A STUDY ON THE RELATIONSHIP OF DEVELOPMENT WITH ENVIRONMENTAL SECURITY IN NATIONAL AND REGIONAL CONTEXT: THE CASE OF ENVIRONMENTAL DIPLOMACY FOR PAKISTAN

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In the name of Allah,

The Most Gracious and

The Most Merciful.

DEDICATION

I dedicate my work to My Beloved Parents, family members, friends and respected teachers

Certificate of Approval

This is to certify that we have evaluated the research work presented by *Mr. Mabroor Hassan* (Registration No: 11-FBAS/PHDES/F13) in his thesis, entitled "*A Study on the Relationship of Development with Environmental Security in National and Regional Context: The Case of Environmental Diplomacy for Pakistan*" submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Environmental Science from the Department of Environmental Science (DES), Faculty of Basic and Applied Science (FBAS), International Islamic University, Islamabad. The candidate has presented and defended his work in a public seminar on 11th May, 2018. We are satisfied from his thesis and understanding of the topic he researched, and the way he defended his thesis. We are pleased to accept his thesis as suitable and of sufficient standard to fulfill the partial requirements for the award of PhD degree.

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I *Mabroor Hassan*, PhD scholar in the Department of Environmental Science enrolled under registration No. 11-FBAS/PHDES/F13, hereby declare that the knowledge contributed by analyses of data collected and results derived to draw conclusion presented in this thesis titled "*A Study on the Relationship of Development with Environmental Security in National and Regional Context: The Case of Environmental Diplomacy for Pakistan*" is my own original work and has not been submitted as research work or thesis in any form in any other university or institute in Pakistan or abroad for the award of any degree. However, two research papers on the basis of this research have been published and six research papers have been submitted for publication in ISI indexed journals, as required by IIU Academic Regulations. The output from this thesis so far published are following two research papers in 2017.

Hassan, M., Afridi, M. K., & Khan, M. I. (2017). Environmental diplomacy in South Asia: Considering the environmental security, conflict and development nexus. *Geoforum*, **82**, 127-130.

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Whereas, the manuscripts of following six research papers are in the process of review by respective journals, which may be published during the course of evaluation of this thesis:

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The thesis entitled "A Study on the Relationship of Development with Environmental Security in National and Regional Context: The Case of Environmental Diplomacy for Pakistan" submitted by Mabroor Hassan in partial fulfillment of PhD degree in Environmental Science has been completed under our guidance and supervision. We are satisfied with the quality of student's research work and allow him to submit this thesis for further process of graduation with PhD Degree from Department of Environmental Science, as per IIU rules & regulations.

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ABSTRACT

The environmental degradation whether local or at regional level poses threats to ecosystem services, human well-being, development and ultimately to national security if water, energy and climate change nexus is taken into account. Hence, energy, climate change and water build an intrinsic link between environmental security and national security. Currently, this complex relationship of environmental security with human and national security is reshaping the contemporary political discourse. As emerging environmental challenges such as climate change, water security and energy security are not only threatening development, but also national security by risking the environmental security. This study engrossed on the interaction of climate change, energy and water security with environment to assess the relationship of environmental security with development in the context of Pakistan and South Asia. The policies are strengthened if quantifiable parameters like inclusive representation, stakeholders' engagement, transparency and environmental protection are included beside economic parameters. This study aimed to assess the potential of environment as a channel for diplomacy in South Asia-a region most vulnerable to climate change. The specific objectives were quantifying energy, water and climate change policies of countries in South Asia using simple multi-attribute rate technique (SMART) and multi-criteria decision analysis (MCDA) on technical, political and sustainability framework. Energy being essential for development is also a scarce commodity in many developing countries. Access to affordable and efficient energy is a basic human right and an imperative for human development as envisioned in 2030 agenda for sustainable development. Energy policies have to ponder technical, economic, environmental, social and political aspects for successful procurement of energy and endowment of energy resources in a sustainable manner. A robust energy policy covering multi-dimensions can assure access to affordable and sustainable energy and clean environment. The results indicated that energy policies in Pakistan have dominancy of economic criteria, fairly considered the social and technical criteria but least excogitated the environmental criteria. The dearth of environmental aspects not only results in environmental insecurity but also lag the development and provisions of the Sustainable Development Goals (SDGs). This study also presented the analysis of energy policies in South Asian region in development, energy trade and environmental security nexus. As energy trade esteems to reduce the cost and greenhouse gases

