in the country is being conducted where the poor are dragged more into poverty with no prospect of a long term protection or welfare system to sustain them especially if a financial or climatic crisis hits them yet again. For example:

⁶² . For example, the government pays an average of 60% of the premium costs; there is no incentive for insurers, for example the government reimbursing the insurers for damage pay-outs - ranging from 25-65% depending on the type of policy - the amount of damages and location in order to ensure that the insurance companies sustain a minimum of 14.5% or similar yearly return on their investment (Schapiro 2007).

“Our ancestors have dealt with rains and storms and other climate disasters why can’t we do it? Because economically we are much more vulnerable than our ancestors... and we are vulnerable because of the government’s policies.”

“We need natural resources (land, water, forests); financial resources (credit and insurance facilities) and economic resources (access to factor and product markets; sustainable technology; energy sources) to become resilient... which is not forthcoming.”

Another theme that emerged during the focus group interviews was the way different people tend to perceive climate change differs according to how they perceive risk depending on their social and economic backgrounds given the current legislation, the climate disasters as experienced and the economic system. Socially constructed risk can have many dimensions and these dimensions need to be analysed for an integrated climate change policy approach.

Building on the idea of risk as being socially constructed it is important to consider ways in which climate and economic risks get amplified or attenuated within society. On one end and the more dominant end, it is ultimately the communication of the scientific knowledge through lobbies and media groups, different political voices and pressure groups that contribute to the perception of risk. In a conventional approach the idea of risk is dealt with predicting the probability of an event occurring and its impact or magnitude needs to be quantified in the risk equation of likelihood and impact using the tools of economics and science. Multiply these two quantities of likelihood of an event and potential damage impacts from it and one has an estimate of the ‘objective’ risk. But even with such seemingly simple formulation of risk, serious problems are encountered in putting numbers into the equation, as discussed in chapter 3(II) of the literature. If one is to read the IPCC reports on the future uncertainties of climate change, the UN endorsements of it and the Stern Review, it becomes clear that the risks of climate change are severe, large and reasonably well identified, as discussed in the literature review. But it is important to identify from critical realist perspective that risk quantification and assessment is not the sole domain of the experts who may have the technical tools and skills and specific knowledge to evaluate risks but in the end it is the individuals – the indigenous often economically poor individuals – who’s input becomes significant in any risk assessment exercise for any credible policy. This is because it is these people who are most affected by climate change events which they physically experience as opposed to the experts’ perceptions of risk.

The vulnerable population understand what is severe and what is not severe because they live through the experience and their poverty is clearly reinforced in the absence of any proactive disaster risk management operations. *Therefore their concerns carry the most weight when considering climate risk assessment exercises for development policy making.* In Pakistan currently the visual images of flood, earthquakes and droughts since 2010 and the resultant large scale socio-economic damages experienced by the vulnerable populations at large resulting in vast displacements, death and disease, has served as a much more powerful determinant of risk perception and hence climate change legislation and policy outcomes as opposed to the global technical accounts of scientific risk analysis.

At the community level risk awareness is usually higher in those areas and villages that have been recently affected by disasters and which have been involved in subsequent Community Based Disaster Risk Management (CBDRM) activities. In other disaster-prone areas communities have often extremely limited information and understanding of the hazards that surround them. By undertaking a thorough National Risk Assessment which would identify highly vulnerable districts and be complemented by higher resolution work at local level to diagnose the underlying causes of risk, concrete risk reduction options and informed development planning can be designed. This requires the development of a National Hazard, Vulnerability and Risk Assessment based on district level data providing for differentiation between urban and rural areas. Such a standard would also require the need to engage in participatory research to address citizens' and communities' risk perception and build their ownership in Disaster Risk Reduction strategies as part of sustainability solutions.

The focus group platform helped integrate a wealth of insights leading to collective social rationalities.

As discussed in the previous chapter, the climate change issue provides ample evidence that there are persisting and sometimes contradictory views of nature and philosophies of risk management. Amongst the indigenous rural population as represented by the focus groups of this research study, irrespective of the province, nature is usually seen as resilient and self-sustaining. Each participant's perception of nature reflects a particular moral conditioning, his or her symbolic, practical and subjective pre-understanding and he or she has a preference in suggesting a response strategy to control climate induced poverty. It is important to

understand that such cultural and social realities cannot be reduced to individual choices, especially to deal with climate change.

Climate change is a social reality. Two or more rational utility maximising individuals may have different preferences even within the same cultural background. For example, one research participant or a rational utility maximising individual preferred more financial help to help her out of her vulnerability and achieve maximisation of utility whereas the other considered ownership of land and physical resources as the best way to address her vulnerability to maximise her utility. The focus group discussions further validate the literature review findings that the rational actor paradigm is not sufficient to handle the ‘publicness’ of the causes and effects of climate change which is a social reality.

The important question inevitably arose that can risk and uncertainty associated with climate change be addressed to alleviate poverty and vulnerability for a sustainable policy approach under social rationality?

The answer to this question, based on the focus group analysis is, yes. Individual rationality can be blended with social rationality to handle uncertainty, to a reasonable extent. Given that a national level authority, such as National Disaster Management Authority (NDMA) in Pakistan⁶³, which is preparing a decision involving environmental risks and uncertainties declares that it will follow the consensual results of a public participation procedure in well specified aspects of its overall decision, through social rationality, it will do the following:

- a) several discussion groups of ordinary citizens will be drawn from a given population likely to be affected by the decision in question (much as the present research strategy);
- b) each group of citizens would specify the criteria, based on their personal experience or background, such as sustainable farming for addressing poverty or becoming climate resilient, which it considers relevant for the decision to be taken (as did the present research participants);
- c) then each group would assess through evidence based debate the consequences of the various courses of action with regard to the chosen criteria for example the consequences of organic farming as opposed to mechanised GMO based farming (as

⁶³ on a global level Hyogo Framework for Action and UN International Strategy for Disaster Reduction

did the present research participants). For the latter step each group may hold hearings with academics of their choice in order to arrive at a specific course of action for example through robust empirical research comparing efficiency of organic and mechanised farming before a specific course of action is chosen under collective social rationality for policy recommendations (as is the case with the present research).

This is how social rationality comes into play with a methodological choice which is very much in line with the well-established practise of using focus groups. In this case social rationality is used to generate local level stakeholder preferences as well as judgements about how to handle uncertainty, through focus groups. Focus groups are a form of Community Based Disaster Risk Management (CBDRM) exercise which focus on local level stakeholder participation for an informed national level policy making decision.

From social rationality to sustainability solutions for climate change. Taking social rationality to sustainability solutions for climate change and poverty in the development process, is discussed in chapter 7, of this research study.

6.6 Conclusion

This chapter focused on the ground level stakeholder involvement in order to gain the much needed insights from the people directly affected by climate change and poverty. Central to the critical theory of Habermas as analysed in the methodology chapter, is the idea that people have contradictory views formed by their own interests and experiences and that they must reflect upon these for personal and collective needs, in order to work towards a social rationality outcome. Critical theory takes seriously the fact that people living together need to discuss norms, interests and values in a reasonable way. For Habermas, rationality is a property not of individuals but of social relations whereas the rational actor paradigm clearly treats rationality as an individual property and so does most modern thinking since the days of Enlightenment. In the latter case, decision making can only be analysed and organised in an atomistic manner. In a social setting however that fosters indigenous dialogue in collaboration with applied science and professional consultancy, the inclusion of ordinary citizens in projects of public interest such as climate change and poverty enhances the level of rationality reflecting stakeholder participation, leading to a collective preference formation.

If the notion of social rationality is to be of real help in dealing with climatic risks, it needs to be applicable not only to the subtleties of social discourse in various institutional settings but also to the realities of the socio-economic related issues. Twenty years ago, economic reality was explained in terms of self-interest and relative scarcities of competition and the equilibrium of supply and demand. But today a more comprehensive framework of economics is required that accommodates multiple equilibria. Social rationality manifested in the discussions of focus groups is relevant because it enables interacting agents to select sets of possible equilibria by developing mutually compatible expectations. This research proposes that these mutually compatible expectations help create synergies with institutional level quantitative findings based on some metric that collects a manual of descriptive data to capture a holistic picture of the qualitative needs of a given society for sustainable policy making as opposed to sustainable policy based on simple GDP money metric.

7 Valuation of Primary Data Analysis through Triangulation of Focus Groups Findings with Interview Findings for a Sustainable Policy Framework

7.1 Introduction

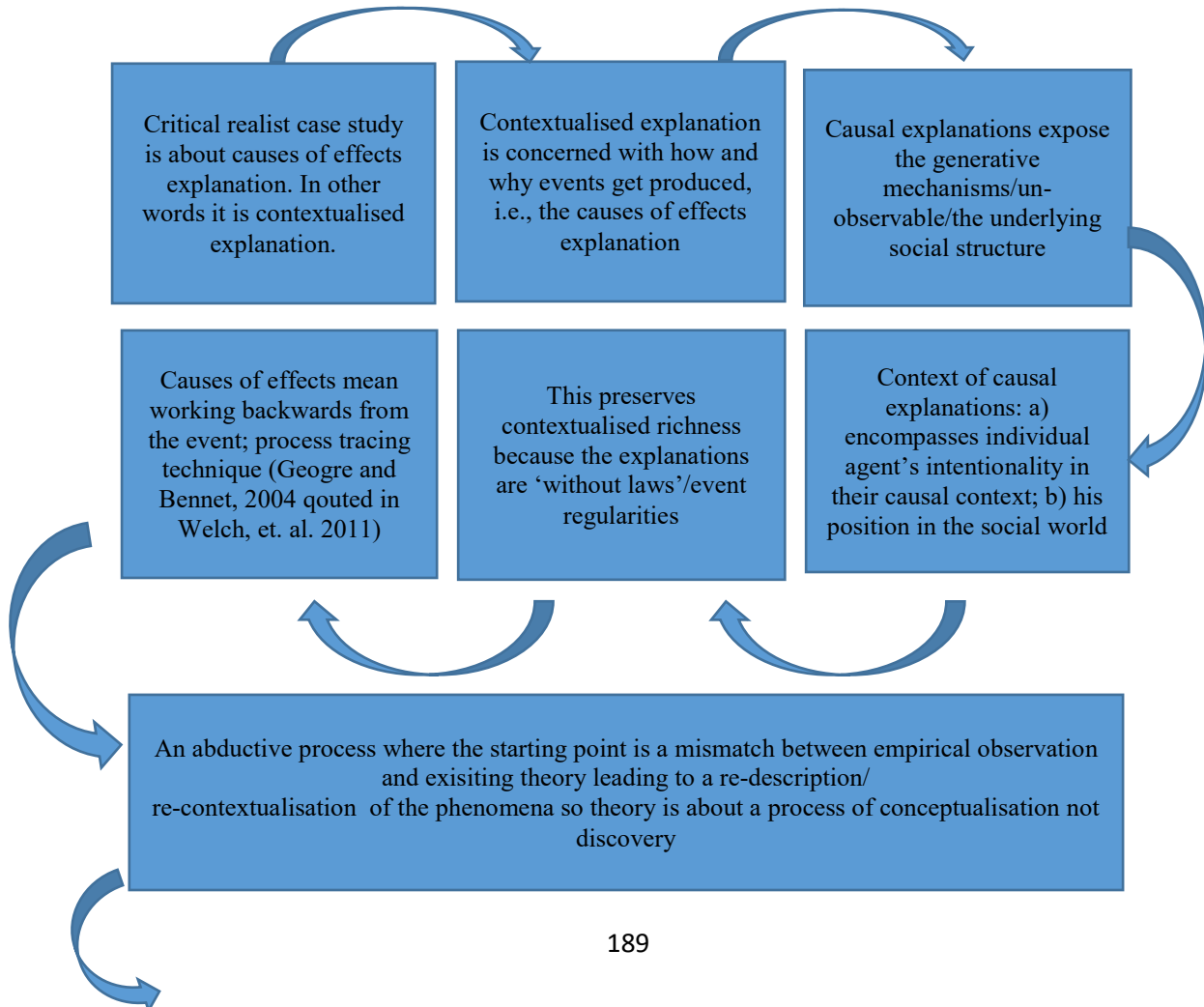
Two main research points of focus under this research have been, a) to analyse the reciprocal impacts of climate change and socio-economic factors with implication for poverty in the development process; and b) to analyse comparative economic paradigms in order to assess how they address the above phenomena with policy implications in order to build a comparative narrative towards sustainable solutions which can lead to a sustainable policy framework under this research.

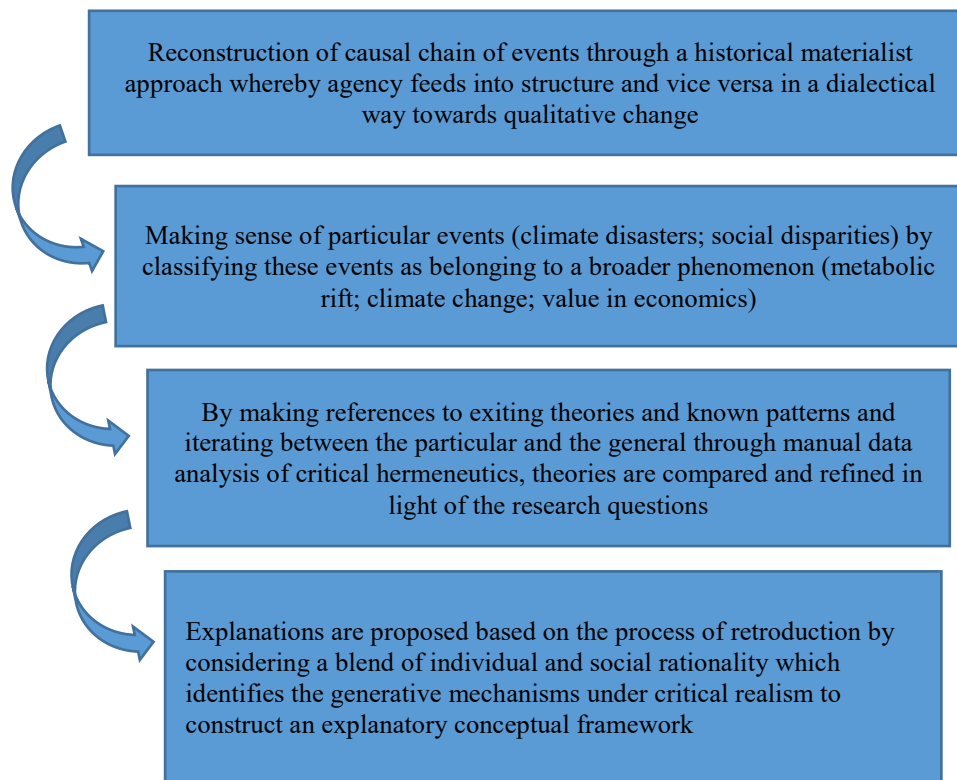
7.1.1 Strength of the Case Study under Critical Realism

Stake (1995) distinguishes intrinsic and instrumental case study research (Welch et al., 2011). In an intrinsic case study the case itself is the focus. In an instrumental case study, the case is being used to understand something else. That something else is the intransitive. In other

words, participants' views are being studied not for their own sake (as in constructivism) but in critical realism these perceptions are being studied as they provide a window on to a reality beyond those perceptions, i.e., the extrinsic reality. Critical realism uses the methods of in-depth interviews and focus groups that have an interview protocol under the case study with probe questions based on not taking for granted the pre-determined outside reality. There is growing concern that, in the pursuit of robust explanations, contextualisation has suffered. Greater use of qualitative research has been suggested as a remedy for this imbalance. According to Welch et al., (2011), the dominant view of the case study as a tool solely for inductive theory-building has restricted its theorising potential, both in terms of generating causal explanations and of contextualising theory. The strength of the critical realist case study is in its contextualised explanations based on the causes of effects instead of the effects of the causes. Such contextualised explanations are based on its methodological tools of intransitivity, transfactuality and ontological stratification, as explained below.

Figure 7.1 Strength of Critical Realist Case Study





7.1.2 Quality criteria of critical realist case study

The following quality criteria confirm to the criteria set by, Healy and Perry (2000) to judge validity and reliability of qualitative research within the realism paradigm (Healy and Perry, 2000).

This case study's *ontological appropriateness* is based on transfactuality, intransitivity and its stratification of reality. These are critical realism's three tools to understand the social complexities and the 'why' and the 'how' problems. Considering the ontological aspect of reality which assumes that the research is dealing with complex social phenomena this research shows through its theoretical and empirical analysis that our ecosystem and the social processes are manifested by complex relationships, interlinkages, uncertainties and non-linearities. In order to try and understand our world as such, requires tapping into the emancipatory project of antecedent and extra-antecedant considerations based on the principle of intransitivity. The *contingent validity* criteria is satisfied by explaining the underlying generative mechanisms in the social structure through exploring the research questions using theoretical analysis. This is supported by reporting of primary findings through direct quotations. Contingent Validity is also based on the tool of transfactuality, i.e.,

the open system, not a laboratory where choices made by people are not made in a mechanical way which is used to study ‘effects of causes’ instead knowledge is based on generative mechanisms operating in the real world which is used to study ‘causes of effects’. Contingent validity is about validity of these generative mechanisms and the context that makes them contingent.

Based on the methodological tool of intransitivity, realism is also *value aware* because a participants’ perception is considered a view on to a reality through which a picture of reality can be triangulated with others’ perceptions. It is about multiple perceptions of a single reality. The *methodological trustworthiness* of critical realism is based on its transferability or extent of applicability in other similar situations and by the use of direct quotations whilst reporting findings. Findings are based on analytical generalisations not statistical generalisations. These analytical generalisations are based on a mix of social, political, cultural, economic, ethnic and gender values and circumstances which are similar across settings. Furthermore, this case study confirms to *construct validity* which is based on how information about constructs⁶⁴ in theory being built are measured in the research. These constructs are the concerns of the realists for a reality out there instead of internal realities. By using prior theory from the literature review to define the research constructs under this research’s conceptual framework based on the process of retrodution as part of theory building, research conclusions are drawn in section 7.6.2.

7.1.3 Practical implications of critical realist research

This research attempts to answer the how and the why questions. How and why socio-economic imperatives embedded in the underlying social structures impact climate change and how and why climate change impacts the socio-economic environment instead of being in a sustainable balance. It further looks at the comparative economic models to understand the gap in the current literature of climate change and sustainability. In order to understand these processes, the case study was employed to conduct this research as the most appropriate method. After having done an extensive literature review, an initial conceptual model of the research was developed. From this information an interview protocol was designed which was used to investigate the research questions through in-depth interviews and focus group research. The process of interviews opened up further avenues in terms of identifying

⁶⁴ an idea or theory containing various conceptual elements.

connecting links to valuable government reports and documents. The rich diversity of information received from the primary data collection was then analysed under the here ontological tools of intransitivity, transfactuality and ontological stratification which together seek to interpret the complex reality beyond the levels of control (surface) and communication (actual) and into the emancipatory (real) territory.

7.1.4 Process of data analysis

Coding and retrieval has been conducted manually and with the aid of a computer software. This is because qualitative analysis involves more than simply coding data. It also requires conceptual level processes of exploring the meanings, patterns and connections among data that involve the researcher's own thoughts, reflections and intuitions (Kvale, 1996). Where the capacity of computers to organise information makes their use in qualitative data analysis appealing, but computer software cannot replace the analytical conceptual processes required of the researcher. So where computers can expand the possibilities for exploring data and enhancing depth of understanding, they may also unacceptably constrain or distort the analysis (Fossey et al., 2002).

Therefore, apart from computer assisted tools as mentioned above such as Nvivo, an important approach towards analysing transcripts, for the purpose of this research study, was through recreating a dialogue with the text about the meaning of the text, seeking to uncover meaning hidden within the text (Kvale, 1996; Fossey et al., 2002). To analyse means to separate something in parts, therefore the interpretation must focus on what has been said and what has not been said, to keep the conversation going with the text, within the hermeneutic circle (Alvesson and Skoldberg, 2009), as explained in chapter 4. By posing different questions to the text, structures and relations of meanings not immediately apparent in text can be analysed (Gadamer, 2006). This would require a certain distance from what is being said by a methodical stance. This distance can be established through the theory of interpretation of critical hermeneutics under the research philosophy of critical realism as explained in chapter 4 and section 5.1.1.

7.1.5 Process Coding under this research

A code is a way of organising data in terms of its subject matter and data is coded according to the types of themes and issues that emerge. So by coding data as ‘fossil fuels’ or ‘water conservation’ one is essentially marking this data in a way that means it can be found later, to identify relevant bits of data that can be pulled together to integrate overall perceptions on ‘fossil fuels’, ‘water conservation’, etc. It should be noted that coding is more than simply organising data in qualitative research. Coding also helps begin the process of systematically analysing data in terms of working out what different categories of data are saying and this leads to further identification of relationships and patterns emerging in the thematic analysis. As the research builds up, the codes are defined and redefined, building up an increasingly detailed understanding of the data.

The concept of node in NVivo represents a code, theme, or idea about the data that needs to be included in research project. Node hierarchies can be created, i.e., moving from general topics (like a parent node e.g., agriculture) to more specific topics (like a child node, mechanised agriculture, monocropping). Multiple codes can be assigned using the same process to build a hierarchy of nodes. Similar process can be performed with a word processing program. Apart from NVivo, much of the data coding and analysis process under this research was done by using MS-WORD. This was done simply by typing up and then cutting and pasting, manually coded text in relevant categories. Colour coding through highlighting text manually was done beforehand using separate colours and shades of colour for each code or category. Colour coding aided the cutting and pasting process of electronic coding to organise themes. Coded text derived from the transcripts was divided further into smaller coded sections (similar to child nodes in NVivo) for analysis often with colour coded phrases, sentences and paragraphs as the main unit of analysis, and these were arranged in computer files. Cutting and pasting of text units was done to produce word documents representing different codes and larger categories and themes with each text unit traceable back to its original context from the stage of initial organisation and coding. It may be worth mentioning here that it is not a neat process and requires going back and forth, over and over to the coded text in order to produce a synthesised bigger picture to answer the research questions. To develop and test theory to allow theoretical modelling, it is important to explore inter-linkages and relationships between coded data. NVivo, uses a hierarchical system as mentioned above which takes a ‘top down’ approach, dividing and subdividing major concepts into their constituent elements through nodes and sub nodes. But this function

remains limited to organising of data and not of data analysis or exploring of relationships and interlinkages between coded data.

7.1.6 The method of analysis of qualitative data under this research went through the following process

1) **Familiarisation with the transcripts** where transcripts were read twice to get a good overall sense. Data was then divided into meaning units secured from the words of the participants. For example, under a thematic analysis all units of data (e.g., sentences or paragraphs) referring to water recycling are given a sub-code, to be examined in more detail as data builds up.

2) **Organisation through coding and indexing of data** for easy retrieval and identification as data build up. Drawing up a thematic framework is the initial coding strategy which is developed both from a priori issues and from emerging issues from the familiarisation stage. For example, under various sub-codes assigned to a parent code of machanized farming, all established and emerging issues relevant to mechanised farming are aggregated and categorised.

3) **Identification of such emerging themes from these categories which are the emergent concepts** as a result of the above exercise (e.g., under emerging themes, sub codes such as, soil fertility; off farm flow of nutrients; minimal integration of livestock with crop production system and under established themes sub-code such as inorganic fertilizers; mono-cropping; ploughing).

5) **Re-coding/reorganisation of data under themes** (for example, for soil fertility, re-coding such as: soil nutrient losses; crop yields; crop by-products; integrated nutrient management within the farm system).

6) **Exploring relationships between themes through reflection.** The use of computer softwares often stops at this point. Hermeneutic circle is about understanding the text as a whole by reference to its parts and understanding of the individual parts of the text by reference to the whole. It is about moving dialectically between parts and whole so that any explanation oscillates between the particular and the general to identify the emerging picture. The aim is to bring different viewpoints of the participants together, reconfiguring them with the emerging picture to produce a more synthesised picture

7) **Refinement of themes and categories through reflective interpretation.** Interpretation involves searching for patterns, defining concepts, assessing the range and nature of

phenomena, creating typologies and finding associations within the data. This includes descriptions of the essential meanings that were discovered through the principle of pre-understanding under the process of critical hermeneutics (as described in section 5.1.1). For example, the practical sphere (habits, practices) is distinguished from the symbolic sphere (beliefs and assumptions) because the practical sphere can highlight how social power structures rooted in social practices and institutions leave their mark on the symbolic sphere that define reality for the participants independently of their awareness of the social influence. As these symbolic forms provide the background horizon of intelligibility for the research participant who is oriented in his experiences (subjective sphere) towards entities in the world, as opposed to structural level of meaning formation, the influence of power on meaning remains hidden from the subject himself. These frameworks of meaning under different spheres provide a social space for pre-understanding that describes essential meaning in text. The articulation of a structure of the phenomenon that is obtained from this pre-understanding principle based on combining the contextual and the pluralistic conceptions of meaning with a critical analysis of power structure, helps identify the causal explanations of generative mechanisms, (section 7.6).

To explain this point further, some examples from Chapters 5 and 6, of experiences, practices and beliefs which aggregate reality to the surface level so that the influence of power stays hidden from the participant individuals are given in, Appendix E.

8) **Development of a conceptual framework** (section 7.6). Reconfiguring the emerging picture by fusing diverse viewpoints to produce a more synthesized thematic framework.

9) **Testing of theory against the data through critical analysis** based on the verification of:

- contextualised explanations (section 7.6) which focus on the cause of effects, the underlying/unobservables/generative mechanism: critical hermeneutics helps identify these unobservables by laying out a concept of reflexivity in interpretation of essential meanings based on pre-understanding principle that allows the researcher to distance herself from taken for granted background of symbolic assumptions and social practices through a dialogic reconstruction of interpretation between the situated self and the distanced self (manifested in the text as explained in section 5.1.1) by questioning text and responding to it. Since the meaning of the text is to be found in the cultural, literal, and historical context, this dialogic/dialectical process leads to a fusion of horizons towards causal findings and contextualised explanations.

- findings emerging from these contextualised explanations provide theoretical accounts that incorporate complexity rather than deny it, (chapter 8 lists these findings).

7.1.7 Organisation of the chapter

This chapter focuses on the discussion of the main themes of the interviews and focus group analysis for the purpose of triangulation. The five primary sections, which are based on the following five main themes, directly link with the main categories of policy level and the focus group questionnaires. These themes of discussion, for the purpose of valuation of the primary data analysis through triangulation of both the primary research methods are as follows:

- a) Reciprocal impacts of climate change and socio-economic factors with implications for poverty (main theme, section 7.2).
- b) Sector specific impacts of climate change and poverty (main theme, section 7.3).
- c) Legislation on climate change to date in Pakistan with implications for socio-economic realities (main theme, section 7.4).
- d) Comparison of capitalist and anti-capitalist economic models (main theme, section 7.5).
- e) Current and proposed sustainable policy frameworks in Pakistan's context under the study's conceptual framework (section 7.6).
- f) Conclusion (section 7.7).

7.2 Reciprocal Impacts of Climate Change and Socio-Economic factors brought forward in this research through empirical evidence

This research shows a reciprocal link between climate change and socio-economic structures with implication for poverty by studying the underlying social structures and generative mechanisms of the case study country and by a theoretical and empirical analysis of comparative economic systems in terms of how they address the above issues.

Socio-economic factors impact climate change with implications for poverty

This research shows through empirical evidence of its case study country that carbon intensive industrial and transport infrastructural lock-in is entrenched in the system. Mechanised agricultural structure which compromises the soil metabolism leading to a metabolic rift in the system has taken place. The above issues also highlight the technological relations of the society with nature and labour. For example, mechanised farming technology, green revolution technology, GMOs, or geo-engineering initiatives undermine the use value of nature and creative capacities of humans.

Water sector crisis in Pakistan are twofold: circumstantial, which is linked to weak water resources management; and structural, which is due to factors deeply ingrained in the underlying socio-economic mechanisms involved in the society. For example, lack of appropriate storage capacity to improve water conservation; ground water exploitation; lack of appropriate technologies for rain water harvesting; no flood and draught management system; absence of necessary regulatory measures such as water licensing, water recharge and water recycling; IWT as a guiding water treaty does not provide any secure minimum flows downstream of the international boundary, amongst other factors. The analysis on energy sector shows major structural weaknesses regarding primary energy sources with an urban fossil fuel based system, while the rural energy system remains dominant by non-commercial biofuels. Fossil fuels apart, some of these biofuels also pose severe environmental and health concerns when used in crude form, such as dung. The energy sector structural imperatives are analysed and discussed in sections, 3.2.4; 5.3.4; and 7.5.1, in detail.

Climate change impacts socio-economic structures with implications for poverty

In large measure through water (excess of it or lack of it): sea level rise causing inundations of city islands, floods, draughts, storms, desertification and other major extreme weather events include earthquakes and landslides (Chapter 3(I); Chapter 5; and Chapter 6); 95% of deaths occurring due to natural disasters take place in developing countries (Chapter 3 (I); Chapter 6); poorest are hardest hit by climate change due to their geographical location, for example, the tropics; their socio-economic vulnerabilities and severe lack of coping mechanisms (Chapter 3(I); Chapter 5; Chapter 6). Sectoral impacts of climate change create further socio-economic and health shocks drastically diminishing monetary and non-monetary factors (Chapter 3(I); Chapter 5; and Chapter 6).

The above socio-economic imperatives drive the GHG emissions responsible for climate change and climate change disasters have the capacity to adversely impact socio-economic structures, for example, the irrigation structural network, agricultural crops or city level infrastructure reinforcing socio-economic vulnerability. Both these impacts have severe implications for the poorer sections of the society in terms of shrinking national output and income levels especially in the absence of DRM.

7.3 Sector specific impacts based on primary research data of chapters 5 and 6

All interviewees showed agreement that Pakistan's small farmers are lacking sophisticated information, climate resilient infrastructure and technology systems and that the local agricultural policies work against these farmers.

The opposition political leaders and senior academics as well as interviewees from the armed forces were of the view that the underlying cause of poverty in Pakistan is that land, water and property rights have been taken away from subsistence farmers of the country who are the backbone of the economy. To give the small farmers their basic rights through reforms so that they are provided with an enabling environment to practise small scale organic agriculture, would be the starting point towards sustainability. This research through its primary and secondary data shows that climate change is such a force that is forcing economists and policy makers to go back to the basics and question the modern agricultural methodological processes and carbon intensive industrial processes.

Regarding discussion on climate-smart localised agriculture, three goals came up as necessary during the focus group sessions: short term productivity and food security; longer-term resilience and adaptation efforts; and organic farming methods across agricultural landscapes and food systems. The poor voiced their concern that agricultural growth does not start and end with enough food for all but it must also relate to natural resources, nutrition, health, knowledge transfer and gender specific development. They further confirmed that along with land, water is generally the most important natural asset. It was agreed by all focus group participants that an important way to increase the security of local water rights is through assigning water rights to small rural communities rather than individuals. According to the focus group participants, a problem may arise in this context that such communities can

also tend to compete for irrigation water, which often results in stretching the services beyond the planned capacity of the infrastructure. This point highlighted the need of building the water structure in such a way which caters to the needs of the rural households sustainably. This point was discussed during the interviews. Although not recognized by formal legal frameworks in many places, rights to water are often claimed on the basis of land ownership. This emerged as one of the main concerns of the poor from the focus group sessions who confirmed that landlords owning land on which there is a spring or a stream use their land ownership as a common mechanism for claiming a right to that water. Thus, where land distribution is skewed against the poor, water is also likely to be unevenly distributed.

One of the main concern of the focus group participants and elite interviewees revolved around the increasing scarcity of water, for domestic and commercial use. The focus group participants also emphasized that there are limited water storage and conservation methods in majority of villages and the households depend on nearby wells and streams.

The main strategies proposed by the focus group participants which converged with some of the proposals drawn in the interviews:

- a) rain water harvesting or conservation;
- b) surface or ground water which is contaminated by industrial and urban domestic waste critically needs proper recycling;
- c) with regards to underground water through tube wells, water charging must take place by small farmers as to not to affect the underground water table⁶⁵;
- d) expansion of water storage capacity by building small dams, across the country.

With regards to energy, wood, kerosene and charcoal are the main fuels to meet cooking and heating needs of the poor. These methods have proved dangerous and have been associated to many serious health related issues. According to a World Bank report, nearly 72 percent of the country's population depends on traditional biomass energy sources such as wood, dung and agricultural waste for fuel for cooking and heating which cause serious health problems especially in case of women and children. The report also revealed that women also walk several miles at least twice a week on average to collect fuel wood from local forests (WB,

⁶⁵ As described in the literature review, Marx argued that it was necessary to restore the soil metabolism to ensure environmental sustainability for the generations to come. German chemist Justus von Liebig, in the 1850s and 1860s employed the concept of metabolism in his studies of soil nutrients.

2010). This was also confirmed by the focus group participants and the interviewees also agreed on the point of traditional carbon intensive energy sources used in the villages across the country due to poverty with implications for climate change and human health.

On a localised scale, according to the analysis of interviewees in general, almost immediate simultaneous effects of alleviating poverty and reducing greenhouse gas emissions, mostly arise in off-grid decentralised power projects which enable the creation of small enterprises in rural communities and reach very poor families, which often lack adequate housing for grid connection. Where the focus group participants emphasized that the persistent lack of energy is highly regressive for their overall development as individuals and communities, they were unaware of the different sources of energy with potential for varied carbon impacts. For the poor, what mattered was provision of energy. It did not matter whether this energy was fossil fuel based or non-fossil fuel based. The interview participants acknowledged the importance of solar energy panels and micro hydro power at local levels, to be provided at affordable competitive prices that the poor can afford. Small-scale projects in the energy sector, such as solar home systems and micro-hydro power projects are energy efficient and sustainable provided that the poor can afford them. The manufacturing, installing and servicing of solar home systems, for example, has also provided jobs in the local areas, especially in Punjab. The technology for micro-hydro power generation is also sourced locally. On a provincial scale, in the province of KPK (Khyber PukhtunKhwa), for example, the government officials as interviewed confirmed to build, 140 kilowatt hydroelectric plant running on the Swat River with potential to provide off-grid power directly to around 700 households. This is part of hundreds of small hydro projects planned in the province, by the current government to provide the poor people essentially with cheap, clean and reliable energy.

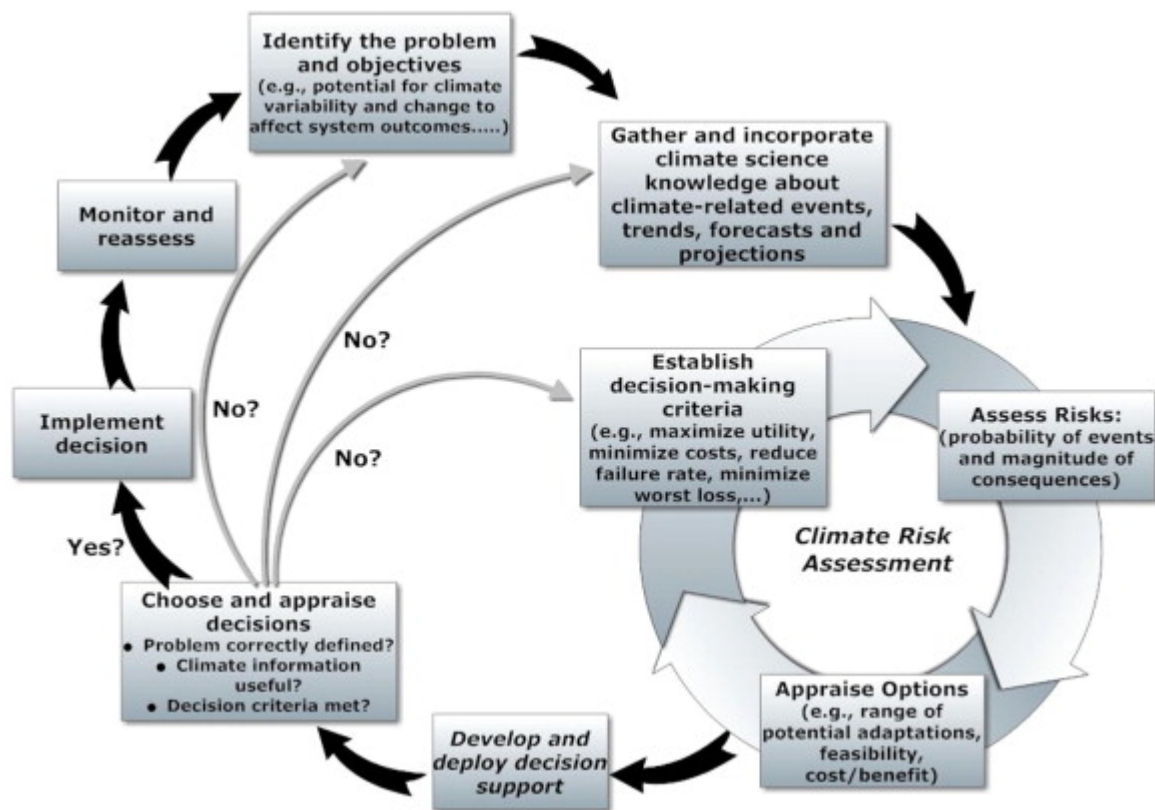
Based on the data brought forward in chapters 5 and 6, **section 7.5.1** of this chapter further elaborates on the specific sector specific adaptation projects necessary for climate change and poverty in the development process.

7.4 Legislation on climate change to date in Pakistan and the importance of Disaster Risk Management (DRM) based on primary data evidence from Chapters 5 and 6

As brought forward in the focus group discussion, the poor understand what is severe and what is not severe in terms of climate and economic disasters because they live through the

experience and their poverty is clearly reinforced in the absence of any proactive disaster risk management operations. *Therefore their concerns carry the most weight when considering climate risk assessment exercises for development policy making.* Policy making methodology emphasised by the poor in the focus group sessions of this study remained at large on the role of climate change risk assessment for Disaster Risk Management (DRM) with stakeholder ownership of the poor in policy making and appropriate actions by the government that could provide them proactive financial and socio-economic resiliency and relief. At the elite level, climate change risk assessment is recognised as important for legislation. Climate change risk assessment can be conceptualized as a form of an iterative “planning model”. Such planning models are usually foreseen as a cycle of: assess, plan, implement, evaluate and re-plan. The cycle starts with problem definition, followed by the gathering and application of climate science in its many forms of knowledge and information. Next, the risk assessment process is illustrated as an iterative process within an iterative model, to capture the value of multiple approaches to decision structuring. Carefully constructed climate risk assessments can then inform decision support systems that feed into the choice, implementation, and monitoring common to the policy process. In this way climate risk management is translated in planning and decision-making. It lends itself to decision support as proposed in the Intergovernmental Panel on Climate Change’s fifth assessment report, Working Group II, chapter 2: “Foundations for Decision Making.” A balanced portfolio of prospective, corrective and compensatory risk management strategies is the most cost-effective way to reduce disaster risks and support development (Global Assessment Report on Disaster Risk Reduction, 2011).

Figure 7.2: Climate Change Risk Assessment



Source: Adapted from the UK Climate Impacts Programme (Willows and Connell, 2003) and the U.S. National Research Council (2010a)

The effort is valuable especially given the range of options considered. A simple hazard reduction policy tends to pursue a single best option based on a narrow range of possibilities (e.g., levees for flood loss reduction) from the much larger range of theoretically-feasible options (Burton et al. 1993; Burton et al. 1996). This is where case studies of local knowledge, scenario approaches, and risk analysis through focus group exercises can combine to enrich the repertoire of climate responses, as analysed in chapter 6. All research participants – elite and poor - endorsed the risk management approach, some with a sense of urgency. Jones (2001) reviewed strengths and weaknesses of risk and decision analysis methods (e.g., expected utility, risk aversion, and robust decisions) in dealing with climate change, pointing especially to the challenges of decision analysis when probabilities of future events are very uncertain. In that case analysts can turn to methods that do not require probability distributions yet still help decision makers avoid the biggest losses. For example, scenario analysis offers a more general climate risk management model that falls somewhere in between the iterative planning model and classical decision analysis, based on a qualitative

explanation of risk tolerance or vulnerability, mapped against a descriptive framing of possible consequence. Risk analysis focuses on pinning down uncertain events and their consequences, and decision analysis is a prescriptive approach that identifies optimal decisions, given the element of uncertainty, hence yielding more nuanced answers rather than a single best outcome (Jones, 2001).

Another tool to assess risk at a local level is Municipality Risk Indicator (MRI) which is a database and a visualization tool that enables government officials to examine sectoral relationships at both the national and municipal level. The MRI methodology assigns high, medium or low risk levels to key sectors in each municipality under various climate scenarios and hazards. Through extensive sectoral data combined with demographic, socio-economic and institutional information used to rank each municipality against a level of vulnerability, the MRI permits decision-makers to quickly grasp and understand levels of risk and identify strategic infrastructures (hospitals, schools, roads, airports) that are exposed to such hazard scenarios. With this snapshot, authorities can identify and target vulnerable municipalities and specific sectors to support the prioritization of key investments to reduce climatic risks (National Authority of Disaster Risk Management Pakistan, 2014).

All interviewees showed agreement on the point that such risk assessment tools, along with other strategic initiatives of economic risk management techniques such as strengthening the technical capacity of national agencies and developing collaborative information-sharing platforms, can help form a comprehensive disaster risk management strategy as the basis for climate change legislation. Focus Group participants could not discuss the technicalities involved in risk assessment but they did emphasize their participation in decision making at the local level which involves their municipalities and natural and financial resources therein.

7.5 Comparative analysis of neoclassical and alternative economic models in context of climate change and poverty in the development process

The common grounds between the poor and elite emerged as that growth without equity cannot adequately achieve sustainable development. In the absence of rent-seeking society

and financialisation which has appropriated value creation of labour and productive capital, as discussed in chapter 3(II), space becomes available for spending society and environment. Without having coherence towards improving the distribution of natural and financial resources, the reciprocal effects of socio-economic disparities and climate change are likely to persist as threats and challenges for development policy making.

7.5.1 Adaptation to climate change: climate change makes it important to base adaptation policy on realistic assessments of socioeconomic realities. Technical solutions by themselves are of no practical use unless they are supported by policy making that supports socio-economic solutions which are well integrated into governance and institutional processes for policy implementation. Adaptation measures vary from region to region, i.e., some regions are more prone to flooding whereas some are more prone to earthquakes and adapting accordingly whilst making use of indigenous knowledge to be combined with up to date scientific knowledge becomes important. Apart from just estimating the reduction in monetised net damage costs of climate change, the importance of adaptation to changes in climate, needs to be considered because some of the damages can be avoided by timely, planned or reactive adaptation. This view corresponds with Tol, et, al., (2004)⁶⁶, a study analysed in the literature review. But adaptation activities can also go the other way causing more damage than benefit, for example, the first and second rounds of Green Revolution to improve agricultural yields with short term economic gains but with drastic long term consequences for the economy and ecology, as analysed in Chapters 2, 5 and 6.

The following areas of concern were raised during the interviews and focus group sessions with potential to form the focus of adaptation projects. The following narrative is based on the data as reported in chapters 5 and 6, with observations showing how the conversations with the research participants on various issues helped generate the conclusions in section 7.6.

Agriculture

The challenges to agricultural growth as shown in this study are primarily due to low productivity of crops and large yield gap relative to potential; non-reliability of water

⁶⁶ Tol, R. S., Downing, T. E., Kuik, O. J., & Smith, J. B. (2004).

services; under performance of land and input markets and under investment in research and technology. Unequal land distribution results in skewed distribution of power and policy. This is compounded by neglect of agriculture in policy decision making and resource allocation. This sector has stagnated over the last two decades largely due to the government's policies to support industrialization in the country as a development priority. Particularly, the last two governments have turned their focus away from agriculture and towards industry, taking away necessary financial resources and attention required for the development of the agriculture sector (Jamal, 2016). Natural disasters, have compounded the problem as severe flooding in September 2014 destroyed around 1 million acres of standing crops; the flooding also caused the destruction of irrigation canals and caused widespread land erosion (Jamal, 2016).

Despite the 18th Amendment to the Constitution, there still exists a dis-connect between the centre and the provinces in decision making and implementation. Moreover, there are credit and capital constraints for the small to medium farmers whereas government subsidies are prone to elite capture and political misuse. The current Pakistan Muslim League Nawaz (PML-N) government is known for its interventionist policies in the agriculture sector, particularly with regard to ignoring the needs of small farmers and imposing additional taxes in the form of increased power tariffs and fertilizer prices (Jamal, 2016).

The following issues are brought forward through the research findings to help revive the small to medium farming community in line with one of the underlying principles of eco-socialist tradition which proposes that agriculture serves as the critical base for the system as a whole where soil metabolism needs to be maintained to ensure regenerative capacities of the eco-system. It is this healthy soil metabolism that determines ecological and economic sustainability for generations to come whereas a metabolic rift causes the rupture in the soil nutrient cycle which undermines the regenerative capacities of the system. The concerned issues for policy making as brought forward under the research findings are: land reforms such that it restores the use value of land; developing and enforcing required regulatory framework to protect water resources from getting privatised; developing best practices of tillage and soil management that improve soil carbon storage; developing a risk management system to safeguard against crop failures due to extreme climatic events e.g. floods and droughts; setting up agricultural production surveillance system in various arid, semi arid and other vulnerable areas to categorize them according to their vulnerability to extreme climate

change events; involving the farming community in risk and decision making analysis; and recognizing the role of indigenous knowledge while managing forests and other natural resources with participation of the local communities. Relevant policy reforms should also target supporting innovative agriculture research system to identify through such cropping mix packages that would be most suited to given areas in different provinces with different geographical disposition, for climate resilient crop varieties.

Industry

In today's economic era as analysed in chapter 3(II), high performing economies rely on cutting edge innovative technologies and high value added services as their drivers of growth and for a developing country like Pakistan to catch up, the long suppressed industrial and manufacturing sectors need to be focused upon. The primary findings brought forward in section 5.3 of chapter 5 show that the imperative need for industrialisation is reflected both in the view of the Ministry of Industries and Production (MoIP) in Pakistan as well as that of the new growth strategy initiated by the Planning Commission, under the direction of SAP. However, a fundamental point of controversy between the two institutions arises because MoIP proposes that Pakistan's industries need to be protected for the same reason that the Planning Commission advocates a level playing field based on privatisation and deregulation. It is these conflicting opinions of Pakistan's policymaking institutions that needs to be addressed, as a starting point. Speakman, et. al., (2012) show the importance of institutions involved in innovation policy and make a large number of other recommendations based on 12 rather broad policy pillars. They note that the policy mix required is a complex interaction of general business-enabling environment reforms, increased competitiveness, key infrastructural investments (mainly in ICT sector), appropriate firm level support; subsidies for innovating firms and establishing dynamic relationships between academia, firms and government (Speakman et. al 2012 quoted in Noman, 2015).

The theoretical case for industry and technology policies, globally, has been bolstered and nuanced in recent years by two factors: (i) the focus on externalities in learning which Stiglitz and Greenwald (2014) and Hausmann and Rodrik (2002), have emphasized; and to a small extent (ii) the importance of socio-economic structures (see Ocampo & Ross, 2011) (Noman, 2015). This research shows that for sustained sophistication in production that takes the environmental externalities and the underlying socio-economic concerns into consideration,

an eco-socialist approach where balance is restored between technology and nature is significant and it provides justification for this approach through its secondary and primary data findings.

The research shows that to start with, a realistic appraisal of Pakistan industry's (potential) strengths and weaknesses, along with an analysis of the reasons why repeated attempts undertaken to promote more technology-intensive industries have not had a more dynamic effect on the sector. The strategy would have to establish a macro-economic and regulatory regime which supports industrial development more effectively by stimulating the organisational and technological up-gradation (greening the supply chain, organisational management that matches up to international environmental standards, product and process innovation, developing green marketing and distribution channels) of existing industries to create a stronger domestic base. This research reveals that economic growth in Pakistan during the past three decades seems essentially to have resulted from larger intakes of natural resources and labour in the primary sector, as opposed to capital intensive investment for value added activity, resulting in increased pressures on already stressed physical infrastructure and natural resources. At aggregate level, gross fixed capital formation in Pakistan is very low by the standards of developing countries, particularly in the Asia region. It decreased from about 16 percent of GDP in 1970 to below 12 percent by 2000 (UNIDO, 2000).

The research findings show that amending building laws to ensure that all new physical infrastructure is energy efficient and is constructed using designs appropriate to local climate is integral to sustainable planning. For example, conversion of tall buildings to solar radiation receptors, where possible, by installing solar panels and making them energy self-sufficient. The findings also show the importance of undertaking of hazard mapping and zoning of areas before construction with seismic surveys of any new township location, to be made mandatory. Development finance to stimulate green investment to getting the risk-reward relation in balance from a given industrial policy with well laid out industrial and technological targets remains fundamental to the success of the industrial policy. Section 7.6 of chapter 7, sheds light on financing for policy implementation.

Energy

This research proposes that the focus of energy policy should be first and foremost to align the primary energy sources with the energy demands of the region. Once the right energy sources are identified to a reasonable extent, the focus then should be to improve the efficiency of the electricity network with a policy emphasis on renewable energy development, in line with the eco-socialist theoretical framework.

Following are some specific points that appear to be misleading energy policy-makers in Pakistan as shown in chapter 5 which corroborate with the findings of the literature review. These points are also highlighted by an important paper conducted by, Saleem (2006).

The most fundamental concern with Pakistan's current energy policy trajectory stems from how success is being defined by the Government (Saleem, 2006). There was a pre-dominant perception till recently that, the more the energy extraction potential of the economic system, the better, the prospect for economic growth. But it is now realised by the government elite interviewees, in the wake of climate change, that energy conservation requires efficient usage of resources with minimal impact on the ecosystem that sustains those resources in the first place. This latter view marks a shift in thinking, from a neoclassical theoretical perspective where nature is seen as a free gift to be exploited, as discussed in Chapter 3(II), and is more in line with the eco-socialist tradition. The ultimate policy goal from an environmental perspective should be to achieve a mix of low energy-intensive economic growth sectors. A measurement of efficiency should be based on an evaluation of how much energy is being used to produce a given industrial output or useful end product and how much is being lost or wasted. This also satisfies the eco-socialist principle as discussed in section 3.7.6 of chapter 3 (II).

The use of per capita consumption as a macro-economic indicator is pervasive in Pakistan as a capitalist country. While there may be some correlation between higher consumption and industrial success, the detailed analysis of which has been presented in chapter 3(II), using per capita consumption as a metric for benchmarking performance against regional economic competitors is highly misleading with the changing economic realities, as this research shows.

Supply-side policies driven by GDP growth targets, as discussed in section 3.2.4 of Chapter 3(I) and Chapters 5 and 6 of this study, are used to calculate the amount of energy which

would be required to meet those growth targets as opposed to demand side policies. This supply-side approach stifles innovation towards environmental consciousness or energy conservation while leading to massive investments in new energy generation capacity with a focus on the rate of return on capital and increased consumption, at the expense of ecological and social factors. This point is also argued by (Saleem, 2006).

As shown in Chapter 3(II) and also highlighted by Saleem, (2006), policymakers are often presented cost-benefit analysis in a ‘stylized objective fashion’ when in fact the embedded assumption in such analyses can reveal enormous inconsistencies and a departure from ecological constraints (Saleem, 2006). For example, as analysed in section 3.6.2 of Chapter 3 (II) the usage of high discount rates being used to calculate the benefits of environmentally beneficial projects or poverty reducing programs may render them uncompetitive in terms of cost even if they are likely to be more secure in the long-run. This point is also argued by Saleem, (2006).

Having taken the above issue into consideration, the first step to solving any technical problem is to audit industrial energy consumption (Saleem, 2006; NCCP, 2013). The major industries in Pakistan include textile, fertilizers, sugar factories, cement, steel and large petrochemical plants (NCCP, 2012). These industries, among others, contribute about 6% to the total GHG emissions of the country due to the industrial processes in use, in addition to being responsible for more than a quarter of the emissions attributed to the energy sector (NCCP, 2012; NCCP, 2013). As discussed in chapter 5, the Government intends to incorporate the following economic measures to promote emission reduction by upgrading the industrial processes and technologies: it aims to prepare voluntary “Corporate Social Responsibility”(CSR) guidelines to create a CSR fund to cover carbon emission reduction efforts in the industrial sector; it further aims to promote the integrated “Cleaner Production” strategy in the industrial sector by making more efficient use of inputs such as energy, water and raw materials for industrial production and by simultaneously making it mandatory that the industrial sector goes through a periodical nation-wide “Energy Efficiency Audit” (NCCP, 2013). This must be followed by appropriate pricing and compliance enforcement to prevent losses and perverse incentives for wastage of energy (Saleem, 2006). However serious concerns remain over funding of these economic measures for policy enforcement (Waqas, 2013, Alam, 2010).

The positive impacts of reduced greenhouse gas emissions of large dams is being questioned since there is potential for methane generation from dam reservoirs (Saleem, 2006). As discussed in section 5.4 of chapter 5, such large scaled projects are subject to Initial Environmental Assessment and detailed Environmental Impact Assessment under section 12 of Pakistan Environmental Protection Act 2012. Compared to large-scale hydropower, small-scale hydropower is a highly attractive renewable solution and must be encouraged across Pakistan, as reported in chapter 5. Such dams have the advantage of being more flexible to engineering redesign or removal if necessary. There are promising possibilities in this regard for smaller rivers across Pakistan (such as the Kunhar, the Swat, and Chitral). This theme is discussed in section 5.3.1 of chapter 5 and section 7.3.

Based on the findings of this research it is suggested that to avoid inconsistent rural electricity supply, a targeted approach is required which addresses stakeholder concerns. All cities, towns, tehsils, zilas and union councils should aim to make their own fuel mix for electricity generation by using locally available renewable resources and these initiatives must be well integrated within provinces and co-ordinated between provinces. This will ensure that electricity supply constraints do not inhibit extending electrification. Developing a regulatory mechanism for off grid rural projects and providing cross-subsidies to ensure long term sustainability of such projects are also suggested, as highlighted in section 7.3. Finally, backward and forward economic linkages, access to credit and institutional arrangements are also highlighted as an essential part of the overall mechanism for off-grid rural electrification projects to facilitate successful outcomes.

Continued shift from traditional sources of energy to commercial and cleaner sources of bio-energy is proposed for rural households, as discussed in section 7.3. The opposition elite primarily emphasizes a focus on capitalising on the large renewable resources of green energy like hydro, solar, wind, biofuels and nuclear to end energy crisis. With regards to nuclear, as argued by Saleem, (2006) the benefits of nuclear energy in terms of reduced greenhouse gas emissions is also misleading since the energy required to mine uranium and the maintenance of reactors shows that there is a net contribution of greenhouse gases from nuclear energy as well. Therefore, while Pakistan and all other countries should keep the nuclear option open it must always be a last resort and probably requires several more decades of research on waste management solutions and cost efficiency before being viable at a large scale (Saleem, 2006).

Climate change mitigation remains a powerful driver for the demand of renewable energy towards a low-carbon energy trajectory. But policy uncertainty and cost of financing of renewable projects, slow down investments and therefore remain a barrier in many developing countries, such as Pakistan. According to the elite interviewees, the country's economy faces costs of between US\$6-10 billion per year to cope with investing in a new green energy system and prepare for targeted adaptation projects. This raises concerns for reliable funding measures to meet the developmental challenges posed by climate change. As discussed in chapter 3(I), renewable growth in the transport sector remains slow and needs significantly stronger policy efforts, such that they induce economies of scale.

In term of non-renewables, the Planning Commission officials and other pro-government elite interviewees emphasized the significance of harnessing coal with Underground Coal Gassification for possible energy solutions. However, no on ground project of this nature is currently underway due to various concerns. These include, an inefficient coal mining/production system; severe lack of appropriate funding to support sophisticated technologies; an absence of a strong regulatory standard and framework for safety which abides by industry-wide efforts to sustainably improve coal mining sector performance; and severe ecological concerns. In 2015, Pakistan halted work on six coal-fired power projects of approximately 14,000 megawatts due to environmental concerns, lack of needed infrastructure, technology and funds (Saeed, 2015).

In 2014, the U.S. Environmental Protection Agency (EPA) proposed New Source Performance Standards (NSPS) to control CO₂ emissions from new fossil fuel fired power plants under the Clean Air Act (EPA Fact Sheet, Carbon Pollution Standards, 2015). The proposal required new coal units to meet a CO₂ emissions rate of 1,100 pounds per megawatt hour. Achieving this rate requires the use of carbon capture and storage technology (CCS) and, therefore, effectively bans new coal plants because at its current stage of development CCS is prohibitively expensive. The proposed NSPS would increase reliance on natural gas to generate electricity. The final standard to limit greenhouse gas emissions from new power plants was re-proposed in 2015. EPA's final "Carbon Pollution Standard for New Power Plants" was developed under Section 111(b) of the Clean Air Act. Section 111(b) calls for a standard that "reflects the degree of emissions limitation achievable through the application of the best system of emissions reduction which (taking into account the cost of achieving such reduction and any non-air quality health and environmental impact and energy

requirements) the Administrator determines has been adequately demonstrated" (EPA Fact Sheet, Carbon Pollution Standards, 2015).

The IEA Coal Industry Advisory Board (CIAB) conducted a study which assessed the impact of coal utilization on energy security in several important world regions and the way ahead for coal based energy. The markets covered in the paper include: the EU-28, the United States of America, Canada, Australia, Japan, China, India and South Africa which together cover two-thirds of total global energy consumption and more than 85% of global coal demand (IEA, 2015)⁶⁷. The key findings of this study are that the use of coal contributes to affordable energy prices, allowing broader access to electricity and it also improves industrial competitiveness of the economy. But given environmental concerns, only advanced coal-based technologies based on high-efficiency low-emission (HELE)⁶⁸ coal plants and carbon capture and storage (CCS) technologies, which minimise the environmental impacts and simultaneously increase security of energy supply in compliance with industry regulation standards should be brought under consideration for policy purposes. HELE coal technologies provide significant immediate CO₂ emission reductions and are a key step on the pathway to CCS (IEA, 2015).

It is important to note the evidence that despite large variation in the power generation mix and fuel supply dynamics globally, coal remains attractive in the Asian market, where coal-based generation is dominant. It remains an important fuel for power generation due to its low costs and greater availability (IEA Clean Coal Centre, 2015). The share of electricity generated by coal in India is 71%, the highest in the region and coal-based thermal power plants are the single biggest source of air pollutants, causing trans-boundary fog in winter, change of weather patterns, including monsoon rainfall (Saeed, 2015).

To summarise, the majority of the elite interviewees, specifically from the anti-government elite group, consider the coal industry development as important part of the overall energy mix which should be based on mining of high quality coal deposits in Thar and elsewhere in the country. However, it must be noted that this majority view that high quality coal deposits should be harnessed but only with appropriate technologies, under strict compliance to a

⁶⁷CIAB, (2014) 'Advanced Coal Technology: Recent Progress and the Road Ahead' Plenary meeting discussion sessions.

⁶⁸ CIAB, (2015) 'High-Efficiency, Low-Emissions Coal-Fuelled Technology Update' Plenary meeting discussion sessions.

strong industry wide regulatory standards, such as those launched by the World Business Council on Sustainable Development as argued by Saleem (2006) and/or US Environmental Protection Agency. On the other hand, there are some strong voices within the pro-government elite group who favour UCG technology, as reported in chapter 5. The former group of the elite interviewees takes a long term view on energy policy which attends to environmental and social concerns and proposes improving efficiency of the national electricity network with a stronger focus on renewables rather than non-renewables in the overall fuel mix for the country's electricity generation with the vision of a low carbon future trajectory, whereas the focus of the latter group of pro-government elites remains on short term planning with emphasis on importing furnace oil, empowering IPPs and using current sometimes indigenous technologies, which raises environmental and social concerns.

Building on its secondary data, this research also proposes gas pipelines as an important part of the country's primary energy sources. It takes the view that the energy factor should also be used as a means of fostering cooperation not only between provinces but also regionally between South and Central Asia. The proposal for various gas pipelines have the potential to not only provide relatively clean and environmentally manageable energy to the region, but also to foster cooperation. A willingness to engage with communities and stakeholders, as discussed in chapter 6, even if this may delay the project, as well as political compromise between regional countries must occur simultaneously for such projects to succeed. The two transnational gas pipelines that Pakistan has pursued for over two decades have been delayed. The 750 MMCFD Iran-Pakistan (IP) gas pipeline has been delayed due to international sanctions (although there is now hope for removal of the sanctions) and the 1,325 MMCFD Turkmenistan-Afghanistan-Pakistan-India (TAPI) gas pipeline has been delayed due to the security situation in Afghanistan (Pakistan Economic Survey 2014-15).

While India, Pakistan, and Bangladesh account for the major natural gas and coal resources, Bhutan and Nepal have large hydropower resources. All the countries have vast renewable energy potential and the sharing of these resources naturally leads to more optimal energy supply solutions for the entire region (ADB, 2013). Regional energy transfers have the potential to leverage economies of scale through a more vibrant intra and inter regional energy trade structure.

Water

In addition to the legal framework of Pakistan water economy, i.e., Canal and Drainage Act 1873 and Indus Water Treaty, the government has recently drafted a comprehensive National Water Policy (NWP) 2016 which advocates an 'integrated water resources management regime' for optimal use of the country's water resources. The research findings raise the following issues which are also targeted by the draft of NWP 2016. The main findings are, constructing reservoirs to improve water conservation and building upon the quality of freshwater resources to meet critical municipal, agricultural, energy security and environmental needs. Promoting appropriate technologies for rainwater harvesting in rural and in urban areas, controlling groundwater pumping and reducing over-extraction, are the need of the country. NWP (2016) introduces the concept of adequate water pricing for proper operation and maintenance of the irrigation system and its long term sustainability which is also brought forward as an important finding of this research study. Other key features of the findings include: emphasis on flood and drought management; technical measures like regulatory frameworks, water licensing, artificial recharge especially for threatened aquifers and taking appropriate measures for construction of additional storage capacity. Furthermore, undertaking studies to estimate the sectoral demands of water and readjusting water allocation according to future projected water demand for each sector of the economy is proposed as a vital part of climate risk assessments.

As reported in chapter 5, the provisions in the IWT for unlimited hydropower development in the upper catchments – within India – have the potential of threatening water availability in Pakistan during low flow periods. IWT does not provide for minimum environmental flows downstream of the international boundary. The research therefore proposes that revisiting Indus Water Treaty (IWT) and 1991- Inter-Provincial Water Apportionment Accord in the light of present realities and climate change scenarios, is important to effectively manage and conserve the country's water resources. Furthermore treaties and agreements on water issues within and between the provinces over the rights, utilisation and conservation of water resources, besides strengthening of the trans-boundary water treaties, are also required.

Given the variety of the above mentioned adaptation projects at local and national levels for sustainable development in context of climate change and socio-economic development, their funding becomes an important and challenging development question especially for a developing country. This funding aspect is analysed in section 7.7 of this chapter.

The following figure brings a detailed comparative analysis on ways to mitigate climate change based on the important questions posed to the interviewees, which highlights their different philosophical approaches depending on which school of thought they belong to. It is necessary to mention here that these questions were only posed to the elite interviewees and not the focus group participants.

7.5.2 Mitigating climate change: A comparative analysis of the main climate change policy level questions as mentioned in section 5.5 of chapter 5

Figure 7.3: A comparative analysis based on the comparative economic paradigms

Sustainability Policy Questions in the research study's context	Neo-Classical/Mainstream School of Thought Government/Pro-Government elite interview officials	Marxist/Eco-Socialist Alternative Radical School of Thought	Anti-Government elite interview officials
1) What are the causes and implications of structural uncertainty inherent in the	Tipping Points, (Weakening of Thermohaline Circulation, the collapse of Greenland Ice Sheet and West Antarctic Ice Sheet) which lead to the disproportionate	Capitalist economy pressing against planetary boundaries will lead to anthropogenic climate change which can be catastrophic. Ecosystems and natural processes are	This group does not dispute the science behind climate change and the element of climate sensitivity or uncertainty in policy making, i.e., the fat tail in statistical

<p>economics of (catastrophic) climate change? How is economic reasoning possible when we don't know the exact risks associated with climate change? How can this be dealt with through policy making?</p>	<p>increased probability of exceedingly damaging temperature thresholds. The threshold effects can be triggered by temperature rise of more than 5-6 degrees C. The climate change impact analysis is done under a possibility of temperature rise of no more than 2 degrees C. Cost-benefit analysis based on expected utility (EU) theory has been applied in practise primarily to cope with climate change uncertainty in the form of a known thin tailed probability density function (PDF). A fat tailed PDF relatively assigns a much higher probability to rare events in the extreme tails than does a thin-tailed PDF. The fat tail in statistical distribution refers to climate sensitivity or uncertainty. In Pakistan CBA is the</p>	<p>complex and exist in multiple layers ultimately serving as the determinants for life. Metabolic rift or the ecological rupture in the metabolism of a system occurs when the natural processes and cycles are interrupted. Materials and energy are transformed into new forms generally associated with the system of commodity production. In this process, an ecological rift manifests itself in climate change disasters. It starts with the robbing of the soil of the countryside of nutrients and sending of these nutrients to the cities in the form of food and fiber, where they end up contributing to pollution. Simultaneously, this rupture in the soil nutrient cycle</p>	<p>distribution. But it considers the aggregated scientific approach towards addressing global GHG concentration levels as partial solutions. The majority under this group propose radical solutions by addressing the metabolic rift for addressing climate change and poverty as opposed to simple Cost Benefit Analysis.</p>
--	--	---	--

	<p>main policy tool used to reach policy solutions with regard to climate change with implications for poverty as discussed and analysed in this thesis.</p>	<p>undermines the regenerative capacities of the ecosystem. The law of value, remains central to solving the ecological (climate change) and social (poverty) crisis. The use value of labour and nature must be restored.</p>	
<p>2) What are the costs of limiting CO2 in the atmosphere to 450ppm to address climate change?</p>	<p>Climate damages from business as usual would be expected to reduce global GDP by 5% based on market impacts alone, or 11% including a rough estimate for the value of health and environmental effects that do not have market prices (Stern, 2007).</p>	<p>The radical schools of thought do not count efforts to limit CO2 in the atmosphere as incurring costs. Their emphasis is on restoring harmony with nature's laws to keep anthropogenic climate change in check.</p>	<p>Where monetary compensation to fund for adaptation policies is positively entertained by this group, the majority emphasize mitigation through a precautionary approach.</p>
<p>3) How is discounting, ethics, distributive justice and intra-generational fairness dealt with in the</p>	<p>In selecting the appropriate discount rate for long-term public policy decisions, economic theory often distinguishes between two components: the rate of pure time preference being the discount rate that</p>	<p>Equity with efficiency is the key to dealing with climate change and poverty. It requires much more concern for the poor. A substantial redistribution of wealth and natural resources within the</p>	<p>Equity with efficiency is considered the key to dealing with climate change and poverty. Such a model will take into account poverty concerns of today's generation and the</p>

<p>economics of climate change?</p>	<p>would apply if all present and future generations had equal resources and opportunities; and the wealth-based component of the discount rate, reflecting the assumption that if future generations will be richer than we are, then there is less need for us to invest today in order to help them protect themselves. In the notation of the Stern Review, the discount rate, r, is the sum of these two parts:</p> $r = \delta + \eta g$ <p>Here δ (delta) is the rate of pure time preference, and g is the growth rate of per capita consumption. If per capita consumption is constant, implying that $g = 0$, then the discount rate $r = \delta$. The second parameter, η (eta) or the marginal utility of consumption, determines how</p>	<p>present generation is required. Such a perspective carries significant positive implications for synchronised climate change and poverty policies. The separation in material reality and human consciousness will inevitably lead to disastrous ecological consequences manifested in what Marx called the ‘irreparable rift’ between nature and society. The contradiction of capital lie at the heart of today’s climate change problem which is likely to add more and more people to the ranks of the poor class. According to Marx, today’s generations are not the owners of the globe, they are only its usufructuaries... and they must hand it</p>	<p>distributional impacts of climate change. This group also proposes private ownership but on a transparent basis.</p>
-------------------------------------	---	---	---

	<p>strongly economic growth affects the discount rate. A larger value of η implies a larger discount rate, and hence less need to provide today for future generations. According to Stern, the unitary value for the elasticity of the marginal utility of consumption $\eta = 1$ together with $\delta = 0.1\%$. It places stronger efforts on later costs and benefits than higher η.</p>	<p>down to succeeding generations in an improved condition' (Marx, 1967, page776). A usufruct is all we can claim with regard to the earth. The notion of usufruct appears in Islamic law, Roman law and Napoleonic Code. Usufructuary relationship is where one uses, enjoys and through that improves a given natural property or asset with an intrinsic aim of handing it down to the next generation. There is no concept of private ownership of natural resources.</p>	
<p>4) What would be the effect on Pakistan's economy of introducing a carbon</p>	<p>Carbon taxation is an effective policy tool to monitor carbon within the overall climate change policy.</p>	<p>Carbon taxation or carbon credits for carbon off-setting as part of the carbon market is just a way to commodify nature by putting an exchange value on it.</p>	<p>Carbon taxation for rich corporations and on the individual use of natural resources and energy use beyond a certain limit. No carbon taxation for the</p>

tax of say Rs. 3000 per ton of carbon?			poor.
5) How best is it to measure welfare, consumption and production as these are the key economic concepts that concern climate change?	To build an economy wide computable general equilibrium model (CGE). The standard neo-classical assumptions underlying these production functions, consumer utility functions and social welfare functions are proposed as best measures to be applied to achieve a stable equilibrium level in the economy.	The key concept to deal with climate change is to address the metabolic rift and address the other contradictions of capital as a system. Then, to build reproduction schemas (as discussed in chapter 3(II)) which are constructed in value terms, not in material terms.	Dynamic modelling exercises by taking space and time into account and by bringing in social rationality for descriptive data collection which can then be put into a well-defined mathematical expectation function.
6) How best is it to compare the costs and benefits of climate change policies?	CBA and risk assessment analytics and precautionary approach under the Dismal Theorem as explained in chapter 3 (II).	Precautionary approaches by addressing the contradiction of capital and reproduction schemas based on value terms.	Precautionary approach by addressing the contradictions of capital and dynamic modelling as part of climate change risk assessment through an iterative planning model.
7) How should the future be	Efficiency over Equity; low discount rate. Less concern for	Equity over Efficiency; high discount rate. More	Equity over efficiency; high discount rate. More

weighted in such compariso ns? What implication s would this have for today's poverty?	today's poverty	concern for today's poverty.	concern for today's poverty.
--	-----------------	---------------------------------	---------------------------------

Source: Author

7.6 Current and Proposed Policy Frameworks in Pakistan's context

7.6.1 Current Approach

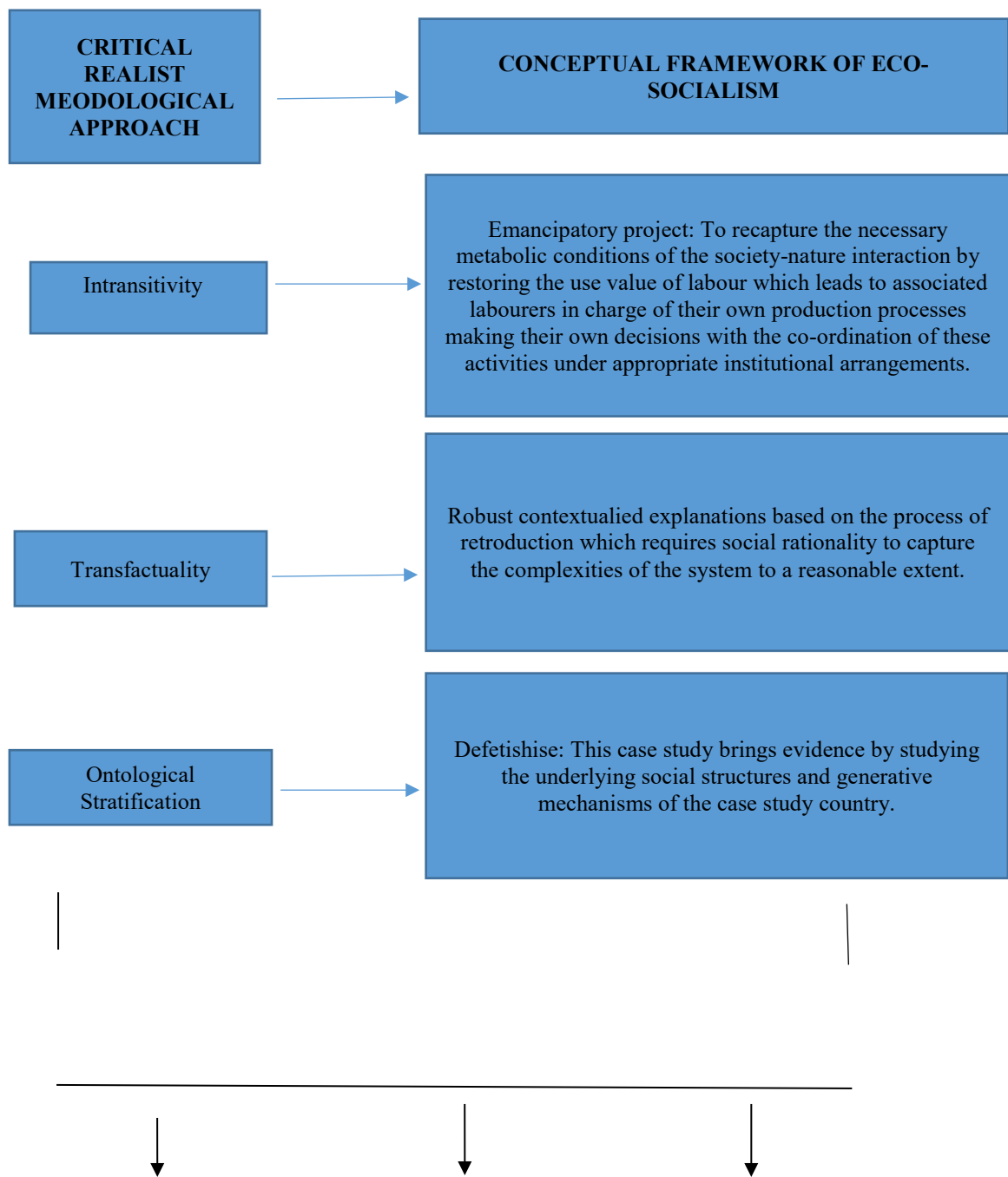
In light of the above policy questions, the Government of Pakistan as confirmed by the government elite interviewees is fully cognizant of the fact that climate change threats are not just limited to environmental issues, but more precisely these are economic and developmental challenges such as intensification of poverty with social and ecological implications. As such the Framework for Implementation of NCCP document has been designed to promote strong institutional framework to mainstream climate change concerns into overall national planning and to promote climate compatible development with clear sets of roles and responsibilities at the federal and provincial levels, according to the pro-government elite interviewees. The NCCP document emphasizes that a major challenge for Pakistan to date has been the lack of donor interest in environment and climate change issues (NCCP, 2013). This implies that the NCCP is confined to a theory level policy document because the Pakistan government looks towards foreign aid and donations to fund the climate related socio-economic costs of policy implementation. These costs are attached to being unable to move theoretical policy proposals to practical on-ground policy implementation, hence the gap between policy making and implementation.

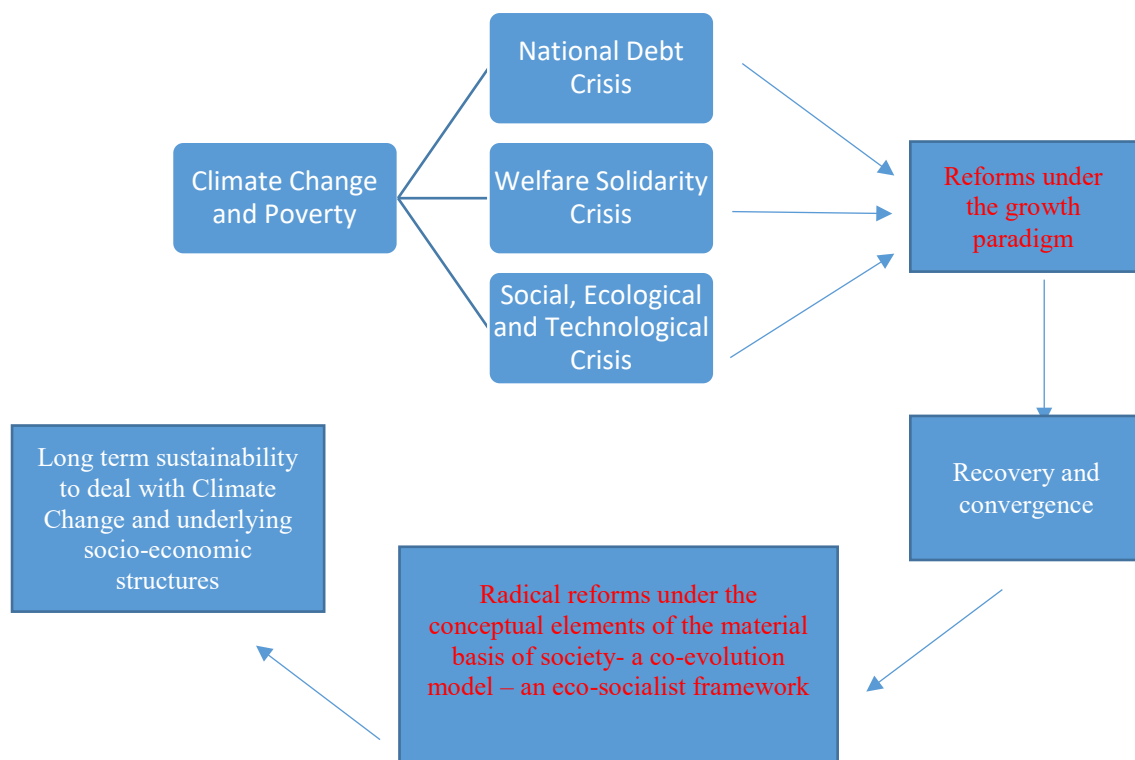
7.6.2 Revised conceptual analysis - sustainable policy framework proposed by this research study – a synthesis of findings under the conceptual framework of eco-socialism

According to Eco-socialists, building on Marx's theory of value, when social metabolism does not stand in harmony with the natural metabolism, the result is a deep ecological and social rift (chapter 3(II)). According to these traditions, to mend the carbon rift or climate change, which are radical challenges, mere market based or interventionist climate change policies based on financial and technological solutions or geo-engineering will not suffice, instead what is required is a social system driven by the use value of labour and nature (chapter 3(II)).

This climate resilient policy framework, is presented under the theoretical model of the eco-socialist tradition. It is underpinned by a critical realist analysis based on its three methodological tools, of stratified ontology, intransitivity and transfactuality. Following the initial conceptual analysis (from chapter 3 (II)), this revised conceptual analysis proposes the following. The crises of capitalism is a unified, solid crisis, though it is metamorphosing and changing. At this juncture it is critical that wild fluctuations in capitalism are controlled and regulated in order to reduce the catastrophic implications of the crisis of capitalism such as climate change and unprecedented human poverty. Therefore, as a first step, based on the evidence brought forward in this study, what is needed is to re-deploy existing institutions in a manner that reduces the ill-effects of the underlying emergent sub-crises afflicting Pakistan's capitalist economy. The sub crisis are: national debt crisis; welfare solidarity crisis; social crisis, ecological crisis and a technological crisis leading to major resultant crisis of climate change and increasing poverty under the current system. Once this reduction is achieved for an acceptable level of recovery and convergence in the economy then the second step based on radical sustainability solutions is proposed to deal with the radical phenomena of climate change and poverty, under the eco-socialist theoretical framework. Without this recovery and convergence, radical solutions are most likely to, not be effective.

Figure 7.4: Revised conceptual analysis: link between critical realism and eco-socialism





There are in climate change and poverty crisis five sub-crises: national debt crisis, welfare solidarity crisis, social crisis, ecological crisis and technological crisis leading to the major twin crisis of climate change and unprecedented poverty (as discussed in chapters 2, 3(I), 3(II), 5 and 6). This proposal utilises existing institutions in an attempt to restructure and empower them in a manner so that they address the issues concerned meaningfully (chapters 5 and 6). This framework does not attempt to propose lengthy radical proposals because radical restructuring is not in the realm of possibility in the foreseeable future. What is proposed is a set of moderate reforms as a transitional path to any truly radical sustainable policy plan in the future.

Attending to the national debt crisis

Capital moves crises around (Chapter 3(II)). Today many nations are in a crises of sovereign debt. Pakistan needs to foster economic development and social cohesion in order to address the growing socio-economic imbalances within the country (Chapters, 2, 3(I), 5 and 6). To

achieve this, what is required, is a new investment led recovery programme by the government to reverse the recessionary elements in the economy and strengthen its economic and social cohesion to counter the reciprocal impacts of climate change and poverty. In this sense, it is proposed, building on the research interview analysis of this study that the government carries out a bundling of public assets (excluding those pertinent to the country's security, public amenities, and cultural heritage but including climate sensitive public goods such as health, knowledge, clean environment, property rights; and natural resource assets such as water, forestry as well as oil, gold, gas and coal reservoirs amongst others), into a central holding company to be separated from the government administration and to be managed as a private entity, under the aegis of a technocratic team chosen by the state of Pakistan with the goal of creating a home-grown investment stream (Chapter 5). This can be based on the maximum value of its natural and public assets. The Pakistan state will be the sole shareholder, but will not guarantee its liabilities or debt. The holding company would play an active role readying the assets for sale. It would issue a fully collateralized bond on the international capital markets to raise \$30-40 billion taking into account the present value of assets (Chapter 5). The raised amount will be invested in developing and restructuring the socio-economic and ecological public assets under its management for long term sustainable development. The plan could envisage an investment program of 4-5 years (Chapter 5). This income stream, would induce proportional increases in tax revenues, thereby contributing to fiscal sustainability, while enabling the government to exercise spending discipline without further shrinking the social economy under the policies of IMF (Chapter 5). These tax revenues can be enhanced by progressive taxation to address social, ecological and technological crisis faced by the country. In this scenario, the primary surplus (which excludes interest payments) can be used to recapitalise banks, to get rid of their non-performing loans, to start lending for productive domestic economic projects (Chapter 5).

Such home-grown investments will help counter the recessionary impacts of the punitive IMF fiscal policies. Furthermore, renegotiating with IMF on the terms of its loans with the aim of getting off the IMF list should be another main priority of this technocratic team (Chapter 5). The investment-led recovery programme will be financed by bonds issued by the holding company to invest in sustainable social, ecological and technological projects (Chapter 5). These investments will be aimed at, not only restructuring and developing the public assets themselves but also developing and restructuring the climate sensitive economic sectors such

as water, agriculture, industry and energy, according to the climate resilient policy objectives discussed in section 5.3 of chapter 5.

Borrowing for the above mentioned, sectoral, infrastructural, technological and institutional level investments need not add to the national debt anymore. The world is awash in savings seeking sound investment outlets⁶⁹ (Chapter 8; section 8.4.1). This investment-led recovery programme essentially aims to re-cycle these global surpluses into the much necessary productive sustainable investments. As mentioned in chapter 5, in fulfilment of its remit to support the general economic policies of the country, the government can issue an advance or precautionary statement that it will support the holding company bonds by means of standard central bank refinancing or secondary market operations. Such a statement should suffice to allow the funded investment recovery programme to be large enough to restructure economic recovery financially without depending on foreign aid and attached conditions. The holding company bonds should be redeemed by the revenue stream of the investment projects they fund (Chapter 5).

The banks are in need of capital injection through a home grown investment scheme with the help of: a) recycling of national level private and global savings into socially productive investments attracted with the help of fully collateralised holding company bonds as mentioned above; and, b) sovereign debt restructuring through re-negotiating the terms of debt with the foreign donors such as IMF, as discussed in chapter 5. The borrowing as proposed in this framework for investment is consistent with greater sovereignty of the country and it is compatible with the principle of reducing and eventually eliminating exorbitant interest based national debt. Simultaneously, no new institutions, no new fiscal compacts, no lengthy legislations, or change of treaties and agreements with long drawn procedures, are required at this provisional stage of reform.⁷⁰ For productive investments industrial capital needs to take over finance capital which is what this home grown investment plan proposes (Chapters 3(II) and 5).

Attending to the welfare solidarity crisis

⁶⁹ Varoufakis, Y. (2015) *Policy Framework for Greece*. Available at: <https://varoufakis.files.wordpress.com/2015/08/policy-framework-for-greeces-fiscal-consolidation-recovery-and-growth.pdf> (Accessed: 13 January 2016).

⁷⁰ Varoufakis, Y., Holland, S., Galbraith, J.K. (2013).

An emergency welfare solidarity programme that will guarantee access to nutrition and to basic energy needs for all citizens. The country now faces the worst human and social crisis where basic needs are not being met (Chapter 6). This is true especially for the poverty struck elderly, the women and children (Chapter 6). There is a moral imperative to act to satisfy these needs. The emergency welfare solidarity program should be funded in the following manner based on the primary and secondary data.

The emergency welfare solidarity programme must redeploy funds created from the asymmetries of money being transferred from deficit to surplus countries – an underlying social-economic mechanism that fuels the crisis. This framework proposes two means to do that (as discussed in chapters 2 and 5):

- a) as analysed in chapter 2, the increase in capital inflows leads the State Bank of Pakistan to purchase foreign currency primarily from the increased worker's remittances resulting in an increase of foreign exchange reserves. Increased foreign exchange reserves, is a good economic indicator but to maintain it, involves heavy cost for a developing country. The cost of holding reserves is the investment that a nation must forego in order to accumulate reserves. The accumulation of foreign reserves in many developing countries is a reflection of imbalance in the current account of the donor countries primarily the USA. The USA has a twin deficit—the current account deficit of 5% of GDP and fiscal deficit of 6% of GDP. Ironically, it is the developing countries, like Pakistan that are financing the current account deficit of USA through investment of its foreign reserves in US treasury bills at a very low rate—less than 1% and negative in real term at present. But when Pakistan, like other developing countries borrows from abroad, (US in this case), a high interest rate as a risk premium is charged. This negative spread of the interest rates implies a transfer of income from Pakistan to the US - from poor to the rich, (Anwar, 2004). This indirect fiscal boost to the surplus country has no rational or moral basis. There is a strong case to be made that the interest collected from the deficit country by the surplus country should be channelled to an account that would fund this proposed emergency welfare solidarity programme.
- b) as was brought forward in chapter 5, Pakistan government should introduce a financial transactions' tax, or stamp duty proportional to the size of corporate balance

sheets as part of CSR, a similar case, as above, can be made, as to why these receipts should fund the emergency welfare solidarity programme.

Attending to the social, ecological and technological crisis

Proposed adaptation projects under this reformatory stage for sustainability policy solutions to attend to *social, ecological and technological crisis* are analysed in detail in section 5.3 of chapter 5; section 6.3 till 6.5 of chapter 6 and section 7.5.1 of chapter 7.

The gauge to measure an acceptable level of socio-economic security once the funding for climate resilient development projects and productive economic investments is organised through a home grown investment stream for policy implementation, may involve a holistic and integrated assessment of targeted local needs, through combined quantitative and qualitative research as brought forward in the previous chapters. This implies, collection of descriptive data and statistics as opposed to pure quantification of data based on GDP to give a sense of the underlying dynamics as to how the society is served by different policies. Such data should be based on multiple socio-economic and cultural variables so that the data collection exercise will help gain a series of statistics, for example, life expectancy; how happy children are when they come back from school; the consumption of books; how many people attend cultural festivals; the level of interest in sports; level of support at local health services, amongst a manual of other such variables for collecting descriptive data, to capture a whiff of the qualities of life for sustainable policy making as opposed to sustainable policy based on simple GDP money metric. The purpose of this descriptive data would be to put these human forecasts into a well-defined mathematical expectation function. Descriptive data collection especially to address the risks and uncertainty of climate change raises the question of social rationality.

The important question arises here as to whether or not risk and uncertainty associated with climate change, can be addressed by social rationality? Chapter 6 showed that individual rationality can be blended with social rationality to handle uncertainty, to a reasonable extent. As mentioned in chapter 6, that a national level authority, such as National Disaster Management Authority (NDMA) in Pakistan which is preparing a decision involving

environmental risks and uncertainties should declare that it will follow the consensual results of a public participation procedure in well specified aspects of its overall decision, through social rationality, as analysed in section 6.6 of chapter 6. The following five points need to be considered to take the process of social rationality further towards policy making:

- a) Combining social rationality with descriptive data based on reliable non-monetary metrics for dynamic modelling exercises by putting these human forecasts into some well-defined mathematical expectation function, proposing regional and local level climate change scenarios (as discussed in chapters 3 (II), 5 and 6).
- b) Mapping of Hazard, Vulnerability and Risk at district level through geospatial (GIS) mapping based on consistent data, comparing it with district level data with previous climate induced socio-economic damages in order to draw a Multi Hazard Risk Analysis or Vulnerability Analysis which can then be aggregated at a national level (as mentioned in section 7.4 above).
- c) Identifying challenges - such as lack of domestic institutional capacity, weak data collection, inadequate forecasting, limited design capacity of critical climate resilient infrastructure amongst others, to methodically address them (as mentioned in chapter 5 and section 7.4 above).
- d) Addressing challenges - by addressing coordination mechanism, roles and responsibilities of different provincial and national institutions followed by institutional training and capacity building (as discussed in chapters 5 and 6).
- e) Devising DRM - mapping of available resources for reactionary disaster management and for proactive disaster management as a medium to long term climate resilient economic approach. On a short term basis, ensuring stock for immediate human emergency relief mechanisms (as discussed in chapters 5 and 6).

In light of the above, for the first step towards reforms, this research is in favour of utilizing existing technology based on the rate of return on capital, carbon taxation and related mainstream regulations, as analysed in section 3.9.2 chapter 3(II) and pro-government elite solutions in chapter 5, as reformatory first steps which subscribe to the growth paradigm but are nevertheless essential as stepping stones, to prevent imminent economic collapse and human suffering due to the crisis of climate change. The key, as a first step, is to use capital for productive investments to attend to the social, ecological and technical crisis through recycling the surpluses under a viable financial program. The latter strategy, as the second step and the main solution to attend to the underlying causes of climate change and socio-

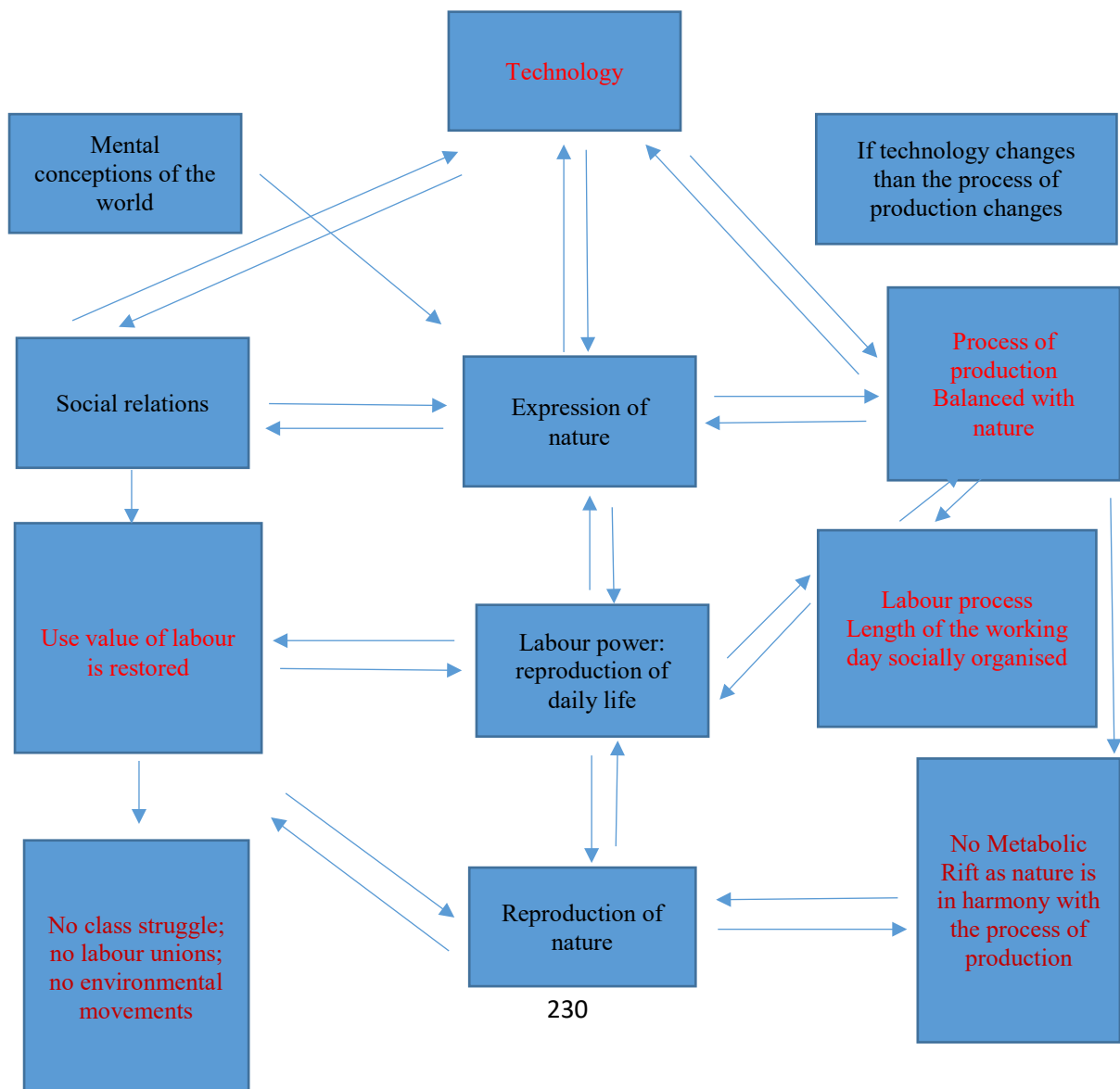
economic vulnerabilities falls under the radical reforms proposed by the eco-socialist framework, as analysed in section 3.7 of chapter 3(II).

Radical solutions proposed under this study based on its primary and secondary data analysis under the Eco-Socialist framework

These solutions, based on this research’s detailed literature review and primary data findings are as follows:

- a) technology and innovation to restore balance with nature (chapter 3(II) and chapter 5); and
- b) changing the social relations of production in order to restore labour’s use value (as analysed in chapter 3(II) and chapter 5).

Figure 7.5: Revised Conceptual Framework: a co-evolution model – a transition from the growth paradigm under the eco-socialist framework



With regards to (a) above, for Marx, technology does not determine but reveals relation to nature as to how humans tend to reproduce nature through technology. Essentially Marx's analysis implies that technology represents the social relations underlying the economic system. It is not neutral. Marx puts the technology relations of the society's material basis parallel to the society's relation to nature. New technologies have huge social and environmental implications for the management of labour surplus and the management of the disposal of surplus capital into the world markets. From steam engine to nano-technology to potential geo-engineering – technology changes all elements in the structure of material basis. Following this theoretical approach, eco-socialists propose technology push investments which does not lead to a metabolic rift. Instead it promotes the creativity of human capacities and stands in harmony with nature's laws.

With regards to (b) above, according to Marx, in *Capital*, money, commodity and buying and selling of labour power, is not capital. Capital is class relation between capital and labour which allows capitalist to extract surplus value (as discussed in chapter 3(II)). So, to change the process of production for restoring labour's use value would mean workers' self-management. Associated labourers in charge of their own production processes making their own decisions is the basis of Eco-socialist radical solutions. But the co-ordination of the activities of these associated labourers is important. This can be done, for example, through green supply chain management and joint stock companies with associated capitals or similar sets of institutional arrangements as part of the material basis of society under a co-evolutionary process.

One of the main questions this research attempted to answer has been, how to utilise the possibilities that the capitalist system presents in its material base towards a sustainable society that could attend the twin phenomena of climate change and poverty? How can eco-socialism make a radical move from the capitalist way of production? *This research proposes that this can be done by engaging with the conceptual elements of the material basis of the society looking at the co-evolution process and the ensemble of relations involved by attending to the contradictions of capital.* Is technology neutral under capitalism? What are the implication of innovative new technology? And what happens when there is a temporal

and spatial displacement of surplus labour? What are the implications for the society and the environment with regards to the metabolic relations to nature; the exponential growth of capital; and universal alienation? Such are the *contradictions* that need attending to, first to a considerable degree towards achieving a certain level of socio-economic security, before any transition to a new sustainable economic system is considered where these contradiction are fully resolved. This research has attempted to do this by first proposing reforms under the system by utilising its existing institutions before radical reforms are proposed under the conceptual framework of eco-socialism by engaging with the conceptual elements of the material basis of the society, as revised above. The above elements of material basis of society hang in totality and co-evolve given that there are institutional arrangements set in place through effective progressive reforms to coordinate the evolving social processes. The policy framework proposed in this research which is based on its primary and secondary data, addresses all of these elements.

7.7 Conclusion

This chapter triangulated the analysis of the primary data gathered through the in depth policy level elite interviews and detailed focus group sessions drawn from a cross section of poor as well as the literature review. A provisional yet reasonable climate resilient sustainability policy framework is suggested under the eco-socialist conceptual model, subject to revision given the changing socio-economic realities, for the case study country, based on the evidence brought forward through the primary and secondary data, under this research study.

Chapter 8 discusses major findings and conclusions. It also presents wider implications of the research findings along with some of the limitations of the study.

8 Discussion and Conclusions

8.1 Introduction

In the field of economics and development studies, climate change is a relatively recent subject which has nevertheless received considerable scholarly and policy attention. This study was a modest attempt to understand the complexity of the economics of climate change and its reciprocal link with the socio-economic structures with implications for poverty in order to find sustainable policy solutions and recommendations under comparative economic paradigms. Pakistan served as the case study country. This chapter draws on and discusses the knowledge claims made in this research process to highlight the major findings and contributions of this study to the concerned literature and the implications of these findings.

This chapter is organised as follows. Section 8.2 briefly reintroduces the research background, context and approach under which the twin problems of climate change and poverty have been explored. Section 8.3 summarises the study and highlights the results. Section 8.4 highlights the contribution of this study to climate change and poverty literature. Wider implications of the findings for policy, practise, theory and future research are outlined in section 8.5. This is followed by possible limitations of the study and a summary of the chapter.

8.2 Research Background and Approach

8.2.1 Background

Despite the existence of relevant academic work on climate change and sustainability, the emphasis of policy making has remained on finding solutions within the dominant economic framework. This study goes beyond the conventional practice by drawing comparisons

between the dominant and radical economic models to answer the research questions. So far, no empirical study has been done which establishes a reciprocal link between climate change and the underlying socio-economic structures with implications for poverty by employing an in depth case study analysis for a sustainable policy framework.

8.2.2 Research Philosophical Approach

Chapter 4, lays out in detail the research philosophical approach adopted under this research study which is that of critical realism and the theory of interpretation of critical hermeneutics which serves as a methodological aid.

8.3 Principle Findings of the Study

This section synthesises the empirical findings concerning climate change and poverty analysed in chapters 5 and 6. This study found various interesting and policy relevant insights about climate change, the underlying social structures and the extent of their reciprocity.

8.3.1 Findings Related to Climate Change and Poverty in the Development Process

In terms of analysis of the in depth elite interviews and focus group sessions, this study found ample evidence that a serious disconnect exists between the policy making government led elite and the poor sections of the society which has resulted in political and economic discontent within the latter group of focus group participants. The interview analysis also revealed that there is a clear divide of opinion on important political and economic issues within the policy making elite. This divide has been sectioned in two groups; one group comprises of the government and pro-government elites with reformatory solutions towards sustainability and the second group consists of political and non-political anti-government elites proposing radical solutions towards sustainability. The concerns and suggestions of both these group participants are analysed under the methodological approach of critical realism.

This study reveals that the official poverty estimates especially in the wake of climate change events do not reveal true poverty figures. This conclusion was drawn after several policy makers from the political opposition, previously in power, themselves revealed that the official poverty figures paint a false picture that poverty is decreasing; this was further confirmed by the focus group participants who represented their localities some of them living in deep pockets of poverty especially after being struck by a natural disaster. These findings were further corroborated by independent surveys carried out by local and foreign academic institutions such as PIDE and OPHI, respectively.

The understanding, that despite the fact that Pakistan contributes only 0.43 per cent of the world's total GHGs yet it is among the countries which will be hit hardest by the impacts of climate change even though it contributes only a fraction to climate change, is shared by all the interview participants.

This research through the process of its interviews and focus group session discussions is in a position to make a realistic observation that in the absence of a strong disaster risk management framework almost all of the poor households hit by floods or other extreme weather events such as draughts since 2005 have been further pushed into poverty which is not reflected in the official estimates of poverty. This judgement is based on the research participants' experiences. This finding is consistent with the data presented in the literature review which analysed the impacts of climate change and socio-economic factors in the development process.

The primary data insights revealed that Pakistan is not a water stressed or an energy stressed country, rather the analysis pointed more towards the fact that Pakistan's water and energy resources are grossly mismanaged under a misguided policy making framework with serious implications for climate change, socio-economic dynamics and overall sustainability of the country.

It was also found that the poor were not satisfied with the government poverty reducing schemes such as cash loans extended to poor households (BISP) or subsidies advanced to subsistence farmers. According to these research participants their climate resiliency is only likely to increase if they were to own a portion of land and associated water rights so that they are able to produce food for domestic and commercial purposes. Such an approach will also target their socio-economic vulnerability.

The research further found and brought empirical evidence that socio-economic setup of unequal societies under the current system, such as Pakistan, impact climate change due to lack of social cohesion, socio-economic resilience and higher carbon intensive environmental loads resulting in a metabolic rift. Under the system of production of capitalism, the destruction and commodification of soil can affect nature's laws in a way that do not stand in harmony with the laws of capital. This destruction of the soil is caused by the socio-economic structures underlying the system impacting climate change with implications for poverty. This scenario is instigated by an economic system based on the extraction of surplus value. In both cases it leads to a metabolic rift. For example, according to the focus groups discussions, increased use of wood for fuel, unsustainable use of land and water resources, in the form of overgrazing, over fishing, resultant depletion of fresh water in the absence of recycling mechanisms and desertification are common in rural areas of Pakistan, which eventually effect the carbon cycle due to the metabolic rupture, giving evidence of the negative impacts of poverty on environment, with the underlying social structures at work.

Furthermore it was brought forward in the primary research that *chemical degradation of soil leads to nutrient depletion in agricultural soils*. Soil organic matter is integral to managing water cycles in ecosystems. As mentioned in the literature review, chapter 3(1), depleted levels of organic matter have significant negative impacts on infiltration and porosity, local and regional water cycles, plant productivity, the resilience of agro-ecosystems, the economic system in term of resource degradation and eventually the carbon cycle. If carbon cycle is compromised, it inevitably leads to climate change. The implication is that water and land degradation whether by large scale mechanised farming or by unsustainable farming at small farmers' scale, will impact climate change, albeit the magnitude of impact will vary. Both are driven by the underlying social structures.

All research participants agreed that while investments in agricultural water management and development play an important part in climate resilient economic outcomes, they cannot banish socio-economic vulnerability alone. Complimentary investments are also critically needed in educational opportunities, health, culture, infrastructure, capacity building, and supportive institutions, together with targeted assistance schemes with low-cost and gender-suited technologies as part of overall sustainable development agenda.

Through the research participants' experiences and knowledge this research established that adaptation projects will not reduce climate change, they will reduce vulnerability to climate change. But sometimes faulty assessment for adaptation purposes can trigger off an environmental disaster which inevitably causes socio-economic and ecological upheaval. Therefore, project development for adaptation through climate change risk assessments based on accurate data needs to be properly analysed and legislated upon.

Furthermore, the dominant economic system advances market based solutions to climate change such as the carbon emission trading schemes which are aimed at trying to correct market failures such as climate change by creating new artificial markets. However, the comparative framework employed under the contradictions of capital, as analysed in the literature review of this research study in chapter 3(II), provides a comparative argument that such market based solutions are bound to fail and more importantly that they can actually add to the problem of climate change. This is because markets hide the underlying structure of labour and the metabolism with nature behind the wage system and act of exchange.

8.4 Contribution to the Study

This section highlights the major methodological, theoretical, empirical, and practical contributions of the study.

8.4.1 Contributions to Climate Change

First, this study contributes to the existing climate change literature by employing a comparative study to understand climate change and socio-economic structures with implications from poverty from different economic perspectives. This research's findings and proposal may work as an important point of departure for future research work towards a more realistic and integrated economic solutions that attend to the realities of nature and indeterminacy of labour.

This research study recognises the significant contribution of economic comparative solutions to the understanding of climate change and sustainability of the social structures in the economic development process, in order to answer the research questions. For example, Marx's dialectical process which elucidates and explains as to how everything in the social

context is pregnant with its opposite discerning the potential for change in the seemingly unchanging social structures hence bringing forward the great contradictions underlying the social mechanisms of our epoch. For example, capitalism is a system that produces immense wealth on the one hand and unprecedented poverty on the other hand. The former is signified by a vast amount of idle savings and the latter signified by an equally vast amount of mounting debts. As part of its first set of reforms discussed in section 7.6.2, this study proposes that these idles savings must be recycled for productive climate and development based investments, before any attempt of radical solutions is undertaken.

This case study research contextualises the socio-economic realities of Pakistan through its interviews and focus group discussions which tests a range of development policy successes and failures against ground realities to identify gaps in policy making in order to to move the focus from a conceptualised framework to an operational policy making exercise.

While the existing literature recognizes the multidimensional aspects of poverty caused by socio-economic vulnerability, the phenomenon of climate change adds a deeper dimension to it. With climate change in picture, the concept of socio-economic vulnerability is not just a social construct it is also a natural environment construct weighted against safe and sustainable natural environment.

Another important finding that this research brings to the fore is that vulnerable households are almost similar to poor households and in the absence of a resilient disaster risk management policy framework which is the case at present these vulnerable households are bound to sink to the ranks of poor as and when another climate disaster takes place.

The climate change issue provides ample evidence that there are persisting and sometimes contradictory views of nature and philosophies of risk management. Each participant's perception of nature reflects a particular moral conditioning, his or her symbolic, practical and subjective pre-understanding and he or she has a preference in suggesting a response strategy to control climate induced poverty. It is important to understand that such cultural and social realities cannot be reduced to individual choices, *especially to deal with climate change. Climate change is a social reality and unless this premise is recognised any attempt of successful climate change policy making will not achieve its objectives.* Two or more rational utility maximising individuals may have different utility preferences and different

subjective probabilities even within the same cultural background. For example, one research participant or a rational utility maximising individual preferred more financial help to help her out of her vulnerability and achieve maximisation of utility whereas the other considered ownership of land and physical resources as the best way to address her vulnerability to maximise her utility. The focus group discussions further validate the literature review findings that the rational actor paradigm is not sufficient to handle the ‘publicness’ of the causes and effects of climate change which is a radical issue and a social reality. This research proposes that individual rationality can be blended with social rationality to handle uncertainty of climate change and the changing development realities, to a reasonable extent. Today, a more comprehensive framework of economics is required that accommodates multiple equilibria. Social rationality manifested in the discussions of focus groups is relevant because it enables interacting agents to select sets of possible equilibria by developing mutually compatible expectations. This research proposes that these mutually compatible expectations help create synergies with institutional level quantitative findings based on some metric that collects a manual of descriptive data (for example through surveys) to capture a holistic picture of the qualitative needs of a given society for sustainable policy making as opposed to sustainable policy based on simple GDP money metric.

8.4.2 Contribution to stabilising climate change and socio-economic structures

This research establishes that a reciprocal link exists between climate change and socio-economic structures with implications for poverty based on the empirical evidence of this research’s primary and secondary analysis.

An important contribution of the study is bringing forward the fact that the vulnerable individuals and communities are responsive enough to *not* be passive in the face of climate change, if empowered with resources such as ownership of land, availability of credit and access to markets. Such empowering requires radical measures to attend to the socio-economic structures based on the restoration of use values of nature and labour.

Another finding which contributes to sustainability policy making is the fact that amongst the poorer, more vulnerable section of the society represented by the focus group participants, the ecological awareness is profound. The modern conservation approaches advocate exclusion rather than integration with the natural environment. The indigenous knowledge, especially

found with the older generation of farmers who were part of the focus groups under this study, reflects a profound ecological awareness. Such elements of self-awareness seem to be based on the development of human faculties and consciousness which complement the eco-socialist project of restoring the intrinsic value of being in harmony with nature.

8.5 Implications of the Findings

This section discusses the wider implications of this study for policy, practise, theory and future research.

8.5.1 Implications for Policy

Where the usefulness of CGE models for some dimensions of integrated assessment modelling cannot be denied, this research questions the legitimacy of employing this particular economic modelling tool as a single integrating modelling framework for a comprehensive evaluation of the multi-dimensional, dynamic and complex interactions between economic policy and ecological sustainability. The implication could be a reductionist policy decision infringing upon the basic values underpinning the sustainability process, namely a transparent, heterogeneous, balanced, inter-disciplinary, evidence based consultative and participatory take to policy evaluation. These basic values underpinning the sustainability process call for a realist methodological approach which integrates social rationality (qualitative) data and a manual of descriptive (quantitative) data to get a real sense of the quality of life for optimum policy making. This data should then be incorporated in an equally well-defined mathematical expectation function to measure economic damages from climate change.

8.5.2 Implications for Practise

One of the findings of the study has been that organic subsistence farming potentially targets both poverty and climate change which means that the small farmers and rural households should be empowered with basic land and water rights combined with an enabling environment in terms of availability of water, clean technology, credit and insurance facilities as well as easy access to market.

For immediate relief for water concerns, this research proposes attending to the issues of the mismanagement and inefficiency of water distribution through improved and better water storage facilities and water conservation methods primarily through, rain water harvesting or conservation; surface or ground water recycling which is contaminated by industrial and urban domestic waste; water charging by small farmers as to not to affect the underground water table; and expansion of water storage capacity by building small dams, across the country, before medium to longer term planning is initiated.

Another important finding revealed that on a localised scale, in general, almost immediate simultaneous effects of alleviating poverty and reducing greenhouse gas emissions, mostly arise in off-grid decentralised power projects which have the potential to reach very poor remotely located families and also enable the creation of small enterprises in rural communities.

8.5.3 Implication for Theory

This study's findings also have some important implications for theories of climate change and sustainability. This research has attempted to show that climate change is changing the development debate and the changing development debate is in turn changing the definition of sustainability. What worked a few years ago for economic development seems highly unsustainable for the new economic development debate which must address climate change issues. There are gaps and concerns with regards to the dominant economic theory, as brought forward by this study in context of climate change which need to be addressed for a successful climate resilient sustainable policy framework.

These gaps and concerns are shown under the framework of contradictions of capital by analysing the socio-economic factors which impact climate change, given the unsustainable economic practices embedded in the social structures of the society. Contradiction of capital framework employed in section 3.7 analysed the underlying social structure under capital. It brought forward the assessment that capital can survive its contradictions but at a major cost for the society and the environment. It also shows that the capitalist system of this day and age is different from the capitalist eras of the past. This is because, exponential growth of capital at 2.2 percent compound rate (Maddison, 2007) combined with rapid turnover time for capital for increased consumption will inevitably lead to a major environmental crises in the form of catastrophic climate change.

8.5.4 Implications for Future Research

This study's findings lead to some crucial research questions. By interviewing high level policy making government and non-governmental elites on one hand and holding focus group discussions at the grass root levels comprising of poor households/individuals from all the four provinces of Pakistan on the other hand, this research study was able to secure some rich insights and diverse data regarding climate change and socio-economic sustainability, to answer the research questions. However, amidst the changing economic realities and development debate, more investigation is required including broad based surveys to strengthen the evidence regarding the research questions.

Furthermore, another important suggestion for future research is the conducting of local level vulnerability and risk assessments, as discussed in section 7.4 of chapter 7. Such local level assessments should then be put against climate scenario mapping for each locality for integrated disaster risk management as the basis for climate change policy making.

In order to further validate the results of this study, it may be beneficial to conduct these interviews and focus group sessions in other localities and districts of Pakistan and also in other countries. These advances in the research work may reduce any informant related biases and increase the robustness of the research findings.

8.6 Limitation of the Study

Findings of this study may be considered in the light of its limitations. Where the sampling strategy is pre-assigned for projects under quantitative methodology, the sampling strategy for qualitative research develops during the study (Yin, 1993). Two key considerations guided the sampling methods, under this research: identification of appropriate participants, being those who can best inform the study objectives and adequate sampling so as to address the research questions in a manner that develops a full description of the phenomena of climate change and poverty in the development process. The findings of case study research, like experiments, are able to be generalised to theoretical propositions and not to populations, because with this methodology the goal is to generalise theories (analytic generalisation) and not to enumerate frequencies (statistical generalisation). A larger sample that includes more diverse participants at the policy level and the grassroots level would have improved results. However this study's sample size provides an image of the wider socio-economic realities impacted by climate change and vice versa. Further limitation may arise as this case study used context specific knowledge rather than general knowledge. Citing single cases, experiments, and experiences of Galileo, Newton, Einstein, Bohr, Darwin, Marx, and Freud; Flyvbjerg makes the point that both human and natural sciences can be advanced by a single case (Flyvbjerg 2006). He also argues that formal generalizations based on large samples are overrated in their contribution to scientific progress. Case study research is often accused of entertaining the researcher's preconceived notions. All attempts are made that this case study research is free from the researcher's preconceived notions or potential biases by employing different research methods, dialectical approach and comparative analysis as quality criteria which exhibits its independent critical thought and internal validity.

8.7 Conclusion

This study has investigated two interrelated research questions: what are the reciprocal impacts of climate change and socio-economic structures with implications for poverty and how does neo-classical economic paradigm address these issues as opposed to comparative economic paradigms towards a sustainable policy framework. It employed the critical realist

philosophical approach with hermeneutics as a methodological aid which views the domain of real causal mechanisms as the appropriate object of science as opposed to the observation of constant conjunction of events. Qualitative data employing in-depth elite interviews and focus groups was collected, with Pakistan as the case study country, to answer the research questions. The originality of this study is that it made several contributions to the existing knowledge, by providing empirical evidence that refuted the theoretical arguments proposed by the dominant narrative of climate change which revolve around resource constraints, by bringing in contradictory and paradoxical evidence. This evidence resulted in providing rich insights to answer the research questions. “Creative insight often arises from the juxtaposition of contradictory or paradoxical evidence and this constant juxtaposition of conflicting realities tends to unfreeze thinking” (Seawright and Gerring, 2008). The general methodology of this research harbours upon the subjection of the climate change as a developmental problem to successive questions and interrogation through critical use of concepts and empirical data in a deliberate attempt to find new answers for the research questions. For the purpose of enhancing rigour, triangulation is used in this study by employing multiple sources of evidence based on insightful primary and secondary data. The final product of this research confirms that failure to see the link between climate change and the structural imperatives in which it is embedded gives a partial view of climate change, with implications for poverty.

A detailed analysis was presented in terms of how the neoclassical tradition approaches the research questions as opposed to radical economic paradigms. The findings under these comparative economic paradigms, lead to certain important policy implications. These findings are then synthesized under this research’s enhanced conceptual framework towards sustainable policy solutions which answer the research questions.

References

- Ackerman, F. (2007) 'Debating Climate Economics: The Stern Review vs. Its Critics', *Report to Friends of the Earth-UK*. Global Development and Environment Institute, Tufts University. July 2007, pp. 1-25.
- Asian Development Bank, (2009) Pakistan Outline Strategic Priorities In Five-Year Plan | Asian Development Bank. Retrieved from <http://www.adb.org/news/adb-pakistan-outline-strategic-priorities-five-year-plan> (Accessed at: 20 August 2013).
- Asian Development Bank (2012) Energy Trade in South Asia Opportunities and Challenges. Retrieved from: <https://www.adb.org/sites/default/files/publication/29703/energy-trade-south-asia.pdf> (Accessed at: 25 October 2016).
- Adger, W. N., Huq, S., Brown, K., Conway, D., & Hulme, M. (2003) Adaptation to climate change in the developing world. *Progress in Development Studies*. July 2003, 3(3), pp. 179-195.
- Aftab, T. B., Husnain, S. A., & Iqbal, S. R. (2012) Save water and safe water: Evaluation of design and storage period on water quality of rainwater harvesting system. *Journal of Environment and Earth Science*, 2(10), pp.106-111.
- Ahmed, V., Rashid, A. (1982) *The Management of Pakistan's Economy 1947-82*. Karachi. Oxford University Press.
- Ahsan, I., & Khwaja, S. A. (2013) *Development of Environmental Laws and Jurisprudence in Pakistan*. Asia Development Bank. ISBN 978-92-9254-310-5
- Alam, A. R. (2010, July 23) New approach to the Indus Treaty - Ahmad Rafay Alam. Retrieved from: <http://www.thenews.com.pk/TodaysPrintDetail.aspx?ID=252248&Cat=9&dt=7/23/2010> (Accessed: 25 June 2013).

- Alam, A.R. (2010, May 14) Throwback to bellbottoms - Retrieved from <http://www.thenews.com.pk/TodaysPrintDetail.aspx?ID=239197&Cat=9&dt=5/14/2010>. (Accessed: 25 June 2013).
- Alam, A. R. (2009, January 19). Meeting the grim challenge of climate change - Retrieved from: <http://www.thenews.com.pk/TodaysPrintDetail.aspx?ID=157845&Cat=9&dt=1/19/2009>. (Accessed: 25 June 2013).
- Alavi, Hamza. (1986) *The Rural Elite and Agricultural Development in Pakistan*, in Karamat, Ali (ed.) *Pakistan the Rural Economy of Political Development*, Vanguard, Lahore.
- Ali, M., Byerlee, D. (2000) Productivity Growth and Resource Degradation in Pakistan's Punjab: A Decomposition Analysis. *Policy Research Working Paper; No. 2480. World Bank, Washington, DC. © World Bank.* <https://openknowledge.worldbank.org/handle/10986/19758> License: CC BY 3.0 IGO.
- Ali, I. (2004) Historical Impacts on Political Economy in Pakistan. *Asian Journal of Management Cases*. 1(2), pp. 129-146.
- Ali, T. (2008) *The duel: Pakistan on the flight path of American power*. New York: Scribner.
- Al-Amoudi, I., & Willmott, H. (2011) Where constructionism and critical realism converge: Interrogating the domain of epistemological relativism. *Organization Studies*, 32(1), pp. 27-46.
- Alvesson, M. and Sköldbberg K. (2010) *Reflexive methodology: new vistas for qualitative research*, Sage Publications.
- Amin, S. (2013) *The implosion of contemporary capitalism*. Monthly Review Press Publication.
- Amjed, R., Kemal, A.R. (1997) 'Macroeconomic Policies and their Impact of Poverty Alleviation in Pakistan', *Pakistan Development Review*, 36(1), pp. 39-683.
- Anwar, T. (1996) 'Structural Adjustment and Poverty: The Case of Pakistan', *Pakistan Development Review*, 35(4), pp. 911-926.
- Andersson, J. O., & Lindroth, M. (2001) Ecologically unsustainable trade. *Ecological Economics*, 37(1), p. 113-122.
- Anderson, S., and R. Newell, (2004) Prospects for Carbon Capture and Storage Technologies: *Annual Review of the Environment and Resources*, v. 29, pp. 109-142.
- Anderson, E. (2006) Potential Impacts of Climate Change on \$2 a Day Poverty and Child Mortality in Sub-Saharan Africa and South Asia, unpublished manuscript. *Overseas Development Institute. UK.*

- Anselin, L. (2000) Computing environments for spatial data analysis. *Journal of Geographical Systems*, 2(3), pp. 201-220.
- Anwar, T. (2006) Poverty and Governance in Pakistan. Paper presented at the 22nd Annual General Meeting of PSDE, held in Lahore December 19-21, 2006, Pakistan Institute of Development Economics, Islamabad.
- Anwar, T. (2004) Recent Macroeconomic Developments and Implications for Poverty and Employment in Pakistan: The Cost of Foreign Exchange Reserve Holdings in South Asia. *ASARC Working Papers 2004, The Australian National University, April 2004*.
- Anwar, T., Qureshi, S.K., Ali, I. (2004) Landlessness and Rural Poverty in Pakistan. *The Pakistan Development Review*, 43, pp. 855-874.
- Archer, D. (2009) *The Long Thaw*. Princeton University Press.
- Arif, H., Ali, A. A. (1993) *Environmental repercussions of development in Pakistan*. Karachi: OPP-RTI Publication.
- Arnell, N. W. (2004) Climate change and global water resources: SRES emissions and socio-economic scenarios. *Global Environmental Change-human and Policy Dimensions*, 14, pp. 31-52.
- Arrow, K.J. et al. (1996) Intertemporal Equity, Discounting, and Economic Efficiency. In: *Climate Change 1995: Economic and Social Dimensions of Climate Change. Contribution of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.
- Arrow, K. (2007) 'The case for mitigating greenhouse gas emissions', *Real-World Economics Review*, no.45, pp. 66-73.
- Arrow, K. (1951) 'An Extension of the Basic Theorems of Classical Welfare Economics', in J. Neyman, (ed.), *Proceedings of the Second Berkeley Symposium on Mathematical Statistics and Probability*, Berkeley, CA, University of California Press, pp. 507-532.
- Asian Development Bank. (2002) *Poverty in Pakistan: Issues, causes, and institutional responses*. Asian Development Bank, Pakistan Resident Mission.
- Assunção, J. and F. Chein Feres. (2009) Climate Change, Agricultural Productivity, and Poverty, Working Paper, Department of Economics, PUC-Rio de Janeiro.
- Bagader, et al. (1996) *Environmental Protection in Islam / Protection de l'environnement en Islam*. IUCN, Gland, Switzerland and Cambridge, UK. / UICN, Gland Suisse et Cambridge, R-U. x+134 pp.
- Bagader, et al. (1983) Basic paper on the Islamic principles for the conservation of the natural environment. *IUCN Environmental Policy and Law Paper*. Saudi Arabia,

- Meteorological and Environmental Protection Administration (MEPA).ISBN: 2-88032-088-7.
- Bakan, Mildred. (1983) Social Science as Critical Hermeneutics: A Radicalized Concept of the Public Language Game. *Contemporary Sociology*, 12(4), pp. 376-378.
- Banerjee, A. V., & Duflo, E. (2007) The Economic Lives of the Poor. *Journal of Economic Perspectives*, 21(2), pp. 141-168.
- Barker, T., Pesaran, M. H. (1990) *Disaggregation in Economic Modelling*, London: Routledge.
- Barnett, William A., Chiarella, Carl., Keen, S., Marks, Robert., Schnabl, Hermann. (2001) *Commerce, complexity, and evolution: topics in economics, finance, marketing, and management: proceedings of the Twelfth International Symposium in Economic Theory and Econometrics*. Cambridge, U.K. : Cambridge University Press.
- Barrett, C. B., Barnett, B. J., Carter, M. R., Chantarat, S., Hansen, J. W., Mude, A. G., Ward, M. N. (2007) Poverty Traps and Climate Risk: Limitations and Opportunities of Index Based Risk Financing. *International Research Institute for Climate and Society. IRI Technical Report*.
- Barrett, C. B., Carter, M. R., & Ikegami, M. (2007) Poverty traps and social protection. *Working Paper Cornell University and University of Wisconsin*.
- Barrett, C.B., Marenya, P.P., McPeak, J.G., Minten, B., Murithi, F.M., Oluoch-Kosura, W., Place, F., Randrianarisoa, J.C., Rasambainarivo, J. and Wangila, J. (2006) 'Welfare Dynamics in Rural Kenya and Madagascar,' *Journal of Development Studies* 42(2), pp. 248–277.
- Barrett, C.B., Carter, M.R. and Ikegmai, M. (2006) 'Threshold-targeted Social Protection to Overcome Poverty Traps and Aid Traps,' University of Wisconsin. Social Protection and Labour World Bank Discussion Paper No. 0804, pp.44.
- Barry, R. G., & Chorley, R. J. (2010) *Atmosphere, weather, and climate*. London: Routledge.
- Bashir ,M.K., Z.N. Bajwa, K., Bakhsh, A., Maqbool. (2007) Food security perspectives in Pakistan. Proceedings of the International Conference on Productivity and Growth in Agriculture: Strategies and Interventions. *University of Agriculture, Faisalabad, Pakistan*. pp.150.
- Bashir, M.K., Schilizzi, S. and Pandit, R. (2012) *The determinants of rural household food security in the Punjab, Pakistan: an econometric analysis*, Working Paper 1203, School of Agricultural and Resource Economics, University of Western Australia, Crawley, Australia.

- Bator, F. M. (1958) 'The Anatomy of Market Failure', *The Quarterly Journal of Economics*, 72 (3), pp. 351-379.
- Behram, J.R. (1995) *Pakistan: Human Resource Development and Economic Growth into the Next Century*.
- Bello, W. (2009) *The Food Wars*. Verso, Original Edition.
- Belokrenitsky, V. (1991) *Capitalism in Pakistan: A History of Socio-Economic Development*. New Delhi: Patriot Publishers.
- Bennett, J. O. (2002) *Pakistan: Eye of the storm*. New Haven Conn: Yale University Press.
- Bergman, L. (1990) The development of computable general equilibrium modeling, in D. J. Bergman, L. and E. Zalai (eds), *General equilibrium modelling and economic policy Analysis*, Basil Blackwell, Oxford, pp. 3–30.
- Bergman, L., Jorgenson, D. W. and Zalai, E. (1990) *General equilibrium modelling and economic policy analysis*. Basil Blackwell, Oxford.
- Bergman, Lars. (2005) CGE Modelling of Environmental Policy and Resource Management, chapter 24, p. 1273-1306 in K., G. Mäler and J., R. Vincent eds., *Handbook of Environmental Economics*, vol. 3, Elsevier, <http://EconPapers.repec.org/RePEc:eee:envchp:3-24>.
- Bergson, A. (1938) "A reformulation of Certain Aspects of Welfare Economics", *reprinted in Arrow and Scitovsky (eds) Readings in Welfare Economics*, Irwin, Homewood, Ill., 1969.
- Bernstein, H. (2001) The Peasantry in Global Capitalism: Who, Where and Why? *Social Register*. Vol 37, pp. 25-51.
- Bernstein, H., (2004) Changing before our very Eyes: Agrarian Question and the Politics of Land in Capitalism Today. *Journal of Agrarian Change*. Vol. 4, Issue 1-2, pp. 190-225.
- Bhagwati, J. (1993) Debate: Does Free Trade Harm the Environment? - *Scientific American*. Retrieved from <http://www.scientificamerican.com/article/debate-does-free-trade-harm-the-env/> (Accessed on: 3 January 2012).
- Bhagwati, J. (1994) "Threats to the World Trading System: Income Distribution and the Selfish Hegemon." *Journal of International Affairs*. 48(Spring), pp. 279-285.
- Bhagwati, J. (1997) The Global Age: From a Sceptical South to a Fearful North. *World Economy*, 20(3), pp. 259-381.
- Bhaskar, R. S., Archer, M., Lawson, T., & Norrie, A. (1998) *Critical realism: Essential readings*. London: Routledge.

- Bhutta, Z. A. (2001) Structural adjustments and their impact on health and society: a perspective from Pakistan. *Int. J. Epidemiol.* (2001) 30 (4), pp. 712-716.
- Bohle, Hans G., Thomas E. Downing., Michael J. Watts. (1994) "Climate change and social vulnerability: Toward a sociology and geography of food insecurity," *Global Environmental Change*, 4(1), pp. 37-48.
- Bose, A. (1980) *Marx on exploitation and inequality: An essay in Marxian analytical economics*. Delhi: Oxford University Press.
- Bovenberg, A. L., & Goulder, L. H. (2000) Neutralizing the Adverse Industry Impacts of CO2 Abatement Policies: What Does it Cost? *Behavioral and Distributional Effects of Environmental Policy*, in C. Carraro and G. Metcalf, eds., *Behavioral and Distributional Impacts of Environmental Policies: Evidence and Controversies*, University of Chicago Press.
- Boyle, B., & McDonough, T. (2011) Critical realism, Marxism and the critique of neoclassical economics. *Capital & Class*, 35(1), pp. 2-22.
- Brien, F., & Meadows, M. (2007) Developing a visioning methodology: Visioning Choices for the future of operational research. *Journal of The Operational Research Society*, 58(5), pp. 557-575.
- Brock, W., & Durlauf, S. (2001) Growth Empirics and Reality. *World Bank Economic Review* 15(2), pp. 229-272.
- Brown, R., & Brignall, S. (2007) Reflections on the use of a dual-methodology research design to evaluate accounting and management practice in UK university central administrative services. *Management Accounting Research*, 18(2007) 32-48.
- Buck, D. (2007) The Ecological Question: Can Capitalism Prevail? *Socialist Register*, 14(28), pp.60-71.
- Bukhari and Haq (2008, May 10) Chronic Poverty on the Rise". Dawn Newspaper, Retrieved from <http://archives.dawn.com/weekly/encounter/20080510/encounter4.htm>.
- Bukhari and Haq (2010, January 8), "The Great Divide". *Business Recorder*, p. 20.
- Bunker, S.G., Ciccantell, P. (1999) 'Economic Ascent and the Global Environment: World-Systems Theory and the New Historical Materialism', *Ecology and World-Systems Theory*. Ed. Walter Goldfrank et al. Westport, CT: Greenwood Press, 1999, pp. 107-122.
- Burkett, P. (2006) *Marxism and ecological economics: Toward a red and green political economy*. Leiden: Brill.

- Burkett, P. (2014) *Marx and nature: A red and green perspective*. New York: St. Martin's Press.
- Burki, J. (1980) *Pakistan under Bhutto: 1971-77*. St. Martin's Press.
- Burton, K., Kates, R., and White, G. (1993) *The Environment as Hazard*, 2nd Edition. New York: Guilford Press.
- Burton, I. (1996) The growth of adaptation capacity: practice and policy. In: *Adapting to climate change: an international perspective* [Smith, J., Bhatti, N., Menzhulin, G., Benioff, R., Budyko, M. I., Campos, M., Jallow, B. and Rijsberman, F. (eds.)]. Springer-Verlag, New York, NY, USA, pp. 55-67.
- Böhringer, C., & Löschel, A. (2006) Computable general equilibrium models for sustainability impact assessment: Status quo and prospects. *Ecological Economics*, 60(4), pp. 678-684.
- Böhringer, C., Löschel, A., & Rutherford, T. F. (2007) Decomposing the integrated assessment of climate change. *Journal of Economic Dynamics & Control*. 31(2), pp. 683-702.
- Carter, S. M., & Little, M. (2007) Justifying Knowledge, Justifying Method, Taking Action: Epistemologies, Methodologies, and Methods in Qualitative Research. *Qualitative Health Research*, 17(10), pp. 1316-1328.
- Carter, M.R. and Barrett, C. (2006) 'The Economics of Poverty Traps and Persistent Poverty: An Asset-Based Approach,' *Journal of Development Studies* 42(2), pp. 178-199.
- CDKN, (2012) flood casualties Pakistan. Retrieved from http://cdkn.org/?s=flood+casualties+pakistan&searchsubmit=s&loclang=en_gb&type=google
- Chang, H-J. (2003) *Globalisation, Economic Development and the Role of the State*, Zed Books, London.
- Cheema, A.R. (2016) The "smart villages" of northern Pakistan. Retrieved from: <https://www.thethirdpole.net/2016/03/10/the-smart-villages-of-northern-pakistan/> (Accessed 10 November 2016).
- Cline, W. R. (1992) *Economics of Global Warming*. Peterson Press.
- Collier, P. (2007) *The bottom billion: Why the poorest countries are failing and what can be done about it*. Oxford: Oxford University Press.
- COMM, (2014) *European commission*. Available at: http://ec.europa.eu/index_en.htm (Accessed: 23 June 2015).

- Commission on the Measurement of Economic Performance and Social Progress France
(2010) *Mismeasuring our lives: Why GDP doesn't add up*. New York, NY: New Press.
- Common, M. S., & Stiglitz, S. (2005) *Ecological economics: An introduction*. Cambridge, UK: Cambridge University Press.
- Conference on Trade and Development. (2013) unctad.org | Trade and Environment Review 2013. Retrieved from <http://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=666>
- Costanza, R., Daly, H., Norgaard, R. B., & Goodland, H. E. (1997) *An introduction to ecological economics*. ST. Lucie Press.
- Costello, A., Watson, F., Woodward, D. (1994) Human face or human façade. The effects of adjustment on the health of mothers and children in developing countries. Working Paper Institute of Child Health London Retrieved from: <http://www.cich.ich.ucl.ac.uk>.
- Crotty, M. (1998) *The foundations of social research: Meaning and perspective in the research process*. London: Sage Publications.
- Cruz, R.V., Harasawa, H., Lal, M., Wu, S., Anokhin, Y., Punsalmaa, B., Honda, Y., Jafari, M., Li, C., Huu Ninh, N. (2007) Climate change in Asia: Impacts, adaptation and vulnerability. Contribution of *Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, eds., Parry, M.L.; Canziani, O.F.; Palutikof, J.P.; van der Linden, P.J.; Hanson, C.E. Cambridge, UK: Cambridge University Press. Pp. 469-506.
- Daly, H. (2013) *Enough is enough: Building a sustainable economy in a world of finite resources*. Routledge.
- Daly, H. E. (1996) *Beyond growth: The economics of sustainable development*. Boston: Beacon Press.
- Daly, H. E., & Farley, J. C. (2003) *Ecological economics: Principles and applications*. Washington, DC: Island Press.
- Daly, H. E., & Farley, J. C. (2005) *Ecological economics: Principles and applications*. Washington: Island Press.
- Dasgupta, P. (2007) Discounting Climate Change. *Review of Environmental Economics and Policy*.
- Dasgupta, P., Tol, R. S., & Yohe, G. W. (2008) Discounting climate change. *Journal of Risk and Uncertainty*, 37, pp. 141-169.

- Dasgupta, P., Mody, A., Roy, S., Wheeler, D. (1995) Environmental regulation and development: a cross-country empirical analysis. *Oxford Development Studies*.
- Davis, S.J., Caldeira, K. (2010) Consumption based accounting of CO2 emissions. *Proceedings of the National Academy of Science of the United States of America*, 107(12), pp. 5687-5692.
- Dawson, B., & Spannagle, M. (2009) *The complete guide to climate change*. London: Routledge.
- Debreu, G. (1954) 'Valuation Equilibrium and Pareto Optimum', *Proceedings of the National Academy of Sciences*, reprinted in *Arrow and Scitovsky (eds.) Readings in Welfare Economics*, Irwin, Homewood, Ill., 1969.
- DeCanio, S. J. (2003) *Economic models of climate change: A critique*. New York: Palgrave Macmillan.
- Dell, Melissa, Benjamin Jones and Benjamin Olken. (2009) "Temperature and Income: Reconciling New Cross-Sectional and Panel Estimates," *American Economic Review Papers and Proceedings*.
- Delworth, T.L., & Dixon, K.W. (2000) Implications of the recent trend in the Arctic/North Atlantic Oscillation for the North Atlantic thermohaline circulation. *Journal of Climate*, 13, pp. 3721-3727.
- Delworth, T.L., Anthony Rosati, Whit Anderson, Alistair J. Adcroft, V. Balaji, Rusty Benson, Keith Dixon, Stephen M. Griffies, Hyun-Chul Lee, Ronald C. Pacanowski, Gabriel A. Vecchi, Andrew T. Wittenberg, Fanrong Zeng, and Rong Zhang. (2012) Simulated Climate and Climate Change in the GFDL CM2.5 High-Resolution Coupled Climate Model. *J. Climate*, **25**, 2755–2781.
- Demerit, D. (2001) The Construction of Global Warming and the Politics of Science. *Annals of The Association of American Geographers*, 91(2), 307-337.
- Dennison, E, F., Chung, W.K. (1976) Economic Growth and its Sources in H., Patrick and H., Rosovsky (eds.), *Asia's New Giant* (Washington, Brookings Institutions).
- Dercon, S. (1998) 'Wealth, Risk and Activity Choice: Cattle in Western Tanzania', *Journal of Development Economics* 55, pp. 1–42.
- Dercon, S. (2005) 'Growth and Shocks: Evidence from Rural Ethiopia', *Journal of Development Economics* 74(2), pp. 309–29.
- Dercon, S., and J. Hoddinott. (2005) 'Health, Shocks and Poverty Persistence'. In S. Dercon, ed. *Insurance Against Poverty*. Oxford: Oxford University Press

- Dessler, A. E., & Parson, E. (2006) *The science and politics of global climate change: A guide to the debate*. Cambridge, UK: Cambridge University Press.
- Dieter, F. (1990) Hermeneutics, deconstruction, and linguistic theory. *Journal for General Philosophy of Science*, 21(1), 183-203.
- Dilley, M., & Boudreau, T. E. (2001) Coming to terms with vulnerability: a critique of the food security definition. *Food Policy*, 26, pp. 229-247.
- Dobb, M., (1973) *Theories of Value and Distribution Since Adam Smith: Ideology and Economic Theory*. Cambridge University Press.
- Dollar, D., Kraay, A. (2001) Growth Is good for the Poor. The World Bank. World Bank Policy Research Working Paper No. 2587.
- Dooley, L. M. (2002) Case Study Research and Theory Building. *Advances in Developing Human Resources*, 4(3), pp. 335-354.
- Dow, K., & Downing, T. E. (2011) *The atlas of climate change: Mapping the world's greatest challenge*. Berkeley: University of California Press.
- Dubash, N.K. (2001) *Tubewell Capitalism: Ground Water Development and Agrarian Change in Gujrat*. OUP India.
- Duncan, R., & Pollard, S. J. (2001) *A conceptual Framework for Designing a Country's Poverty Reduction Strategy. Paper prepared for Asia and Pacific Forum on Poverty: Reforming Policies and Institutions for Poverty Reduction: ADB*.
- Easterling, D. R., Meehl, G. A., Parmesan, C., Changnon, S. A., Karl, T. R., & Mearns, L. O. (2000) Climate Extremes: Observations, Modelling and Impacts. *Science*, 289(5487), pp. 2068-2074.
- Easton, G. (2010) Critical realism in case study research. *Industrial Marketing Management*. 39(2010), pp. 118- 128.
- Ebrahim, Z. (2015, February 6) Pakistan's new climate change ministry merely "cosmetic" - Pakistan - DAWN.COM. Retrieved from <http://www.dawn.com/news/1161895>
- Elder-Vass, D. (2004) RE-EXAMINING BHASKAR'S THREE ONTOLOGICAL DOMAINS: THE LESSONS FROM EMERGENCE. Paper presented at International Association of Critical Realism Conference. Cambridge UK, April 2004.
- EPA (2015) Carbon Pollution Standards Final Rule. Federal Register/ Vol. 80, No. 205 // Rules and Regulations. Retrieved from: <https://www.gpo.gov/fdsys/pkg/FR-2015-10-23/pdf/2015-22837.pdf>. (Accessed on: 21 October 2016).
- EPA FACTSHEET (2015) Carbon Pollution Standards FINAL LIMITS ON CARBON POLLUTION FROM NEW, MODIFIED AND RECONSTRUCTED POWER

- PLANTS. Retrieved from: <https://www.epa.gov/sites/production/files/2015-11/documents/fs-cps-overview.pdf>. (Accessed on 21 October 2016).
- Engels, F. (2012) *Dialectics of nature*. London: Wellred.
- Eriksson, M., Xu, J., Shrestha, A.B., Vaidya, R.A., Nepal, S., Sandstrom, K. (2009) *The changing Himalayas: Impact of climate change on water resources and livelihoods in the greater Himalayas*. Kathmandu: ICIMOD, pp. 28
- Faiz, A. (1996). *Air pollution from motor vehicles: Standards and technologies for controlling emissions*. Washington, DC: World Bank.
- Faiz, A., Weaver, C., Sinha, K., Walsh, M., & Carbajo, J. (1992) *Air Pollution from Motor Vehicles: Issues and Options for Developing Countries*. Washington DC: World Bank.
- FAO, (2010). *The state of food insecurity in the world: addressing food insecurity in protracted crises*. Food and Agriculture Organization of the United Nations, Rome.
- Faruqee, R. (1995) *Pakistan's agriculture sector: Is 3 to 4 percent annual growth sustainable?* Washington: World Bank, South Asia, Country Department I, Agricultural Operations Division.
- Faruqi, N. I., Biswas, A. K., Bino, M. J., & International Development Research Centre (Canada). (2001) *Water management in Islam*. Tokyo: United Nations University Press.
- Fine, B. (2002) 'Economic imperialism': a view from the periphery. *Review of Radical Political Economics*, 34(2), pp. 187-201.
- Fine, B. (2002) Economics Imperialism and the New Development Economics as Kuhnian Paradigm Shift? *World Development*. 30(12), pp. 2057-2070
- Fisher, F. M. (1983) *Disequilibrium foundations of equilibrium economics*. Cambridge University Press.
- Fischer, Carolyn. (2004a) Emission pricing, spillovers, and public investment in environmentally friendly technologies. Washington, DC: *Resources for the Future*. 1616 P St. NW Washington, DC02036 202-3285000.
- FitzRoy, F., Papyrakis, E., & International Institute for Environment and Development. (2010) *An introduction to climate change economics and policy*. London: Earthscan.
- Flyvberg, B. (2006) Five misunderstandings about case-study research. *Qualitative Inquiry*, 12(2), pp. 219-245.
- Fossey, E., Harvey, C., Mcdermott, F., & Davidson, L. (2002) Understanding and Evaluating Qualitative Research*. *Australian and New Zealand Journal of Psychiatry*, Vol.36, pp. 717-732.

- Foster, J. B. (2000) *Marx's ecology: Materialism and nature*. New York: Monthly Review Press.
- Foster, J. B. (2001) *The vulnerable planet: A short economic history of the environment*. New York: Monthly Review Press.
- Foster, J. B. (2009) John Bellamy Foster - The Crisis of Capital: Economy, Ecology and Empire on Vimeo. Retrieved from <https://vimeo.com/8838868>
- Foster, J.B. (2011) *The Ecological Rift: Capitalism's War on the Earth*. Monthly Review Press.
- Foster, J.B. (2011) Marxism and Ecology. *Talk delivered at the Marxism 2011 Conference. UCL July 3, 2011.*
- Foster, J. B. (2014) *The Theory of Monopoly Capitalism: An Elaboration of Marxian Political Economy*. New York: Monthly Review Press.
- Foster, J. B. (2015) Mészáros and the Critique of the Capital System | John Bellamy Foster | Monthly Review. Retrieved from <http://monthlyreview.org/2014/12/01/meszaros-and-the-critique-of-the-capital-system/>
- Foster, J. B., Clark, B., & York, R. (2010) *The ecological rift: Capitalism's war on the earth*. New York: Monthly Review Press.
- Foster, A.D. (1995) 'Prices, Credit Markets and Child Growth in Low Income Rural Areas.' *Economic Journal* 105, pp. 551–570.
- Foster, J. E., and Miguel Szekely. (2001) Is Economic Growth Good for the Poor? Tracking Low Incomes Using General Means. *Paper presented at the United Nations University World Institute for Development Economic Research Development Conference on Growth and Poverty, Helsinki, May 25-26, 2001.*
- Fowler, H.J., Archer, D.R. (2005) Hydro-climatological variability in the Upper Indus Basin and implications for water resources. *IAHS Publications* 295, pp. 131-138.
- Franck, L. and D'Amato, A. (2009) "Environmental policy as a multi-task principal-agent problem", Working Paper Series no. 2003-12, *Energy, Transport & Environment* Catholic University of Lovaine, Faculty of Economics and Applied Economic Sciences.
- Gadamer, H. (2006) Classical and Philosophical Hermeneutics. *Theory Culture & Society, Sage Publications*, 23(1), pp. 29-56.
- Gaiha, R., & Thapa, G. (2006) *Natural Disasters Vulnerabilities and Mortalities: A Cross Country Analysis*. International Fund for Agricultural Development. Working Paper.

- Gazdar, H. (2004) Labour Market and Poverty in Pakistan: Institutional Arrangements and Policy. In Proceedings of the Seminar on Employment-based Poverty Reduction Strategy for Decent Work. Islamabad: PIDE/ILO/UNDP.
- Georgescu-Roegen, N. (1999) *The entropy law and the economic process*. New York.
- Giljum, S., & Eisenmenger, N. (2004) North-South Trade and the Distribution of Environmental Goods and Burdens: a Biophysical Perspective. *The Journal of Environment & Development*, 13(1), pp. 73-100.
- Gillham, B. (2000) *Developing a Questionnaire*. London: Bloomsbury Publishing.
- Global Assessment Report on Disaster Risk Reduction. (2011) Global Assessment Report on Disaster Risk Reduction 2011 Revealing Risk, Redefining Development. Retrieved from <http://www.preventionweb.net/english/hyogo/gar/2011/en/home/index.html>
- Gobo, G. (2004) Sampling, representativeness and generalizability. In C. Seale, G. Gobo, J.F. Gubrium, & D. Silverman (Eds.) *Qualitative research practice*. London: Sage.
- Golden, J. S. (2004) The Built Environment Induced Urban Heat Island Effect in Rapidly Urbanizing Arid Regions – A Sustainable Urban Engineering Complexity. *Environmental Sciences*. doi:10.1080/15693430412331291698
- Gollier, C. (2009a) Expected net present value, expected net future value, and the Ramsey rule. *Journal of Environmental Economics and Management*. doi:10.1016/j.jeem.2009.11.003
- Gollier, C. (2009b) Should We Discount the Far-Distant Future at Its Lowest Possible Rate? *Economics: Open-Assessment E-Journal*, 3(25), pp. 2009-25.
- GOVERNMENT OF PAKISTAN MINISTRY OF LAW, JUSTICE, HUMAN RIGHTS AND PARLIAMENTARY AFFAIRS (Law, Justice and Human Rights Division). (1983) Ministry of Parliamentary Affairs.
- GOP, (1998) Population census of Pakistan. Population Census Organization, *Statistics Division*, Government of Pakistan.
- GOP, (2003) Economic survey of Pakistan 2002-03. Finance Division, *Ministry of Finance*, Government of Pakistan.
- GOP, (2010) Economic survey of Pakistan 2009-10. Finance Division, *Ministry of Finance*, Government of Pakistan.
- GOP, (2011) Economic survey of Pakistan 2010-11. Finance Division, *Ministry of Finance*, Government of Pakistan.

- Gowdy, John M. & Mayumi, Kozo. (2001) 'Reformulating the foundations of consumer choice theory and environmental valuation', *Ecological Economics*, Vol. 39, pp. 223–237.
- Grimes, P., & Kentor, J. (2003) Exporting the Greenhouse: Foreign Capital Penetration and CO₂ Emissions 1980–1996. *Journal of World System Research*, 9(3), pp. 251-275.
- Guba, E. and Y. Lincoln (1994) *Competing Paradigms in Qualitative Research*. Sage Publications: Thousand Oak, California, U.S.A.
- Habermas, J. (1984) *The theory of communicative action*. Boston: Beacon Press.
- Haq, M. (1995) *Reflections on human development: How the focus of development economics shifted from national income accounting to people-centred policies, told by one of the chief architects of the new paradigm*. New York: Oxford University Press.
- Hamel, J., Dufour, S., & Fortin, D. (1993) *Case study methods*. Sage Publications.
- Handmer, J. W., Dovers, S., & Downing, T. E. (1999) Societal Vulnerability to Climate Change and Variability. *Mitigation and Adaptation Strategies for Global Change*, Vol. 4, pp. 267-281.
- Hanif, U., Syed, S. H., Ahmed, R., & Malik, K. A. (2010) Economic Impact of Climate Change on the Agricultural Sector of Punjab. *The Pakistan Development Review*, 49(4), pp. 771-798.
- Hansen, J. (2002) Global Warming Continues. *Science*. **295**, 275, doi:10.1126/science.295.5553.275c.
- Hansen, J., Nazarenko, L., Ruedy, R., Sato, M., Willis, J., Genio, A. D., Tausnev, N. (2005) Earth's Energy Imbalance: Confirmation and Implications. *Science*, **308**, pp. 1431-1435.
- Hansen, J. et al. (1981) Climate impact of increasing atmospheric carbon dioxide. *Science*, **213**, pp. 957-966.
- Harijan, K., Uqaili, M. A., Memon, M.D.: Prospects of Renewable Energy for Meeting Growing Electricity Demand in Pakistan. In: *AIP Conf. Proc. Renewable Energy for Sustainable Development in the Asia Pacific Region*, vol. 941, pp. 53–61 (2007)
- Harvey, D. (2007) *The limits to capital*. London: Verso.
- Harvey, D. (2010) *A companion to Marx's Capital, Vol.1*. London: Verso. Paperback, 368 pages.
- Harvey, D. (2013) *A companion to Marx's Capital, Vol. 2*. London: Vero. Paperback, 404 pages.
- Harvey, D. (2014) *Seventeen contradictions and the end of capitalism*. Profile Books.

- Hassan, J. (2006) *Environmental Issues and Environmental Laws in Pakistan*. Hassan and Hassan (Advocates) Lahore.
- Hathaway, et al. (2007) *Fueling the future: Meeting Pakistan's energy needs in the 21st century*. Washington, DC: Asia Program, Woodrow Wilson International Center for Scholars.
- Healy, M., & Perry, C. (2000) Comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm *Qualitative market research: An international journal*, 3(3), pp. 118-126.
- Hayami, Y., & Godo, Y. (2005) *Development economics: From the poverty to the wealth of nations*. Oxford: Oxford University Press.
- Heltberg R., Siegel P. B., Jorgensen S. L. (2008) 'Climate Change, Human Vulnerability and Social Risk Management', *World Bank*, Washington, D.C.
- Hepburn, C. (2010) "Environmental policy, government, and the market" *Oxford Review of Economic Policy*, Vol 26, No. 2, pp.117-136.
- Hertel, T. W., & Rosch, S. D. (2010) Climate change, agriculture and poverty. *Applied Economics Perspectives and Policy*, 32(3), pp. 355-385.
- Hewitt, K. Wake, C.P. Young, G.J. David, C. (1989) Hydrological investigations at Biafo Glacier, Karakorum Range, Himalaya; An important source of water for the Indus River. *Annals of Glaciology*, Vol. 13, pp. 103-108.
- Hidore, J. J., & Oliver, J. E. (1993) *Climatology: An atmospheric science*. New York: Macmillan.
- Hiferding, R., (2009) *Böhm-Bawerk's Criticism of Marx*. Evergreen Review Inc.
- Higgins, J.W., Stephen, L., Douse, A., & Langston, R.H.W. (2012) Greater Impacts of wind farms in bird populations during construction than subsequent operation: results of a multisite and multispecies analysis, *Journal of Applied Ecology*, 49:2, pp. 386-394.
- Hoddinott, J. (2006) 'Shocks and Their Consequences Across and Within Households in Rural Zimbabwe', *Journal of Development Studies* 42(3), pp. 301-321.
- Hoddinott, J., and B. Kinsey. (2001) 'Child Growth in the Time of Drought.' *Oxford Bulletin of Economics and Statistics* 63(4), pp. 409-436.
- Hoekstra, A. Y., & Hung, P. Q. (2005) Globalisation of water resources: international virtual water flows in relation to crop trade. *Global Environmental Change*, 5(1), pp. 45-56.
- Horlings, L. G., & Marsden, T. K. (2012) Exploring the 'New Rural Paradigm' in Europe: Eco-economic strategies as a counterforce to the global competitiveness agenda.

- European Urban and Regional Studies*, Published online in May 2012. doi:10.1177/0969776412441934.
- Human Development Report. (1997) Retrieved from hdr.undp.org/en/content/human-development-report-1997
- Hussain, Akmal (2003) *Pakistan National Human Development 2003: Poverty, Growth and Governance*. Karachi, Oxford University Press.
- Hussain, A. (2004). Institutions, Economic Structure and Poverty in Pakistan. *South Asia Economic Journal*, 5(1), pp. 69-102.
- Hutton, M. and Symon, C., (1986) “The quantities of cadmium, lead, mercury and arsenic entering the UK environment from human activities”, *Sci. Total Environ.*, Vol. 57, pp.129-150.
- IAASTD. (2008) Food security in a volatile world. International Assessment of Agricultural Knowledge, Science and Technology for Knowledge. Available from: http://www.agassessment.org/docs/10505_FoodSecurity.pdf [Accessed 08 January 2012].
- IEA. (2015) Coal Industry Advisory Board International Coal Policy Developments in 2015. Retrieved from: https://www.iea.org/ciab/ciabmark_2015.pdf. (Accessed on 21 October 2016).
- IEA Clean Coal Centre. (2015) Coal and gas competition in power generation in Asia. Retrieved from: <http://www.iea-coal.org.uk/documents/83565/9241/Coal-and-gas-competition-in-power-generation-in-Asia,-CCC/246>. (Accessed on 21 October 2016).
- Ilyas, S. Z. (2005) “*Environmental Simulation in Quetta, Pakistan*”, (Unpublished doctoral dissertation). University of Baluchistan, Quetta, Pakistan.
- Ilyas, S. Z. (2007) A Review of Transport and Urban Air Pollution in Pakistan. *Journal of Applied Sciences and Environmental Management*, 11(2), pp. 113-121.
- International Permafrost Association. (n.d.). Retrieved from <http://ipa.arcticportal.org>
- IPCC Scientific Assessment (1990) *Report prepared for IPCC by Working Group I* J.T. Houghton, G.J. Jenkins and J.J. Ephraums (eds.). Cambridge University Press, Cambridge, Great Britain, New York, NY, USA and Melbourne, Australia.
- IPCC Impact Assessment (1998) *The Regional Impacts of Climate Change: An Assessment of Vulnerability*, edited by R.T.Watson, M.C.Zinyowera, R.H.Moss. Special Report of International Panel on Climate Change, Working Group II, Cambridge University Press, Cambridge, United Kingdom. pp. 253-330.

- IPCC (2001) *Climate Change 2001: Working Group II: Impacts, Adaptation and Vulnerability* http://www.grida.no/publications/other/ipcc_tar.
- IPCC (2007) *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- IPCC (2014) *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- IPCC (2014) *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- IUCN. (2011, February 14) IUCN and The Brooke join hands to help animals in the flood-affected areas. Retrieved from http://www.iucn.org/about/union/secretariat/offices/asia/asia_where_work/pakistan/?6983/IUCN-and-The-Brooke-join-hands-to-help-animals-in-the-flood-affected-areas
- Ivanic, M., & Martin, W. (2008) Implications of higher global food prices for poverty in low-income countries. *Agricultural Economics. WB Policy Research Department Working Paper 4594*.
- Jacoby, H., Skoufias, E. (1997) "Risk, Financial Markets, and Human Capital in a Developing Country." *Review of Economic Studies*, Vol. 64, pp. 311–335.
- Jackson, T. (2009) *Prosperity without growth: Economics for a finite planet*. London: Earthscan.
- Jamal, N. (2014) Available at: Sound bytes: 'Scrapping the water treaty is no solution'. Retrieved from: <http://www.dawn.com/news/1135898>.
- Jamal, U. (2016) Saving Pakistan's Dying Agriculture Sector. *The Diplomat*. Retrieved from <http://thediplomat.com/2016/06/saving-pakistans-dying-agriculture-sector>.
- Janjua, P. Z., Samad, G., & Khan, N. U. (2010) Impact of Climate Change on Wheat Production: A Case Study of Pakistan. *The Pakistan Development Review, PIDE*, 49(4), pp. 799-822.
- Jeroen, C., & Bergh, V. (1996) *Ecological economics and sustainable development: Theory, methods, and applications*. Cheltenham, UK: Edward Elgar.

- Johnson, S.R and Holt, M.T. (1997) The Value of Weather Information. In R.W Katz and A.H Murphy, eds. *Economic Value of Weather and Climate Forecasts*. NY: Cambridge University Press, pgs: 75-107.
- Jomo, K. S. (2005) *The pioneers of development economics: Great economists on development*. New Delhi: Tulika Books.
- Jones, J. A. (1997) *Global hydrology: Processes, resources and environmental management*. Harlow, Essex: Longman.
- Jones, J. A. (2008) *Global hydrology: Processes, resources and environmental management*. Harlow: Longman.
- Jones, O. B. (2002) *Pakistan: Eye of the storm*. Yale University Press.
- Jones, R.N. (2001) An environmental risk assessment/management framework for climate change impact assessments. *Natural Hazards*, 23(2), pp. 197-230.
- Jonker, J., & Pennink, B. J. (2010) *The essence of research methodology: A concise guide for master and PhD students in management science*. Berlin: Springer.
- Jorgenson, A. K., & Rice, J. (2005) Structural Dynamics of International Trade and Material Consumption: A Cross-National Study of the Ecological Footprints of Less-Developed Countries. *Journal of World-Systems Research*, 11(1), pp. 57-77.
- Jorgenson, D. W., & Wilcoxon, P. J. (1990) Environmental Regulation and U.S. Economic Growth. *Rand Journal of Economics*, 21(2), pp. 314-340.
- Jorgenson, D. W., & Wilcoxon, P. J. (1993) Reducing US carbon emissions: an econometric general equilibrium assessment. *Resource and Energy Economics*, Vol. 14, pp. 243-268.
- Jorgenson, D.W., & Wilcoxon, P.J. (1997) 'Fundamental U.S. Tax Reform and Energy Markets,' *The Energy Journal*, *International Association for Energy Economics*, vol. 0(Number 3), pages 1-30.
- Kardar S. (2003) 'Dogmatic Adherence to Macro Stability' Daily Times Lahore, 29 April 2003.
- Karp, L. (2005) Global warming and hyperbolic discounting. *Journal of Public Economics*, 89, pp. 261-282.
- Kauffman, S. (2010) *"The Attestation of the Self as a Bridge Between Hermeneutics and Ontology in the Philosophy of Paul Ricoeur"* (Doctoral dissertation). Retrieved from http://epublications.marquette.edu/dissertations_mu/34
- Keen, S. (2011) *Debunking economics: The naked emperor dethroned?* London: Zed Book.

- Kemal, A. R. (1995) Structural Adjustment, Employment, Income Distribution and Poverty. *Pakistan Development Review*, 33(4), pp. 901-914.
- Kemal, A. R. (1989) Fiscal Imbalances as an Obstacle to Privatisation Effort. *The Pakistan Development Review*, 28:4, pp. 1009–1019.
- Kemal, A. R. (2003) *Structural Adjustment and Poverty in Pakistan*. Pakistan Institute of Development Economics Islamabad.
- Khan, M. S. (1996) Government Investment and Economic Growth in the Developing World. *The Pakistan Development Review*, 35:4, pp. 419–439.
- Khan, M.A. (1986) ‘A review of the atmospheric pollutants in Pakistan. The City of Lahore’, *In Int. Symp. "Environmental pollution and toxicology"*, Hong Kong, Baptist College, Kowloon, Hong Kong.
- Khan, M. H. (1985) *Lectures on agrarian transformation in Pakistan*. Islamabad: Pakistan Institute of Development Economics.
- Khan, S. R. (1999) *Fifty years of Pakistan's economy: Traditional topics and contemporary concerns*. Karachi: Oxford University Press.
- Khan, et. al. (2011) Impact evaluation of structural adjustment program: a case of Pakistan. *European Journal of Economics, Finance and Administrative Sciences* ISSN 1450-2275 Issue 29 (2011) © EuroJournals, Inc. 2011
- Khan, S. R., (2007) Pakistan’s Economy since 1999: Has There Been Real Progress? *South Asia Economic Journal*, Vol. 8, No. 1.
- Kiani, K. (2016) Centre puts national water policy on hold. Dawn News. Published June 21, 2016.
- Kirman, N., Calika, N., & International Monetary Fund. (1994) International Trade Policies: The Uruguay Round and Beyond. *World Economic and Financial Surveys*.
- Kim, J.-II- Lau L. J.(1994) “The Sources of Economic Growth of the East Asian Newly Industrialized Countries,” *Journal of the Japanese International Economies*, (8)3, pp. 235-271.
- Kinsella, E.A. (2006) Hermeneutics and Critical Hermeneutics: Exploring Possibilities within the Art of Interpretation [47 paragraphs]. *Forum Qualitative Sozial forschung / Forum: Qualitative Social Research*, 7(3), Art. 19, <http://nbn-resolving.de/urn:nbn:de:0114-fqs0603190>.
- Kitchen, L., & Marsden, T. (2011) Constructing sustainable communities: a theoretical exploration of the bio-economy and eco-economy paradigms. *Local Environment: The International Journal of Justice and Sustainability*, 16(8), pp. 753-769.

- Kitzinger, J. (1995). Qualitative research: introducing focus groups. *BMJ*, 311(7000), pp. 299–302.
- Kling, C. L., & Rubin, J. (1997) Bankable permits for the control of environmental pollution. *Journal of Public Economics*, 64(1), pp. 101-115.
- Kogler, H. H. (1999) *The Power of Dialogue: Critical Hermeneutics after Gadamer and Foucault*. MIT Press.
- Kovel, J. (2007) *The enemy of nature: The end of capitalism or the end of the world?* London: Zed Books.
- Kuffner, I. B., Anderson, A. J., Jockiel, P. L., Rodgers, K. J., & MacKenzie, F. T. (2008) Decreased abundance of crustose coralline algae due to ocean acidification. *Nature GeoScience*, 1, pp. 114-117.
- Kugelman, M. (2013, March 13) Pakistan's Energy Crisis. Retrieved from <http://www.nbr.org/research/activity.aspx?id=323>
- Kuhn, T. S. (1970) *The structure of scientific revolutions*. Chicago: University of Chicago Press.
- Kvale, S. (1996) *Interviews: An introduction to qualitative research interviewing*. Thousand Oaks, CA: Sage Publications.
- Laffont, J.J. and Martimort, D. (2002) *The Theory of Incentives. The Principal-Agent model*, Princeton University Press.
- Lawson, C., Latsis, J., & Martins, N. (2007) *Contributions to social ontology*. London: Routledge.
- Lawson, T. (2003) *Reorienting economics*. London: Routledge.
- Lawson, T. (2004) *Economics and reality*. London: Routledge.
- LEAD, (2008) Retrieved from <http://www.lead.org.pk/lead/searchlead.aspx?valSrch=2008>
- LEAD, (2015) Our Programmes. Retrieved from <http://www.lead.org.pk/lead/Pages/programmes.aspx>.
- Lehman, & Joseph. (2015) Biochar for Environmental Management: Science and Technology | International Biochar Initiative. Retrieved from <http://www.biochar-international.org/projects/book>.
- Lewis, S. R., & Pakistan Institute of Development Economics. (1969) *Economic policy and industrial growth in Pakistan*. London: Allen & Unwin.
- Littau, K. (1992) Hermeneutics. *The Year's Work in Critical and Cultural Theory*, 2(1), pp. 46-51.
- List, F. (1966) *The national system of political economy*. New York: A.M. Kelley.

- Long, S. P., Ainsworth, E. A., Leakey, A. D., Nosberger, J., & Ort, D. R. (2006) Food for Thought: Lower-Than-Expected Crop Yield Stimulation with Rising CO₂ Concentrations. *Science*, 312(5782), pp. 1981-1921.
- Low, D. A. (1991) *The Political Inheritance of Pakistan*. London Macmillan.
- Löwy, M. (2005) *The theory of revolution in the young Marx*. Chicago: Haymarket Books.
- Löwy, M. (2015) *Ecosocialism: A radical alternative to capitalist catastrophe*. Chicago, Illinois: Haymarket Books.
- Machado, G., Schaeffer, R. and E. Worrell. (2001) 'Energy and carbon embodied in the international trade of Brazil: an input-output approach', *Ecological Economics*, 39, pp. 409-424.
- Maddison, Angus (2007) '*Contours of the World Economy, 1–2030 AD. Essays in Macro-Economic History*'. Oxford University Press.
- Malik, Sohail, J. (2005) Agricultural Growth and Rural Poverty: A Review of the Evidence. Pakistan Resident Mission *Working Paper No. 2*. Islamabad: ADB.
- Malik, .S.J. (2015) Agriculture Policy in Pakistan-what it is and what it should be. *Working Paper 2015*, Pakistan Institute of Development Economics.
- Manzoor, M., Tabssum, F., Javaid, H., and Qazi, J. (2015) Lucrative future of microalgal biofuels in Pakistan: a review. *International Journal of Energy and Environmental Engineering*, 10.1007/s40095-015-0186-9, pp. 393-403.
- Marx, K. (1973) *Grundrisse: Foundations of the critique of political economy*. New York: Vintage Books.
- Marx, K. (1975) *Wage-labour and capital*. New York: International Publishers.
- Marx, K., (1859) *A Contribution to the Critique of Political Economy*, Part 1, The Commodity. Progress Publishers, Moscow.
- Marx, K. (1990) *Capital: A critique of Political Economy Vol. I*. London: New Left Review: Penguin Classics.
- Marx, K. (1991) *Capital: A critique of Political Economy Vol. III*. London: New Left Review. Penguin Classics. .
- Marx, K. (1992) *Capital: A critique of Political Economy Vol.II*. London: New Left Review: Penguin Classic.
- Marx, K. (2013) *Capital*. Woodsworth Edition.
- Marx, K. (2012) *The poverty of philosophy*. Foreign Languages Publishers.
- Marx, K. (2013) *Theories of surplus value Marx-Engels Collection Book*. Pine Flag Books.

- Marx, K., & Engels, F. (1986) *Karl Marx and Frederick Engels: Selected works in one volume*. New York: International Publishers.
- Marx, K., Engels, F., Mandel, E., Fowkes, B., & Fernbach, D. (1990) *Capital: A critique of political economy*. London: Penguin Books in association with New Left Review.
- Marx, K., & Engels, F. (2011) *Economic and philosophic manuscripts of 1884*. Wilder Publications.
- Marx, K., & Engels, F. (1967) *Capital: A critique of political economy*. New York: International Publishers.
- Mas-Collel. (1995) *Microeconomics*. OUP USA: Int Edition.
- McDonald, B.J. (2002) Marx, Foucault, Genealogy, *Polity*, 34(13), pp. 259-275.
- McKibbin, W. J., & Wilcoxon, P. J. (1995) The Theoretical and Empirical Structure of the G-Cubed Model. *Brookings Discussion Paper in International Economics No. 18*, pp. 1-59.
- McPeak, J.G., and C.B. Barrett. (2001) "Differential Risk Exposure and Stochastic Poverty Traps among East African Pastoralists." *American Journal of Agricultural Economics* Vol. 83, pp. 674–679.
- Meek, R. L. (1973) *Studies in the labour theory of value*. London: Lawrence and Wishart.
- Meier, G. M., & Stiglitz, J. E. (2000) *Frontiers of development economics: The future in perspective*. Washington D. C.: World Bank.
- Mendelsohn, R., Morrison, W., Schlesinger, M. E., & Andronova, N. G. (1998) Country-specific market impacts of climate change. *Climatic Change*. 45(3), pp. 553-569.
- Mészáros, I. (2015) *The necessity of social control*. Monthly Review Press, U.S.
- Mills, E. (2012, June 15) Pakistan's Energy Crisis | United States Institute of Peace. Retrieved from <http://www.usip.org/publications/pakistans-energy-crisis>
- Mingers, J. (1992) Recent Developments in Critical Management Science. *Journal of The Operational Research Society*, 43(1), pp. 1-10.
- Ministry of Agriculture. (n.d.). Pakistan Agriculture Research Council. Retrieved from <http://www.parc.gov.pk/index.php/en/component/search/?searchword=agriculture%20policy&searchphrase=all&Itemid=101>.
- Ministry of Climate Change. (n.d.). Retrieved from <http://mocc.gov.pk/gop/index.php?q=aHR0cDovLzE5Mi4xNjguNzAuMTM2L21vY2xjLw%3D%3D>.

- Ministry of Environment. (2012) Ministry of Climate Change. Retrieved from <http://mocc.gov.pk/gop/index.php?q=aHR0cDovLzE5Mi4xNjguNzAuMTM2L21vY2xjL3BvbGljaWVzRGV0YWlscy5hc3B4>.
- Ministry of Industry and Production (MoIP). (n.d.) Sector Briefs - Sectoral Briefs. Retrieved from: http://www.smeda.org/index.php?option=com_phocadownload&view=category&id=28&Itemid=139.
- Mody, A., Roy, S., Wheeler, D., & Dasgupta, S. (1995) Environmental regulation and development: a cross-country empirical analysis. *World Bank Working Paper No. 1448 Washington DC*.
- Montgomery, D. (2007) *Dirt*. University of California Press.
- Mootz, F. J. (2008) Gadamer's Rhetorical Conception of Hermeneutics as the Key to Developing a Critical Hermeneutics. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1316033.
- Morduch, J. (1995) Income Smoothing and Consumption Smoothing. *Journal of Economic Perspectives*. Vol. 3 pp.103–114. OCHA.
- Morony, M. G. (2002) *Production and the Exploitation of Resources (The Formation of the Classical Islamic World)*. Aldershot, Hampshire: Ashgate/Variorum.
- Morris, P.M., Neuhauser, L., and Campbell, C.C. (1992) Food security in rural America: a study of the availability and costs of food. *J Nut Educ*, Vol. 24, pp. 52-58.
- Morton, J. F. (2007) Climate Change and Food Security Special Feature: The impact of climate change on smallholder and subsistence agriculture. *Proceedings of The National Academy of Sciences*, 104(50), pp. 19680–19685.
- Multidimensional Poverty Assessment Tool (MPAT), (2014) Retrieved from <http://www.ifad.org/mpat>.
- Munich Re. (2004) hw.d / Annual Report 2004. Retrieved from http://www.hwdesign.de/en/projects/project/geschaeftsbericht_2004.
- Munich Re. (2006) Two new Munich Re publications | Munich Re. Retrieved from <http://www.munichre.com/en/media-relations/publications/press-releases/2006/2006-02-23-press-release/index.html>.
- Muradian, R., & Martinez-Alier, J. (2001) Trade and the environment: from a ‘Southern’ perspective. *Ecological Economics*, 36 (2001), pp. 281 – 297.
- Muzamil, H. (2015) Pak Energy Mix Power and Politics. Dawn News. Retrieved from: <http://www.dawn.com/news/1210831>.

- Napoles, P. R. (2014) Macro Policies For Climate Change: Free Market Or State Intervention? *World Economic Review*, Vol. 3, pp. 90-108.
- Naeem, W. (2013) *Paradigm Shift? Pakistan launches first National Climate Change Policy*. The Express Tribune.
- Naqvi, F. (1998) A computable general equilibrium model of energy, economy and equity interactions in Pakistan. *Energy Economics*, Vol. 20, pp. 347-373.
- Naqvi, S. N. (2002) *Development economics-- nature and significance*. New Delhi: Sage.
- Narain, U., & Veld, K. V. (2008) The Clean Development Mechanism's Low-hanging Fruit Problem: When Might it Arise, and How Might it be Solved? *Environmental & Resource Economics*, 40(3), pp. 445-465.
- Narayan, D., The International Bank for Reconstruction and Development. (2000) *Voices of the poor*. Oxford University Press.
- Narayan, D., Petesch, P. L., Pritchett, L., & Kapoor, S. (2007) *Moving out of poverty*. Basingstoke: Palgrave.
- National GHG Inventory Submission, UNFCCC. (2008) Retrieved from: unfccc.int/national_report/annex_i_ghg/inventories/national_inventories-submission/items.4303.ph.
- NASA. (n.d.). Retrieved from <http://www.nasa.gov>.
- Naureen, M. (2009) Development of Environmental Institutions and Laws in Pakistan. *Pakistan Journal of History and Culture*, 30(1), pp. 93-112.
- Nussbaum, M. C., Sen, A., & World Institute for Development Economics Research. (1993) *The Quality of life*. Oxford England: Clarendon Press.
- NCCP, (2012) *National Climate Change Policy*. Government of Pakistan Climate Division.
- NCCP, (2013) *National Climate Change Policy*. Government of Pakistan Climate Division.
- NDMA, (2014) Annual Report. Retrieved from: <http://www.ndma.gov.pk/dynamic>.
- Newell, P. (2012) *Globalization and the environment: Capitalism, ecology and power*. Cambridge: Polity.
- Newell, R.G. (2008) "International Climate Technology Strategies." Discussion Paper 08-12, *Harvard Project on International Climate Agreements, Belfer Centre for Science and International Affairs*, Harvard Kennedy School, October 2008.
- NOAA - National Oceanic and Atmospheric Administration. (n.d.). Retrieved from <http://www.noaa.gov/>.

- Noman, A., (2015) The Return of Industrial Policy and Revival of Pakistan's Economy: Possibilities of Learning, Industrial and Technology Policies. *The Lahore Journal of Economics* (September 2015) pp. 31-58.
- Nordhaus, W. D. (1994) *Managing the global commons: The economics of climate change*. Cambridge, MA: MIT Press.
- Nordhaus, W. D. (2006) After Kyoto: Alternative Mechanisms to Control Global Warming. *American Economic Review*, 96(2), pp. 31-34.
- Nordhaus, W. D. (2007) A Review of the Stern Review on the Economics of Climate Change. *Journal of Economic Literature*, 45(3), pp. 687-702.
- Nordhaus, W. D., & Boyer, J. (2000) *Warming the world: Economic models of global warming*. Cambridge, MA: MIT Press.
- Nordhaus, W. D., & National Bureau of Economic Research. (2004) *Schumpeterian profits in the American economy: Theory and measurement*. Cambridge, MA: National Bureau of Economic Research.
- O'Boyle, B., & McDonough, T. (2011) Critical realism, Marxism and the critique of neoclassical economics. *Capital & Class*, 35(1), pp. 3-22.
- Oki, T., Entekhabi, D. and Harrold, T. I. (2004) *The Global Water Cycle, in The State of the Planet: Frontiers and Challenges in Geophysics* (eds R.S.J. Sparks and C.J. Hawkesworth), American Geophysical Union, Washington, D. C.
- Olmos, S. (2001) *Vulnerability and adaptation to climate change: Concepts, issues, assessment methods* | SEA Change CoP. Retrieved from: <http://www.seachangecop.org/node/977>.
- Oostindie, H., R. van Broekhuizen, G. Brunori and J.D. van der Ploeg (2008) The endogeneity of rural economics, in: Ploeg, J.D. vander and T. Marsden (eds.), *Unfolding Webs, the dynamics of regional rural development*, Assen, Royal Van Gorcum, pp. 53-67.
- OPHI. (2010) *OPHI Country Briefing 2010: Multidimensional Poverty Index (MPI)* (OPHI Working Paper 38 and UNDP Research Paper Series.). Oxford Poverty and Human Development Initiative (OPHI).
- Osborne, G. R. (1991) *The hermeneutical spiral: A comprehensive introduction to biblical interpretation*. Downers Grove, IL: InterVarsity Press.
- Osgood, D., Hellmuth, M.E. (2010) Annex- Index Insurance and Climate Risk: Prospects for Development and Disaster Management. *IRI Technical Report 10-10*.

- Outhwaite, W. (1987) *New philosophies of social science: Realism, hermeneutics, and critical theory*. New York: St. Martin's Press.
- Pakistan Agricultural Policy, (1991) Pakistan Agriculture Research Council. Retrieved from <http://www.parc.gov.pk/index.php/en/component/search/?searchword=agricultural%20policy&searchphrase=all&Itemid=101>
- Pakistan Economic Survey 1992-1993* (1993) Retrieved from <http://121.52.153.178:8080/xmlui/handle/123456789/6563>
- Pakistan Economic Survey 2014-15*. (2015) Retrieved from www.finance.gov.pk/survey/chapters_15/01_Growth.pdf
- Pakistan National Commission on Agriculture, (1988) *Report of the National Commission on Agriculture*. Islamabad: Ministry of Food and Agriculture Government of Pakistan.
- Pakistan Planning Commission (2004) Ministry Of Planning, Development & Reforms: Pakistan Participatory Poverty Assessment. Retrieved from <http://www.pc.gov.pk/>
- Pakistan Planning Commission, (2012) Ministry Of Planning, Development & Reforms, Task Force.
- Palit, D., Chaurey, A. (2011) Off-grid rural electrification experiences from South Asia: Status and best practices. *Energy for Sustainable Development*, 15(2011) pp. 266-276. Elsevier Inc.
- PAMA - Pakistan Automotive Manufacturers Association. (n.d.). Retrieved from <http://www.pama.org.pk/>
- Papanek, G. F. (1967) *Pakistan's development*. Cambridge, MA: Harvard Univ. Press.
- Parikh, A., & Thorbecke, E. (1996) Impact of Rural Industrialization on Village Life and Economy: A Social Accounting Matrix Approach. *Economic Development and Cultural Change*, 44, pp. 351-377.
- Parks, B. C., & Roberts, J. T. (2007) *A climate of injustice: Global inequality, North-South politics, and climate policy*. Cambridge, MA: MIT Press.
- Parry, M. L., Rosenzweig, C., Iglesias, A., Livermore, M., & Fischer, G. (2004) Effects of climate change on global food production under SRES emissions and socio-economic scenarios. *Global Environmental Change-human and Policy Dimensions*, 14, pp. 53-67.
- Parry, M., Rosenzweig, C., & Livermore, M. (2005) Climate change, global food supply and risk of hunger. *Philosophical Transactions of The Royal Society B: Biological Sciences*. doi:10.1098/rstb.2005.1751

- Patton, M. Q. (2002) *Qualitative research and evaluation methods*. Thousand Oaks, CA: Sage Publications.
- Pearce, F. (2006) *When the rivers run dry: Water, the defining crisis of the twenty-first century*. Boston: Beacon Press.
- Peet, R., & Hartwick, E. R. (1999) *Theories of development*. New York: Guilford Press.
- Pepper, D. (1993) *Eco-socialism: From deep ecology to social justice*. London: Routledge.
- Pepper, D. (1996) *Modern environmentalism: An introduction*. London: Routledge.
- Pervaiz, H. (1997) *Pakistan's economy at the crossroads: Past policies and present imperatives*. Karachi: Oxford University Press.
- PIDE Policy Review, (2007) Retrieved from: www.pide.org.pk/pdf/PolicyViewPoint/viewpoin3-2007.pdf.
- Pierrehumbert, R. T. (2010) *Principles of planetary climate*. Cambridge: Cambridge University Press.
- PILDAT. (2009) Pakistan Institute for Legislative Development and Transparency: climate change. Retrieved from <http://www.insightonconflict.org/?s=climate+change>
- Pizer, William A. (1999) Optimal choice of policy instrument and stringency under uncertainty: the case of climate change. *Resource and Energy Economics*, 21 (34), pp. 255-287.
- Pizer, William A. (2002) Combining price and quantity controls to mitigate global climate change. *Journal of Public Economics*, 85 (3), pp. 409-434.
- PMD (2014) Climate Change in Pakistan. Retrieved from <http://www.pmd.gov.pk/repot/rnd-pdf>.
- Polyani, M. (1962) *The Republic of Science - Its Political and Economic Theory*. Retrieved from: <http://itech.fgcu.edu/faculty/bhobbs/Polyani%201962%20The%20Republic%20of%20Science.pdf>.
- PRES (2007) Pakistan Renewable Energy Society. Retrieved from: <http://www.pres.org.pk/category/reaepakistan/bio-mass/>
- Prabhat, P., & Chandrasekhar, C. P. (1995) Indian Economy under 'Structural Adjustment'. *Economic and Political Weekly*, 30(47), pp. 3001-3013.
- Proctor, J. D. (1998) The Social Construction of Nature: Relativist Accusations, Pragmatist and Critical Realist Responses. *Annals of The Association of American Geographers*, 88(3), pp. 352-376.
- Puu, T., (2015) *Time and Space in Economic Theory*, CERUM, UmeÅ University, SE- 90187 UmeÅ, Sweden.

- Quinn, M.J (1985) 'Factors affecting blood lead concentration in the U.K. Results of the EEC blood lead surveys', *Int. J. Epidemiol*, 14(1985), pp. 420-431.
- Raffer, K., & Singer, H. W. (2001) *The economic North-South divide: Six decades of unequal development*. Cheltenham, U.K: Edward Elgar.
- Rahmstorf, S. (2003) Timing of abrupt climate change: A precise clock. *Geophysical Research Letters*, 30(10). doi:10.1029/2003GL017115
- Rahmstorf, S., & Richard, K. (2007) *Our threatened oceans*. London, U.K: Haus Pub.
- Raina, V.K. (2009) Himalayan glaciers: A state-of-art review of glacial studies, glacial retreat and climate change. *MoEF Discussion Paper. New Delhi, India*. Ministry of Environment and Forests.
- Raleigh, C., Jordon, L., & Salehyan, I. (2008) *Assessing the impact of Climate Change on migration and conflict. Paper prepared for World Bank seminar on 'Exploring the Social Dimension of Climate Change'*. Washington DC: WB.
- Rashid, A. (1997) The New Great Game: The Battle for Central Asia's Oil. *Far Eastern Economic Review*, 10 April 1997.
- Rashid, A. (2008) *Descent into chaos: The United States and the failure of nation building in Pakistan, Afghanistan, and Central Asia*. New York: Viking.
- Rasmussen, et.al. (2004) Evolution: Transition from Non-Living to Living Matter. *Science*, 303(5660), pp. 963-965.
- Ravallion, M. (1996) Issues in Modelling and Measuring Poverty. *Economic Journal*, 106(438), pp. 1328-1343.
- Ravallion, M. (2010) The developing world's bulging (but vulnerable)"middle class". *World Development*, 38(4), pp. 445–454.
- Ravallion, M. (2011) On multidimensional indices of poverty. *Journal of Economic Inequality*, 9(2), pp. 235–248.
- Ravallion, M. (2011) The two poverty enlightenments: historical insights from digitized books spanning three centuries. *Poverty and Public Policy*, 3(2), pp. 1-46.
- Ravallion, M. (2012) Poor, or just feeling poor? on using subjective data in measuring poverty. *WB Policy Research Working Paper No. 5968*.
- Ravallion, M., Chen, S., Sangraula, P. (May 2008) Dollar a Day Revisited (PDF Report) *Washington DC: The World Bank*. Retrieved 10 June 2013.
- Rawls, J. (1971) *A theory of justice*. Cambridge, MA: Belknap Press of Harvard University Press.

- Reilley, J., Hohmann, N., & Kane, S. (2001) Climate Change and Agricultural Trade: who benefits and who loses? *Global Environmental Change*, 4(1), pp. 24-36.
- Reuveny, R. (2007) Climate change-induced migration and violent conflict. *Political Geography*, 26(6), pp. 656-673.
- Ribot, J. C. (1995) The causal structure of vulnerability: Its application to climate impact analysis. *Geojournal*, 35(2), pp. 119-122.
- Ribot, J. C., Magalhaes, A. R., Panagides, S. S., & Esquel Group Foundation Brazil. (1995) *Climate variability, climate change and social vulnerability in the semi-arid tropics*. Cambridge University Press.
- Ribot, J. C., Magalhães, A. R., & Panagides, S. S. (1996) *Climate variability, climate change, and social vulnerability in the semi-arid tropics*. Cambridge: Cambridge University Press.
- Ricardo, D. (2004) *On the principles of political economy and taxation*. London: Dover Publications.
- Rice, J. (2007) Ecological Unequal Exchange: Consumption, Equity, and Unsustainable Structural Relationships within the Global Economy. *International Journal of Comparative Sociology*, 48(1), pp. 43-72.
- Rice, J. (2007) Ecological Unequal Exchange: International Trade and Uneven Utilization of Environmental Space in the World System. *Social Forces*. 85 (3), pp. 1369-1392.
- Richards, R. N., & Stavins, K. R. (2005) The Cost of U.S. Forest-based Carbon Sequestration. *Pew Centre on Global Climate Change*. Retrieved from: <http://www.c2es.org/publications/cost-us-forest-based-carbon-sequestration>.
- Ricœur, P. (1992) *Oneself as another*. Chicago: University of Chicago Press.
- Ricœur, P., & Taylor, G. H. (1984) *Lectures on ideology and utopia*. New York: Columbia University Press.
- Rizvi, J. (2015) Demystifying Pakistan's Energy Crisis. *MIT Technology Review Pakistan*. Retrieved from: <http://www.technologyreview.pk/demystifying-pakistans-energy-crisis/>. (Accessed: 19 October 2016).
- Roberts, J. T., & Parks, B. C. (2007) *A climate of injustice: Global inequality, North-South politics, and climate policy*. Cambridge, MA: MIT Press.
- Rosdolsky, R., & Burgess, P. (1977) *The making of Marx's 'Capital'*. London: Pluto Press.
- Rosegrant, M. W., Cai, X., & Cline, S. A. (2002) World Water and Food to 2025: Dealing with Scarcity. *International Food Policy Research Institute*, Washington, D.C.

- Rosenzweig, C., Iglesias A. (1994) Implications of climate change for international agriculture: crop modeling study. *US Environmental Protection Agency*, Washington, DC.
- Rosenzweig, et al. (2001) 'Climate change and extreme weather events; Implications for food production, plant diseases, and pests,' *Global Change & Human Health*, 2(2), pp. 90-104.
- Rosenzweig, C., and D. Hillel. (2000) "Soils and global climate change: Challenges and opportunities," *Soil Science*, Vol. 165, pp. 47-56.
- Rosenzweig, C., Parry M.L. (1994) Potential impacts of climate change on world food supply. *Nature*. 367, pp. 133–138.
- Rosset, P., Collins, J., & Frances-Moore, L. (2000) 'Lessons from the Green Revolution' *Tikkun Magazine*, Vol. 15, Issue 2, pp. 52-56.
- Roth, I.J. (1971) Government and the Development of Industry in Pakistan --1947-1967. *Journal of Asian Survey*. 11(6), pp. 570-581.
- Roychowdhury, A. (2002) Submission to Discussion Forum on Enforcing Emission Standards for In-Use Vehicles, July 17, *The World Bank*, Washington, DC; available at <http://lnweb18.worldbank.org/SAR/sa.nsf/All/2F391E72031478F6>.
- Roychowdhury, A. (1997) Ozone: the other angle. *Down to Earth*. 6(14), pp. 20–23.
- Ruth, M., & Ibarrarán, M. E. (2009) *Distributional impacts of climate change and disasters: Concepts and cases*. Cheltenham, UK: Edward Elgar.
- Rutherford, T.F. (1992) 'The Welfare Effects of Fossil Carbon Restrictions: Results from a Recursively Dynamic Trade Model', *OECD Economics Department Working Papers*, No. 112.
- Sachs, J. (2005) *The end of poverty: How we can make it happen in our lifetime*. London: Penguin.
- Saeed, A. (2015) Pakistan shelves six coal-fired power projects. *ClimateHome*. Retrieved from: <http://www.climatechangenews.com/2015/03/26/pakistan-shelves-six-coal-fired-power-projects/>
- Saleem, H.A. (2006) Resolving environmental conflicts in Pakistan's energy policy. Prepared for the *Woodrow Wilson International Center for Scholars*, Washington DC. Retrieved from: www.wilsoncenter.org.
- Samuelson P. A. (1950) Spatial price equilibrium and linear programming. *American Economic Review*, 42, pp. 283–303.
- Samuelson, P., Nordhaus, W. (2004) *Economics*. McGraw Hill Publications.

- Sanchez-Triana., Afzal, J., Enriquez, S. (2014) *'The Role of International Organisations and Development Banks in Pakistan's Environmental Impact Assessment Practices'*, IUCN Pakistan Publication, pp. 58-81.
- Santos, P., Barrett, C. (2006a) "Heterogeneous Wealth Dynamics: On the Roles of Risk and Ability." *Working paper*, Cornell University.
- Santos, P., Barrett, C. (2006b) Informal Insurance in the Presence of Poverty Traps: Evidence from Southern Ethiopia. *Working paper*, Cornell University.
- Saunders, M., Lewis, P., Thornhill, A. (2009) *Research Methods for Research Students*. Pearson Education Limited.
- Savoskul, O. S., & Vladimir, S. (2013) Glacier Systems and Seasonal Snow Cover in Six Major Asian River Basins: Hydrological Role under Changing Climate. *IWMI Research Report*, (150) CGIAR.
- Sayed, A. (1995) *Political Alignments, the State and Industrial Policy in Pakistan: A Comparison of Performance in the 1960s and 1980s*. Doctoral dissertation, Cambridge University, Cambridge, UK.
- Schapiro, M. (2007) *Exposed: The toxic chemistry of everyday products : who's at risk and what's at stake for American power*. White River Junction, VT: Chelsea Green Pub.
- Schapiro, M. (2014) *Carbon shock: A tale of risk and calculus on the front lines of the disrupted global economy, how carbon is changing the cost of everything*. Chelsea Green Publishing.
- Schatzki T., Stavins, R.N. (2012) Using the value of allowances from California's GHG Cap and Trade System. Retrieved from: http://www.analysisgroup.com/uploadedFiles/Publishing/Articles/Value_Allowances_California_GHG_Cap_Trade_System.pdf.
- Schneider, S. H., & Goulder, L. H. (1997) Achieving low-cost emissions targets. *Nature*, 389, pp. 13-14.
- Schmalensee, R. (1993) Comparing greenhouse gases for policy purposes. *The Energy Journal* 14, pp. 245-255.
- Schmidt, G, Wolfe, J., (2008) *Climate Change: Picturing the Science*. W. W. Norton & Company.
- Seale, C., Gobo, G., Gubrium, J.F., Silverman, D. (2007) *Qualitative Research Practise*. Sage Publications.

- Seawright, J., Gerring, J., & Sridhar, M. S. (2008) Case Selection Techniques in Case Study Research: A Menu of Qualitative and Quantitative Options. *Political Research Quarterly*, 61(2), pp. 294-308.
- Sen, A. (1981) *Poverty and famines: An essay on entitlement and deprivation*. Oxford: Clarendon Press.
- Sen, A. (1989) Development as Capability Expansion. *Journal of development planning*, (19), pp. 41-58.
- Sen, A. (1999) *Development as freedom*. New York: Knopf.
- Sen, A. (2009) *The idea of justice*. Harvard University Press.
- Sen, A. K. (1993) Capability and Well-Being. In Nussbaum, M., Sen, A. eds *The Quality of Life*, pp. 30-53.
- SHAFIYUDDIN, M. (1998) HOW DID DEVELOPED COUNTRIES INDUSTRIALIZE? THE HISTORY OF TRADE AND INDUSTRIAL POLICY: THE CASES OF GREAT BRITAIN AND THE USA. No. 139. UNCTAD/OSG/DP/139.
- Shah, S., Bhatti, M.K.L. (2009) Crisis of Electrical Energy in Pakistan and Future guideline for Policy makers. *International Journal of Basic & Applied Sciences*, 9(9), pp. 1–17.
- Shakoor, U., Saboor, A., Ikram, A., Mohsin, A.Q. (2011) Impact of Climate Change on Agriculture: Empirical Evidence from Arid Region. *Pak. J. Agri. Sci.* 48(4), pp. 327-333.
- Shukla, S.K. (2011) Maintenance of solar power plants. *Presentation made at the workshop on off-grid access system in South Asia* [January 6, 2011; New Delhi].
- Siddiqui, R. (2006) The Role of Household Income and Public Provision of Social Services in Satisfaction of Basic Needs in Pakistan: A Cross District Analysis. *The 22nd Annual General Meeting and Conference of The Pakistan Society of Development Economists*, PIDE, Islamabad.
- Siddiquie, R. Malik, A. (2001) Debt and Economic Growth in South Asia. *The Pakistan Development Review* 40(4), pp. 677–688.
- Silverman, D. (2000) *Doing qualitative research: A practical handbook*. London: Sage Publications.
- Silverman, D. (2001) *Interpreting qualitative data: Methods for analyzing talk, text, and interaction*. London: Sage Publications.
- Silverman, D. (2004) *Qualitative research: Theory, method and practice*. London: Sage Publications.

- Silverman, D. (2007) *A very short, fairly interesting and reasonably cheap book about qualitative research*. Los Angeles: SAGE.
- Sims, H. (1988) *Political regimes, public policy, and economic development: Agricultural performance and rural change in two Punjabs*. New Delhi: Sage Publications.
- Skees, J.R., and Barnett, B. (2006) Enhancing Micro Finance Using Index-based Risk Transfer Products. *Agricultural Finance Review*. Vol. 66, pp. 235–250.
- Skoufias, M., Rabassa, M., Olivieri, S. (2011) *The poverty impacts of climate change: a review of the evidence*. Policy Research working paper ; no. WPS 5622. Washington, DC: World Bank.
- Smith, M. L. (2006) Overcoming theory-practice inconsistencies: Critical realism and information systems research. *Information and Organization*. Vol, 16, pp. 191-211.
- Smith, A. (2008) *Wealth of Nations*. Oxford University Press Inc., New York.
- Smith, P. (2012) Agricultural greenhouse gas mitigation potential globally, in Europe and in the UK: what have we learnt in the last 20 years? *Global Change Biology*. Vol. 18, p. 35–43.
- Smith, Joel B., Tirpak, D. (1989) The Potential Effects of Global Climate Change on the United States: *Report to Congress*. United States Environmental Protection Agency: Washington, D.C. EPA-230-05-89-050.
- Söderbaum, P. (2000) *Ecological economics: A political approach to environment and development*. London: Earthscan.
- Sokolov, et.al. (2009) Probabilistic Forecast for 21st Century Climate Based on Uncertainties in Emissions (without Policy) and Climate Parameters. *MIT Joint Program on the Science and Policy of Global Change*. Report No. 169.
- Spencer, R. W. (2008) *Climate confusion: How global warming hysteria leads to bad science, pandering politicians, and misguided policies that hurt the poor*. New York: Encounter Books.
- Staff Report (JFIT), (2011) *Judicial Flood Inquiry report on Canal and Spur Breaches in Punjab*. The Judicial Flood Inquiry Tribunal (JFIT).
- Stake, R. E. (1995) *The art of case study research*. Thousand Oaks: Sage Publications.
- Stavrianos, L. S. (1981) *Global rift: The Third World comes of age*. New York: Morrow.
- Steiner, A., & Maxwell, D. (2013) Sustainability at a Profit - Project Syndicate [25 April 2013].
- Stern, N. (2007) *The economics of climate change: The Stern review*. Cambridge University Press.

- Stern, N., Bowen, A., & Whalley, J. (2014) *The Global Development of Policy Regimes to Combat Climate Change*. Singapore: World Scientific Publishing Company.
- Stern, N. (2015) *Inequality and Climate Change - The Graduate Centre CUNY Special Presentation* [Video file]. Retrieved from <http://www.youtube.com/watch?v=claASDi9Ktm>
- Stiglitz, J.E., (1991) 'The Invisible Hand and Modern Welfare Economics' *Working Paper No. 3641 National Bureau of Economic Research*, Cambridge, MA, March 1991.
- Stiglitz, J. (2006) *Making Globalisation Work*. Penguin London.
- Stiglitz, J. (2002) *Globalisation and its Discontent*. Penguin London.
- Stiglitz, J. (2013) Increasing Inequality within Countries: The Cost for the World's Economies. | *Columbia Business School Newsroom*. Retrieved from <http://www8.gsb.columbia.edu/newsroom/newsn/2349/>
- Stiglitz, J., Sen, A., & Fitoussi, J. P. (2009) *Report by the Commission on the Measurement of Economic Performance and Social Progress*. Retrieved from The Commission, Paris website: <http://stiglitzsenfitoussi.fr/en/index.htm>.
- Sweezy, P. M. (1970) *The theory of capitalist development: Principles of Marxian political economy* New York: Monthly Review Press.
- Syed, M. A. (2005) Another development strategy for Pakistan. *Daily Times, Business Plus*. Retrieved from http://www.dailytimes.com.pk/default.asp?page=story_31-5-2005_pg3_5 (1 of 2)5/3/2006 11:21:14 PM
- Szatzschneider W and Kwiatkowska, T. (2008) 'Environment & Principal - Agent approach, *Riskmathics*. <http://www.riskmathics.com/files/PODCAST/Environment-Principal-Agent-approach-Wojciech-Szatzschneider.pdf>.
- The Constitution of the Islamic Republic of Pakistan, (2013) The National Assembly of Pakistan. Retrieved from: www.na.gov.pk/uploads/documents/333523681_951.pdf.
- The Farming Systems Trials: Rodale Institute. (n.d.). Farming Systems Trial: 30-year Report | Rodale Institute. Retrieved from <http://rodaleinstitute.org/our-work/farming-systems-trial/farming-systems-trial-30-year-report/>.
- Thomas, A. (2008) Focus groups in qualitative research: culturally sensitive methodology for the Arabian Gulf? *International Journal of Research & Method in Education*, 31(1). doi:10.1080/17437270801919941
- Thomas D., Beegle, K., Frankenberg, E., Sikoki, B., Strauss, J., and Teruel, G. (2004) Education in Crisis. *Journal of Development Economics* Vol. 74, pp. 53–85.

- Thompson, J. B. (1995) *Critical hermeneutics: A study in the thought of Paul Ricoeur and Jürgen Habermas*. Cambridge University Press.
- Tol, R. S. (1999) The Marginal Damage Cost of GHG Emissions. *The Energy Journal*, Vol. 2, pp. 61-81.
- Tol, R. S. (2002a) Estimates of the damage costs of climate change: Part 1: Benchmark estimates. *Environmental & Resource Economics*, 21(1), pp. 47-73.
- Tol, R. S. (2002b) Estimates of the damage costs of climate change: Part II. Dynamic estimates. *Environmental & Resource Economics*, 21, p. 125-160.
- Tol, R. S. (2003) Is the uncertainty about climate change too large for expected cost-benefit analysis? *Climatic Change*, 56, pp. 265-289.
- Tol, R. S. (2004) The marginal damage costs of carbon dioxide emissions: An assessment of the uncertainties. *Energy Policy*, 33, pp. 2064-2074.
- Tol, R. S., Downing, T. E., Kuik, O. J., & Smith, J. B. (2004) Distributional aspects of climate change impacts. *Global Environmental Change-human and Policy Dimensions*, 14, pp. 259-272.
- Tol, R. S., & Yohe, G. W. (2006) A Review of the Stern Review. *World Economics*, 7(4), pp. 233-250.
- Tol, R. S., & Yohe, G. W. (2007) A Stern Reply to the Reply to the Review of the Stern Review. *World Economics*, 8(2), pp. 153-159.
- Tol, R. S., & Yohe, G. W. (2007) *Precaution and a Dismal Theorem: Implications for Climate Policy and Climate Research*. University of Hamburg.
- Tol, R.S. (2007) The Social Cost of Carbon: Trends, Outliers and Catastrophes. Economics Discussion Papers, No 2007-44, *Kiel Institute for the World Economy*. Retrieved from: <http://www.economics-ejournal.org/economics/discussionpapers/2007>
- Trenberth, K. E. (2010) Changes in Precipitation with Climate Change. *Climate Research*, 47(1-2), pp. 123-138.
- Trenberth, K. E., & Karl, T. R. (2003) Modern Global Climate Change. *Science*, 302(2651), pp. 1719-1723.
- Trenberth, K. E., Rasmussen, R., Parsons, D.B. (2003) The changing character of precipitation. *Bull. Amer. Meteor. Soc.*, 84, pp. 1205-1217.
- Trigg, Andrew (2006) *Marxian Reproduction Schema: Money and Aggregate demand in a Capitalist Economy*. New York: Routledge.

- Trucost, (2013) TEEB natural capital at risk business externalities. Retrieved from <http://www.trucost.com/published-research/99/natural-capital-at-risk-the-top-100-externalities-of-business>.
- UNEP, (1985). The Vienna Convention for the Protection of the Ozone Layer. Retrieved from http://ozone.unep.org/new_site/en/Treaties/treaties_decisions-hb.php?sec_id=155
- UNEP,(1999) Retrived from: <http://www.unep.org/climatechange/SearchResults/tabid/130/Default.aspx?Search=UNEP+1999>.
- UNFCCC (1992) Retrieved from [unfccc/int/resource/docs/convkp.conveng.pdf](http://unfccc.int/resource/docs/convkp.conveng.pdf)
- UNIDIO, (2000) *INDUSTRIAL POLICY AND THE ENVIRONMENT IN PAKISTAN*. Cleaner Production and Environmental Management Branch, Sectoral Support and Environmental Sustainability. NC/PAK/97/018.
- Varoufakis, Y. (2013) *The global minotaur: America, Europe and the future of the global economy*. London: Zed Books.
- Varoufakis, Y. (2015) *Economic indeterminacy: A personal encounter with the economists' peculiar nemesis*.
- Varoufakis, Y., & Young, D. (1990) *Conflict in economics*. New York: St. Martin's Press.
- Varoufakis, Y., Holland, S., Galbraith, J.K. (2013) *Modest Proposal for Resolving the Eurozone Crisis, Version 4*. Retrieved from: <https://varoufakis.files.wordpress.com/2013/07/a-modest-proposal-for-resolving-the-eurozone-crisis-version-4-0-final1.pdf> (Accessed: 12 May 2016).
- Varoufakis (2015) *Policy Framework for Greece*. Available at: <https://varoufakis.files.wordpress.com/2015/08/policy-framework-for-greeces-fiscal-consolidation-recovery-and-growth.pdf> (Accessed: 13 January 2016).
- Viqar, A., Amjad, R. (1984) *The Management of Pakistan's Economy 1947–82*. Karachi: Oxford University Press.
- Waqas, N. (2013) Paradigm shift: Pakistan launches first National Climate Change Policy - *The Express Tribune*. [27 February 2013] Retrieved from <http://tribune.com.pk/story/513157/paradigm-shift-pakistan-launches-first-national-climate-change-policy/>.
- Wapner, P., Mathew, R.A. (2009) The Humanity of Global Environmental Ethics. *The Journal of Environment and Development*. Vo. 18, pp. 203-222.

- Watson, R. T. (1995) IPCC Second Assessment Report Climate Change SAR. Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses. *Working Group II IPCC*.
- Watson, R. T., Zinyowera, M. C., & Moss, R. H. (1998) The Regional Impacts of Climate Change - An Assessment of Vulnerability. *A Special Report of IPCC Working Group II*. Cambridge University Press.
- Weitzman, M. L. (1998) 'Why the far distant future should be discounted at its lowest possible rate', *Journal of Environmental Economics and Management*, 36(3), pp. 201–208.
- Weitzman, M. (2007) Subjective Expectations and Asset-Return Puzzles. *American Economic Review*. 97(4), pp. 1102-1130.
- Weitzman, M. (2007) A Review of The Stern Review on the Economics of Climate Change. *Journal of Economic Literature*. 45(3), pp. 703-724.
- Weitzman, M. (2009) *Some Basic Economics of Climate Change*. *Changing Climate, Changing Economy*. Edward Elgar; 2009.
- Weitzman, M. (2009) On Modeling and Interpreting the Economics of Catastrophic Climate Change. *Review of Economics and Statistics*, 91(1), pp. 1-19.
- Weitzman, M., Gollier C. (2010) How Should the Distant Future be Discounted When Discount Rates are Uncertain?. *Economic Letters*. 107(3), pp. 350-355.
- Weitzman, M. (2011) Fat-Tailed Uncertainty in the Economics of Catastrophic Climate Change. *Review of Environmental Economics and Policy*. 2011;5(2), pp. 275-292.
- Weitzman, M. (2012) "The Ramsey Discounting Formula for a Hidden-State Stochastic Growth Process" *Journal of Environmental and Resource Economics*. 53(3), p. 309-321.
- Weitzman, M. (2012) GHG Targets as Insurance Against Catastrophic Climate Damages. *Journal of Public Economic Theory*. 14(2), p. 221-244.
- Weitzman, M. (2014) Can Negotiating a Uniform Carbon Price Help to Internalize the Global Warming Externality? *Journal of the Association of Environmental and Resource Economists*. 1(1/2), p. 29-49.
- Weitzman, M. (2014) Should Governments Use a Declining Discount Rate in Project Analysis? *Review of Environmental Economics and Policy*. 8(2), p. 145-163.
- Weitzman, M. (2014) Fat Tails and the Social Cost of Carbon. *American Economic Review: Papers and Precedings*. 104(5), p. 544-546.

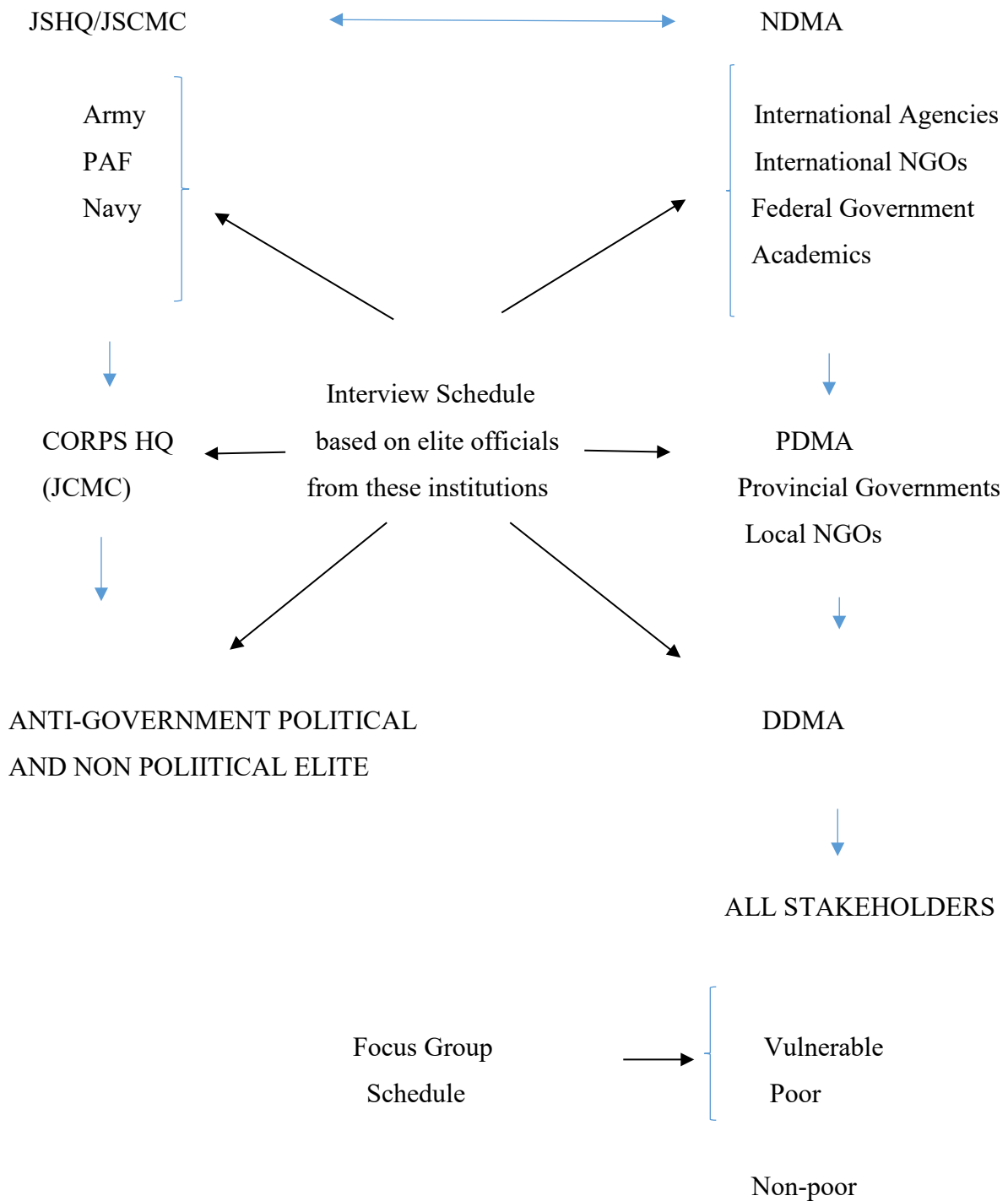
- Welch, C., Piekkari, R., Plakoyiannaki, E., & Paavilainen-Mantaymaki, E. (2011) Theorising from Case Studies: Towards a pluralist future for International business research. *Journal of International Business Studies*, 42(5), pp. 740-762.
- White, S. K. (1986) Foucault's Challenge to Critical Theory. *The American Political Science Review*, 80(2), pp.419-432.
- Willows and Connell. (2003) Decision-Making Framework | GlobalChange.gov. Retrieved from <http://www.globalchange.gov/browse/multimedia/decision-making-framework>
- WMO, (1986) 'Report of the International Conference on the assessment of the role of carbon dioxide and of other greenhouse gases in climate variations and associated impacts'. *Statement by the UNEP/WMO/ICSU International Conference*. Villach Austria. 9-15 October 1985.
- Woodward, D. (2015) Incrementum ad Absurdum: Global Growth, Inequality and Poverty Eradication in a Carbon-Constrained World. *World Economic Review*, 4, pp. 43-62.
- World Bank. (1986) *The World Bank annual report 1986*. Washington, DC: World Bank. <http://documents.worldbank.org/curated/en/1986/01/438415/world-bank-annual-report-1986>.
- World Bank. (1994) *The World Bank annual report 1994*. Washington DC ; World Bank. <http://documents.worldbank.org/curated/en/1994/08/698118/world-bank-annual-report-1994>.
- World Bank. (1998) *The World Bank annual report 1998*. Washington DC ; World Bank. <http://documents.worldbank.org/curated/en/1998/01/441258/world-bank-annual-report-1998>.
- World Bank. (1990) *The World Bank annual report 1990*. Washington, DC : The World Bank. <http://documents.worldbank.org/curated/en/1990/01/700363/world-bank-annual-report-1990>.
- World Bank. (2002) *Main report*. Washington DC; World Bank. <http://documents.worldbank.org/curated/en/2002/01/2017572/world-bank-annual-report-2002-vol-1-2-main-report>
- World Development Report (2000) WDRs - World Development Report 1999-2000. Retrieved from <http://web.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTWDRS/0,,contentMDK:22295143~pagePK:478093~piPK:477627~theSitePK:477624,00.html>

- World Bank. (2002) *Pakistan Poverty Assessment – Poverty in Pakistan: Vulnerabilities, Social Groups, and Rural Dynamics*. Washington, D.C: The World Bank.
- World Bank. (2005) *Pakistan - water resources assistance strategy : water economy running dry*. Washington, DC: World Bank. <http://documents.worldbank.org/curated/en/2005/11/6492396/pakistan-country-water-resources-assistance-strategy-water-economy-running-dry>
- World Bank. (2006c) “World Development Report 2007. Development and the Next Generation”. The International Bank for Reconstruction and Development. The World Bank, Washington, D.C.
- World Bank. (2006d) *Summary of Key Findings and Recommendations*. World Bank.
- World Bank (2007) *Pakistan Promoting Rural Growth and Poverty Reduction*. Sustainable Development Unit, South Asia Region. *World Development Report*. (2007). WDRs - WDR 2007: Full Text.
- World Bank. (2008) *Managing risk to increase efficiency and reduce poverty*. Retrieved from: <http://siteresources.worldbank.org/>.
- World Bank. (2010) *World Development Report 2010: Development and Climate Change*. Washington, DC. © World Bank. <https://openknowledge.worldbank.org/handle/10986/4387> License: CC BY 3.0 IGO.
- WHO | Air pollution. (n.d.). Retrieved from http://www.who.int/topics/air_pollution/en/
- Yang, H., Zehnder, A.J.B. (2011) Globalisation of Water resources through Virtual Water Trade. In Garido, A., and Ingram, H (eds) 2011, *Water for Food in a Changing World. Rosenberg International Forum on water Policy*. Routledge, Taylor Francis Group, London, 117-132.
- Yasin, M.A. (2000) An investigation into food security situation in rain-fed areas of district Rawalpindi. M.Sc. (Hons.) *Thesis (Unpublished)*, Department of Agricultural Economics. University of Agriculture Faisalabad, Pakistan.
- Yin, R. (1984) *Case study research: Design and methods*. Sage Publishing.
- Yin, R. (1989a) *Case study research: Design and methods* (Rev. ed.). Beverly Hills, CA: Sage Publishing.
- Yin, R. (1993) *Applications of case study research*. Beverly Hills, CA: Sage Publishing.
- Yin, R. (1994) *Case study research: Design and methods* (2nd ed.). Beverly Hills, CA: Sage Publishing.
- Yin, R. (2004) *Case Study Research: Design and Methods, Applied Social Research Methods Series*. Sage Publications.

- Zaidi, A. (2004) *Pakistan's Economic and Social Development: the domestic, regional and global context*. Rupa & Co.
- Zaidi, A. (2005) *Issues in Pakistan Economy*. Karachi. Oxford University Press.
- Zaman. (1985) Pakistan economic survey 1984-85, *Ministry of Finance, Islamabad*, Pakistan.
- Zimmerman, F. and Carter, M. (2003) Asset Smoothing, Consumption Smoothing and the Reproduction of Inequality Under Risk and Subsistence Constraints, *Journal of Development Economics* 71(2), pp: 233–260.

APPENDIX A

Coordination mechanism to align all relevant stakeholders in decision making under this case study research



APPENDIX B

Elite Interview Questionnaire (Policy Level)

1. What does climate change mean to you?
2. How would you define sustainable economic development?
3. How does the climate change discourse fit into this definition of sustainable economic development?
4. What are the main causes of widespread poverty and vulnerability in Pakistan?
5. Given the recent increase in the frequency of climate disasters and increase in poverty alike, is there a link between these two phenomena within the development process?
6. How does one impact the other?
7. What are your views on the economic development of Pakistan in the background of its political history?,
8. Can you distinguish between radical and reformist approaches towards sustainable development? Which one is required for Pakistan?
9. Which one of the following approaches is the most appropriate approach to measure poverty:
Monetary Approach; Capability Approach; Multidimensional Poverty Index Approach; Multidimensional Poverty Assessment Approach; or any other?
Could you please mention why the approach you have chosen is the most appropriate approach.
10. In your opinion what is the percentage of people who are poor in Pakistan?
11. In your opinion what are the major coping strategies poor adopt in times of their livelihood vulnerability? Please choose from the following:
a) rely on government support; b) rely on community support; c) rely on NGOs/charity; d) rely on family and friends; or any other support.
12. What economic costs will you associate with climate change disasters?
13. In your opinion what has been the impact of economic liberalisation and privatisation on poverty and environment?
14. What has been the role of trade and globalisation in terms of their implications for poverty and environment?
15. Many research studies confirm that energy intensive core production of the Western countries (the global North) is increasingly being relocated to non-core countries of the global South or the developing countries, where environmental controls are less stringent. Such environmental cost shifting and appropriation of environmental space contribute to

processes of underdevelopment within developing countries through unsustainable trade, as is the case in Pakistan. Do you agree or disagree with the above analysis and why?

16. Carbon offsetting involves purchasing credits from projects that reduce GHG emissions in the developing countries that a developed country is unwilling or unable to reduce domestically. Offsetting projects are expected to increase efficiency, renewable energy, forestry and carbon and methane sequestration. These projects are managed under the flexible carbon trading mechanism of the Kyoto Protocol as CDM. Do you think CDM projects that maybe undertaken in Pakistan are truly sustainable? Please give reasons for your answer.

17. Does the mechanism of CDM and International Trade with developed countries appear to be contradictory in approach when it comes to tackling climate change and development issues in developing countries like Pakistan? What should be the way forward?

18. What implications has modern industrial/mechanised agriculture had (for example, in the form of Green Revolution or second phase Green Revolution, i.e., GMOs) on the poorer section of the society? (For example, for the poor farmer there is livelihood insecurity and for the poor buyer there is food insecurity).

19. What implications has modern industrial agriculture had with regards to ecology/climate change?

20. How has Pakistan's agricultural policy evolved since 1947 and what implications has it had for the economy and ecology?

21. What alternative farming methods would you suggest which can aid sustainable agriculture?

22. Why is Pakistan becoming water scarce?

23. Where has Pakistan gone wrong given its water policy?

24. How can Pakistan's physical water infrastructure be improved?

25. What are your views on Indus Water Treaty? How does it aggravate or alleviate Pakistan's water problems?

26. What is the way forward on water policy for Pakistan?

27. What precautionary adaptation measures are necessary to reduce vulnerability from extreme weather events, especially for the poor?h

28. How does climate change impact public health?

29. What are the implications of industrial activity on the environment of Pakistan?

30. What are the key areas of concern in the energy policy of Pakistan which are the cause of inefficiency of energy production and uneven energy distribution?

31. How can Pakistan successfully tap into its renewable and non-renewable resources for a diverse energy mix in order to reduce foreign dependence?
32. What are your views on bio-fuels as part of the energy mix, in Pakistan?
33. What changes would you suggest in the urban transport system to cut down on high carbon and gasoline evaporative emissions which lead to harmful air pollution effects?
34. Do you think that the NCCP and the 18th Amendment are effective legislative tools to address climate change and poverty aspects in the economic development process of Pakistan? Why?
35. What adaptation measures would you propose to minimise vulnerability from climate change impacts?
36. Should a precautionary approach be adopted by policy makers to address the structural uncertainty fundamental to the economics of climate change?
37. If you were to propose five major design principles for a climate resilient sustainable policy, what would those be? (for example, internalising external costs for firms; by shifting tax base from labour and capital to natural resources; or moving away from globalisation; land reforms; local sustainable agricultural methods etc)
38. The professionalization of environmental organizations NGOs achieved with foreign support engenders the necessary cognitive organizational capacities but it can also isolate such organizations from socio-political processes or reduce their social credibility, as in Pakistan. How important are indigenous democratic institutions for successful development and environmental policies and what can facilitate their growth?
39. Are climate change models based on Cost Benefit Analysis (CBA) an adequate tool for climate change policy analysis? Why?
40. Do you think that the local impacts of climate change on different economics sectors should be quantified through Cost Benefit Analysis (CBA), for policy making? Why?
41. How does the current capitalist economic model address climate change? What would be the implications of such an approach for poverty?
42. How do the alternative economic models (Islamic, socialist, eco-socialist, ecological economic system) address climate change? What would be the implications of such approaches for poverty?
 - What are the costs of limiting CO₂ in the atmosphere to 450ppm?
 - What would be the effect on Pakistan's economy of introducing a carbon tax of say Rs. 3000per ton of carbon?

- How best is it to measure welfare, consumption and production as these are the key economic concepts that deal with climate change?
- How best is it to compare the costs and benefits of climate change policies?
- How should the future be weighted in such comparisons?
- How is economic reasoning possible when we don't know the exact risks associated with the climate change of today's day and age?

APPENDIX C

Focus Group Questionnaire

1. How many households are there in your village in total?
2. How many of these households would you consider poor?
3. How many households would you consider **not** poor?
4. How many villages are there in your tehsil?
5. Would you consider your tehsil poor or **not** poor, in terms of the infrastructure it has and the social welfare system it provides?
6. How many tehsils are there in your district?
7. How vulnerable do you feel from extreme weather events?
8. Has the government put in place disaster management measures to provide relief to poor families in case of flooding or any other extreme event?
9. Do you think extreme climatic disasters push you further into poverty?
10. How many more households have become poor in your village because of extreme climate events such as flooding?
11. How many households in your village receive social security allowances from the government?
12. What factors or government policies do you think are necessary to improve the economic wellbeing of people in your village?
13. To what extent are you satisfied or not satisfied with your livelihood and why?
14. If you are currently in debt, to whom, is the majority of this debt owed?
15. How do you plan to clear the debt?
16. What are your thoughts regarding the current supply of food available for domestic consumption, in your area?
17. Do you own any land?
18. Is this land sufficient to provide for your household's food requirements?
19. Does this land bring you any income?
20. What are your thoughts about the current food prices in your local market?
21. During the last 12 months, for how many months was your household's main source of food supply sufficient or not sufficient to meet your household's demands and why do you think that maybe the case?

22. How much does your household rely on natural resources (land, forest) for livelihood?
23. Do you own any natural resource, other than land?
24. Does owning a natural resource, such as land, have an effect of reducing poverty?
25. What does your household usually do with food waste/remains?
26. What does your household usually do with non-food waste/garbage?
27. Do you have easy access to clean drinking water?
28. What is the main source of water for your household uses regarding drinking, cooking, bathing or cleaning inside the home, please choose:
 - a) a private or a communal borehole;
 - b) a private or a communal well;
 - c) piped from water treatment plant;
 - d) spring; river; stream; pond;
 - e) rainwater harvesting container;
 - f) irrigation canal,
 - g) water vendor
 - h) or a dam.
 - i) Or some other source
29. Can you describe the quality of this water?
30. During the last 12 months, for how many months was your household's main source of water sufficient or not sufficient to meet your household's drinking, cooking, bathing and cleaning needs and why do you think that may be the case?
31. What does your household usually do with wastewater, for example:
 - a) does it go down the drain through piped sewage network,
 - b) or used to water crops grown for livestock fodder
 - c) or any other sort of disposal?

Please explain.
32. Can you explain the importance of agriculture, for your livelihood whether it is working on your own land or someone else's land?
33. If you have access to land for agriculture, can you describe the quality of soil that covers this land?
34. Can you describe the main agricultural method that you use?
35. What changes in agricultural methods would you suggest or are you happy with the current way of agricultural activity?

36. How do the government's land and water policies affect you?
37. What changes would you want the government to bring to these land and water policies to make life easier for you and your household?
38. How often does your household use electricity?
39. What is the primary fuel source your household uses for cooking and the reasons for using this particular fuel type over others?
40. What is the primary fuel source your household uses for heating in winters and the reasons for using this particular fuel type over others?
41. What do you think of the government's electricity/energy policy?
42. Are you satisfied with it?
43. What changes would you like to see in the energy policy to make life easier for your household?
44. How has climatic disasters affected your family's health?
45. Can you explain how much financial and physical effort is involved, for your household, to reach the nearest clinic where simple illnesses can be diagnosed or basic medicines can be prescribed?
46. For the majority of households in your village/area, do you think there is a better chance for a woman or a man to receive healthcare when needed and why do you think that may be the case?
47. For the majority of households in your area, do you think there is a better chance for a male or a female to complete their school education and why do you think that may be the case?
48. How will you describe the quality of education of public schools and relevant facilities provided by the government for educational purposes in these schools, in your area?
49. What is the primary construction material of your housing unit's main roof and to what extent are you satisfied with it?
50. How likely is that your home can withstand strong winds, floods, severe rain, snow or hail without significant damage and why?
51. Of all the negative climatic disasters which occurred in the region over the last five years which five were the most damaging to people in your area?
52. Of all the possible negative/extreme climatic disasters, which could occur in the next 12 months, which five are you most worried about because of their negative impacts on your households and livelihoods?

53. If two or three of the five negative events you just mentioned were to occur in the next twelve months, what coping strategies would you adopt in reaction to these events?
54. In the past few years how has your thinking changed regarding natural climate hazards/events and can you elaborate how do such events aggravate your poverty?
55. In response to extreme climate events, such as the 2010 floods or the 2007 heat wave or the 2005 earthquake, what sort of immediate coping response would you expect the government to undertake?
56. Who do you think would be most likely to assist your household in times of extreme natural events:
- a) the government in general;
 - b) aid agencies;
 - c) financial institutions;
 - d) friends, family
 - e) or no one?
57. Why is there widespread poverty in Pakistan?
58. What must the government do to reduce this poverty from Pakistan?
59. Do you think poverty degrades the environment? Please explain, why?
60. What can provide you with a sense of protection against negative climate events?
61. What can provide you with a sense of protection against poverty?
62. What kind of economic system will you like to live in?

APPENDIX D

List of Research Respondents – Elite Level Interviews

S.N	Position/Subject	Name
1	Chairman PTI and former Pakistan Cricket Team Captain	Mr. Imran Khan Niazi
2	Chairman Planning Commission of Pakistan	Dr Nadeem-ul-Haq
3	Former Chairman Joint Chief of Staff Committee	Lt. General Tariq Majeed
4	Former Vice Chief of Army Staff	Lt. General Ahsen Saleem Hayat
5	NI(M), T.Bt Ex-Chief of the Army Staff and Ambassador to USA	Lt. General Jehangir Karamat
6	Director General Strategic Plan Division (SPD)	Lt. Gen Khalid Kidwai
7	Ex-Chief of the Army Staff	Lt. Gen Waheed Kakar
8	Cor. Commander and Ex Director General Joint Services Staff Headquarters	Lt. Gen Naeem Akbar
9	Cor. Commander and Ex- Governor Lahore	Lt. Gen Khalid Maqbool
10	Former Federal Finance Minister (Musharraf regime)	Dr Salman Shah
11	Current Cabinet Minister PML (N), Author and Academic/Economist	Mr. Sartaj Aziz
12	Ex-Governor State Bank of Pakistan and Ex-Finance Minister	Mr. Shahid Kardar
13	Former Secretary General Finance, in Musharraf regime	Mr. Mueen Afzal

14	Judge Supreme Court	Justice Nasira Javed Iqbal (Daughter in Law of Allama Iqbal)
15	Advisor to the Chief Minister Punjab	Dr Kaiesar Bengali
16	Current Academic/Economist and Former Federal Finance Minister	Dr Hafiz Ahmad Pasha
17	Professor of Physics and Climatology at the College of Earth and Environmental Sciences, PU.	Dr Riaz Ahmad Sheikh
18	Water Expert/Engineer/Academic	Mr. Salman Najeeb Khan
19	Judge, Supreme Court	Mr Justice Khalil ur Rehman Ramday
20	Academic/Scientist- Advisor on Pakistan Energy Policy	Dr Gulfraz Ahmad
21	State Minister for Finance, GOP	Mr Omer Ayub Khan
22	Deputy Chairman Planning and Development Division, GOP	Dr Akram Sheikh
23	Industrialist, Chief Executive, Beeta Industries.	Mr. Khurram Khokar
24	Industrialist, Owner Salt Processing Plants/Salt and Coal mines.	Mr Haroon Ghani Cheema
25	Industrialist, Executive, Fazal Din and Sons, Pharmaceuticals.	Ijaz Mumtaz
26	Ex-Federal Minister -4 times (Ministry of Commerce and Trade)	Mr. Malik Naeem Awan
27	Landlord, Politician and Media Anchor Person for various national/international channels	Mr. Ali Sawal
28	Barrister-at-Law of Lincoln's Inn London. Advocate of High Courts in Pakistan. Fellow at LEADS	Ms Mehr Saleem
29	Senior Think Tank Analyst/ Academic	Anonymous
30	Writer and Think Tank Analyst	Anonymous

31	Senior agriculturalist/ Farmer/Landlady/Entrepreneur	Ms Rabia Sultan
32	Deputy Head PMD	Anonymous
33	Professor/Senior Academic	Prof. Dr. Tariq Rehman
34	Landlord/Agriculture and Farming	Mr. Bilal Khokar
35	Senior Politician (Member of the Parliamentary Assembly)	Tasawar Khan
36	Senior Journalist/Media Anchor Person	Anonymous

APPENDIX E

Sample of reflective interpretation based on the principle of pre-understanding

Quote # 1 Chapter 5: “The framework of economic growth proposed by the Planning Commission under this interviewee’s guidance focuses on fast economic growth... According to him, ‘... environmental degradation is costing Pakistan in terms of low GDP growth. In order to reverse this phenomenon a total restructuring of economic sectors is required with a focus to improve the total factor productivity (TFP), ... a vibrant private sector based on free market economy where government is seen just as a facilitator of private growth with limited regulations to exercise, is proposed.’”

The influence of social power rooted in social institutions, in this case the Planning Commission, and practices reproduce the system, independent of the interviewee’s awareness of the social influence. The next paragraph and reporting that follows the above quotation in chapter 5, challenges this view of free market economy and puts the social power structures rooted in the institutions into perspective.

Quote #2 Chapter 6: “... Approximately 80% of the focus group participants were unaware of the number of tehsils in their respective districts or average amount of villages in their respective tehsils whereas most of them were aware of the average amount of households in their respective villages. This lead to an important insight that the poor may be well connected at an immediate community level but are disconnected from their local administrative policy making structures and procedures which affect their socio-economic positioning in society and hence the extent of the understanding of their rights as citizens.”

This disconnect of the poor from the lower tier provincial level policy implementing institutional structures reflects an underling social mechanism that reinforces socio-economic inequality without the poor being aware of this mechanism.

Quote # 3 from Chapter 6: It became clear from the focus group discussions that it is absolutely normal for a household to go hungry or without a meal in a day. Most farming households produce their own basic food but it depends on the quality of their land ... More than 70% of these people live in rural areas and depend, directly or indirectly, on agriculture for their living.... Pakistan clearly underinvests in its domestic agricultural sector and its

rural indigenous small farmer community due to which its rural households are more vulnerable to price instability. As analysed in chapter 2 of this study, the main focus of agricultural investments since 1990s onwards remained on exportable crops to generate foreign exchange at the expense of developing its domestic market and to provide food security to its population. Despite the fact that Pakistan is one of the largest producers of many agricultural commodities for the world, i.e., wheat, sugarcane, basmati rice and dairy products, over 26% of the population is undernourished”

The poor think that the normal solution to attend to food security is to put more volume of work on land or supplement their income by putting in more labour hours in the market, often informal market. They don't question the agricultural policies that reproduce food insecurity which often stays hidden from them. Chapter 6 also shows how Green Revolution strengthened the already unequal social power structure through this technological innovation but the effects of this technology stayed hidden from the small-medium farmer who reproduced the system nevertheless by working intensively for the landlords. Similarly chapter 6 highlight exploitation of ground water due to biased policies and vested interests embedded in the social power structure which often times remain hidden from the poor.

Quote # 4 Chapter 6: “As poor families struggle to survive, environmental degradation is likely to be more pervasive. For example, increased use of wood for fuel, unsustainable use of land and water resources, in the form of overgrazing, over fishing, resultant depletion of fresh water in the absence of recycling mechanisms and desertification are common in rural areas of Pakistan, which eventually effect the carbon cycle due to the metabolic rupture, giving evidence of the impacts of poverty on climate change.”

This quote gives evidence of the impact of poverty on the ecosystem in other words the poor reproduce the system without being aware of the socio-economic and ecological consequences, hence the system reproduces itself.

APPENDIX F
Coding Sample leading to Reflective Analysis

Q: What is climate change and its impacts?

a) Starting off with different responses on this question as the text unfolds and then organising them as follows in different colour codes. These codes can represent small to medium to large chunks of text in files (MS Doc). All other responses under different questions, (such as questions 12 and 29 from the elite questionnaire in this case) which may generate a similar code, e.g., infrastructural damage, are linked to study the relationships in different contexts posed under different questions. So all data under infrastructural damage from different sources/responses can be stored under this code.

Glaciers receding Floods/Sea level rise leading to inundations of cities located next to the sea Draughts/Heatwaves
Migrations/displacements/refugees Property loss Resource conflicts and violence Loss of agriculture based livelihoods
Disease Death
Loss of crops on cultivated land Loss of income Infrastructural damage High CO2 Levels Fossil fuel based development path Urban Heat Island effect

b) Putting these responses/codes according to their colours under appropriate categories and themes:

Natural factors (all purple)

Social factors (all brown)

Epidemiological factors (all red)

Economic factors (all blue)

c) Re-coding into sub-codes under named categories to identify emerging themes. These codes refer back to the main text and references from transcripts. So once everything about a given code is in one place, its easier to look for imilar and conflicting opinions uncover issues and generate new ideas.

Natural factors

Floods

Inundations
Hazardous substances
leaking into water
Leakage from nuclear plants
Physical infrastructural damage
Disruption of electricity supply
Excess sediments deposits
affecting marine life
Distorting natural eco-system
balance

Draughts

Water sustains life so health
effects are prime
loss of wildlife
loss of marine life
migration of wildlife
High Water Demand
Hunger/Famine
Wildfires due to low
moisture/precipitation

burden

Heatwaves

Death and other
health impacts
Asphalt roads-
Transport impacts
Agriculture/Livestock
poultry effected
power lines sag in extreme
temperatures
Demand for increased water

Glacier Melt

Sea level rise
Increased probability of
earthquakes/volcanic eruptions

Economic factors

Loss of crops on agricultural land

Loss of production
Changing Soil fertility
Land erosion
Faulty local water supplies
Loss of water absorption by plant roots
Waterlogging and salinity
Pesticide residue and Animal waste
from intensive production under
mechanised farming methods

Example:

**Emerging themes: mechanised farming
a carbon emitter; structural faults of
irrigation infrastructure causing
ecological imbalances; Soil metabolism.**

Loss of income

Increasing Financial vulnerabilities
Credit constraints
Absence of insurance
Uncertainty about livelihoods

Infrastructural damage

Roads, Building, Bridges (q1)
Loss of irrigation infrastructure(q12)
Lag in institutional infrastructure(q29)
q1 and q12 = ecological

relationship? q29 =economic burden

High CO2 Levels

Climate change at 750ppm CO2e on BAU
Emission path scenarios
Impact of 2 degree C warming
Beyond 2 degree C – catastrophic
Tipping points
Collapse of West Antarctic Ice Sheet
Overturning of the Thermohaline

Fossil fuel based development path

Non renewable energy mix
Policy uncertainty on
financing renewable projects

Decrease in water for irrigation
Hydroelectric plants effected
Seasonal flooding

Barriers to market entry due to
coal and oil industry dominance

Urban Heat Island effect

Urbanisation in capital's image
Carbon intensive production system
High turnover time of consumption
Spectacle

Drivers of above: Resource extractions (social and natural)

Aim of the above: Exponential growth rates

**Emerging theme: capital of today
is different from capital of earlier era
How? Why? It's implications?**

Social Factors

Migration/Displacements

Homelessness
Refugees
Increased demand for food
Disruption of local coping strategies
Decreased wage effect
Increasing fiscal pressures
Increasing environmental degradation
Increasing pressure on the reproduction of daily life

Resource Conflicts

Violence
Socio-economic unrest
Increasing inequality
Poverty

Property Loss for many and private appropriation of assets by a few

Socio-economic vulnerability
Poverty
Psychological stress
Required shifts in public sector investments
Social security system
Welfare system
Food stamps and social medicare
Personal asset liquidation

Agriculture based economy

Majority of labour force in agriculture

Health Factors

Diseases

Infectious diseases
Vector borne diseases
Water borne diseases
Migration of susceptible people
Effected sanitation/hygiene levels
Water contamination
Breeding of vectors
Ground level ozone

Death

Contaminated food chain
Leakage of hazardous
chemicals in the water supply

Livelihood vulnerability
Social structure setup biased towards big farmers

d) Linking the above codes and sub-codes under different themes and identifying their relationship to each other. Looking for similarities and conflicting issues. For example, linking physical factors to economic factors. How do receding glacial activity impact agricultural productivity? And what does the mean for industry? Energy? How is the current industrial structure linked to fetching exponential growth rates? What is the role of MCM circuit here and exchange value? Does climate change beyond 750ppm CO₂e not threaten this underlying structure as well? How does this underlying industrial structure on BAU with backward and forward linkages with other sectoral activities create a metabolic rift in the system? Why would the industrial/capitalist class want to change this underlying social structure? Is it because it's not capital vs. labour anymore; it is about capital or financialisation vs. everyone? Does the primary/secondary data and theoretical analysis review and provide evidence of this?

e) Reflection stage beyond data organisation and coding:

What are the specific views of the research participants, in a personal context and in a social context and how do they appear in light of the theoretical analysis of the literature review? Contextualised explanations based on the pre-understanding principle of critical hermeneutics are required to gain a sense of the underlying structures and their causes. To what extent are these objects of inquiry products of the interpretations of human beings and to what extent are they structures by 'deeper causes which are opaque to human consciousness'? Hermeneutic circle of interpretation through stratification of reality creates the awareness to accommodate explanations within a wider context.

A dialogic reconstruction with the coded text at this point is built to combine the contextual and pluralistic meaning with a critical analysis of power. Conflicting and similar views are identified and linked to other categories to build a thematic framework, e.g., linking industry to agriculture and other socio-economic structures which in turn build up on legislation affairs and comparative economic models.

Certain questions to the text in question are posed based on the conceptual elements of the material basis of society framework. What is the role of technology in these industrial process? What are the mental perception of the society regarding the role of nature and it's link to this industrial process? Who gets affected given the socio-economic dynamics underpinned by the industrial process of production? What are the socio-economic implications with what implications for poverty? How does the process of production affect the labour process? How can the metabolic rift on BAU given such industrial trajectory be avoided?

Comparison based on reflection of the mechanistic and the materialist frameworks brought forward under theoretical analysis *to aid an aspect of the answer* for the above. Bringing theory and field data together.

For example:

Historical Materialism = Materialist theory based on a natural social method of investigation where nature is not of an abstract form but nature is about concrete social practices/praxis. It's a process of production of material goods through labour process which in turn is about the process of creating value. Such process of production depicts the social relations serving society's needs.

Pro-government elite interviewees: emphasise on the exchange value of the commodity, which is an embodiment of abstract human labour measured in socially necessary labour time and it is independent of any determination by nature. Commodification over value creation. So commodification dictates the social relations serving society' needs under this case study.

Extract chapter 5: "for the carbon economy to have traction for the policy makers and other social agents, emissions of CO2 and any related information should be treated as commodities."

Labour constitutes nature's self movement and it is captured in the dialectics which is the metabolism between man and nature. Dialectics is captured when a qualitative change occurs in the system... system being non-linear, dynamic, complex.

Man is a product of nature, nature transforms him and man then confronts nature as a consciously acting subject to transform it for his own survival purposes and in transforming nature, he also transforms his own nature.

Extract from chapter 6: "These farmers who participated in the focus group sessions seemed to understand the harmony and balance that exists between sun, air, water and soil. Climate change is intricately linked to these four elements of nature: sun, air, water and soil. That is also the case for the individual farmer who conjures food from these essential elements... (a process of value creation; use value; dialectical relationship; structure and agency feeling into each other)... Compared to the above scenario, GHGs are emitted at every stage of industrial scale food production. A team of scientists at Berkley documented a study showing significant spikes in emissions levels during the planting season when fertilizers are usually applied (Schapiro, 2014). Similarly tilling of the soil unearths natural occurring CO2 and sends it into the atmosphere instead of keeping it in place for another millennium or two. Modern industrialised agriculture heavily depends on machines (what is the role of technology and how does it serve the society?) and fertilisers for planting, harvesting and feeding crops as well as imported water to sustain itself,"

Highlighted text: further themes, further questions being generated under this theme to be linked to other themes produced from the code list.

This relationship between man and nature is the pre-condition between the relation between man and man.

The dialectics is in this qualitative change where man changes the structure of matter within nature's laws.

Nature's laws are appropriated and applied by man through the mediating practise of human agency.

So structure and agency feed into each-other >>> this dialectic reflected in the restoration of metabolism between man and nature is the essence of the value theory >>>> it's about the concrete, the particular, the differentiated and distinct modes of labour, i.e, the use value.

But if structure and agency don't feed into each other and nature's laws are not abided by we have a metabolic rift.

Extract from chapter 3(II): (Foundational axiom of neoclassical theory) methodological individualism, where all explanations are synthesised from the level of the individual and where strict explanatory separation of structure from agency is imposed and all agency feed into structure with no feedback from structure to agency. So that any socio-economic phenomena is to be explained via a synthesis of partial knowledge derived at the level of the individual.

From the primary data examples of agency feeding into structure (one way traffic):

- a) Material on mechanised farming*
- b) Material on carbon intensive industrial activities*
- c) Material on fossil fuel based energy trajectory*

Above denoting structural imperatives which essentially drive emissions, impact climate change and carry severe implications for poverty.

Further questions to build a dialogue and find other patterns and relationships:

What other socio-economic realities? For example, open, non linear, complex system with different temporalities, inter-linkages and uncertainties involved.

What are the solutions for the above according to the theory of value (Marx/Eco-socialist) and the theory of growth (Neo-classical)? What did the research participants say?

Further Inquiries Materialist Insights into a complex system

- **What use values are needed by the society and how do we organise them accordingly?**
- **Dept II over Dept I?** *Social Rationality and descriptive data collection exercises.*
- **Coordination of three circuits of capital through social control so that the means of production are socially organised?** *Equity over efficiency in capital circulation and choosing the right discount rate for timely and socially necessary investments.*
- **How can we realistically know what the society needs are? How can such data be collected for policy making that serves the society realistically and sustainably?**

- Can it be a blend of individual and social rationality based on the process of reproduction to understand the underlying social structures and generative mechanisms?
- How can this social rationality be taken further towards realist policy making? Would dynamic system modelling in run time be good enough?
- Can it address deep structural uncertainty? The fat tails where probability distribution shows lack of statistical symmetry as opposed to lognormal distribution of the standard deviation curve?
- Can dynamic modelling at this level capture the dynamics of this complex system through for example cyclical modelling exercises keeping in view that intransitivity does not preclude cyclical practices?

In an attempt to build a dialogue following argument is presented

Exponential growth of capital cannot be captured realistically in dynamic modelling (re Wietzman) because it is reproduction on an expanded scale where things have the tendency to spiral out of control unless numbers are assigned to simplify and solve the equations under rigid assumptions (e.g., looking at t-statistics, or R squared). Can this approach help keep temperature rise below 2 degree C at 450ppm CO2e?

Comparative solution?

Materialist solution: dynamics of the complex system can be captured realistically provided that it is based on the reproduction of the social processes depicting use values with the understanding (as Keynes had) that these models cannot be determinate and that intransitivity and indeterminacy are essential parts of the complex system. So use values need to be organised for the society realistically. Use value based system cannot run into infinity. Exchange value system especially when dematerialised run into infinity with exponential growth rates which are hard to model.

Does the theoretical analysis and empirical evidence from this research provide sufficient proof that this approach can contain temperatures rising over the tipping points? With what implications for poverty?

Mechanistic Insights into a complex system

- Based on growth theory where growth rates depict MCM way
- Dematerialisation of capital as it escapes the immediate constraints of socially necessary labour time
- Value relations based on exchange value and it exponential growth
- Coordination of the means of production done privately
- Private control over the circuits of capital

- Dept I dictates Dept II depicting the domination of exchange value over use value
- Space time compression >>>> allows for equilibrium
- Equilibrium reflects fetishism where market conceals underlying social relations behind the act of exchange
- Complexities of the system are done away with through assumptions of exact relationships and no random variables >>> equilibrium modelling for neat determinate solution.
- Thin tail logic – no deep structural uncertainties entertained

Does the theoretical analysis and empirical evidence from this research provide sufficient proof that this approach will contain temperature from rising at catastrophic levels? What implications for poverty in this case then?

Such has been the process of coding, linking themes, finding patterns and reflection (moving between the general and the specific; the whole and the parts given the principle of CR pre-understanding) under this research's data analysis where all the participants' answers are considered in their individual and social capacities for contextualised explanations. Each view is given space so that each voice is heard before research solutions are proposed in section 7.6.2.