emissions. The energy trade can foster economic development, functional area of the cooperation, sustainable energy supply and environmental security. The results not only comprehend feeble coherence among energy policies of individual countries in the region but also with the requirements of trade and regional environmental sustainability. Water insecurity has anticipated an ample threat to livelihood, economy, development, environment, peace, security and poverty reduction efforts in South Asia. Thirty-two technical, economic, social, environmental and political criteria were used to establish the relationship of water security with environmental security and development in national (Pakistan) and regional (South Asia). MCDA was also applied on regional water accords and treaties to assess the nexus of water and environmental security with conflict as well as considered international water laws. The results expressed various gaps in selected criteria which were probable cause of environmental damage, conflicts and mistrust. The divesting impacts of climate change have jeopardized the sovereignty, socioeconomic, political, national and environmental security across the world. The South Asia, a habitat of most vulnerable people to climate change has already agonized the damage due to climate and musing the risk to sustainable future. This study was conducted with objectives to portrait climate change scenario in South Asia, the analysis of climate change policies and plans in the South Asia and demonstrate the relationship of climate change with environmental security. The results revealed gaps in around twenty criteria particularly low institutional capacity, less coherence with Paris Agreement, the Sustainable Development Goals of 2015, and limited implementation of proposed mitigation and adaptation measures. Overall, the situation is critical for environmental security, economic development and poverty reduction. Meanwhile the regional disputes and lack of cooperation have imperilled environmental security and development. The region is looking for negotiation and diplomacy for dispute settlement, energy trade, and cooperation on shared water resources for sustainable development and to combat impacts of climate change in the region. This study has suggested quest for environmental diplomacy in South Asia to persuade cooperation for achieving the 2030 agenda for sustainable development goals, national and regional environmental security.

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LIST OF ABBREVIATIONS

AC	Alternate Current
ADB	Asian Development Ban
AEDB	Alternative Energy Development Board
AJK	Azad Jammu and Kashmir
ARE	Alternative and Renewable Energy
ARETs	Alternative and renewable energy technologies
ASEAN	Association of Southeast Asian Nations
BOD	Biochemical Oxygen Demand
BRICS	Brazil, Russia, India, China, South Africa
C	Criteria
CDM	Clean development mechanism
COP	Conference of Parties
CSR	Corporate Social Responsibility
DC	Direct Current
ECO	Economic Cooperation Organization
EIA	Environmental Impact Assessment
FY	Fiscal Year
GB	Gilgit-Baltistan
GCF	Green Climate Fund
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse gas
GHI	Global Horizontal Irradiance
GLOF	Glacial Lake Outburst Floods
GNP	Gross National Product
GoB	Government of Bangladesh
GoI	Government of India
GoIRA	Government of Islamic Republic Afghanistan
GoM	Government of Maldives
GoN	Government of Nepal
GoP	Government of Pakistan
HKH	Hindukush Karakorum Himalaya

IAEA	International Atomic Energy Agency
ICIMOD	International Centre for Integrated Mountain Development
ICJ	International Court of Justice
IEA	International Energy Agency
ILA	The International Law Association
IPI	Iran, Pakistan and India
IPPC	Intergovernmental Panel on Climate Change
IRBS	Indus River Basin System
IRSA	Indus River System Authority
IUCN	International Union for Conservation of Nature
IWT	Indus Water Treaty
KPK	Khyber Pakhtunkhwa
LNG	Liquefied natural gas
LPG	Liquefied Petroleum Gas
MCDA	Multi-criteria Decision Analysis
MDGs	Millennium Development Goals
NA	Not Available
NAPA	National Adaptation Programme of Actions
NAS	National Academy of Sciences
NDCs	Nationally determined contributions
NDMA	National Disaster Management Authority
NEPRA	National Electric Power Regulatory Authority
NGOs	Non-governmental organizations
NPP	National Power Policy of Pakistan
O&M	Operation and Maintenance
OECD	Organization for Economic Cooperation and Development
PCEEC	Pakistan-China Energy and Economic Corridor
PDGs	Pakistan Development Goals
PGP	Power Generation Policy of Pakistan
PPIB	Private Power and Infrastructure Board
RGOB	The Royal Government of Bhutan
SAARC	South Asian Association for Regional Cooperation
SACEP	South Asia Co-operative Environment Programme

SAME	SAARC Market for Electricity
SBP	State Bank of Pakistan
SCO	Shanghai Cooperation Organization
SDGs	Sustainable Development Goals
SEC	SAARC Energy Centre
SMART	Simple Multi Attribute Rate Technique
TAPI	Turkmenistan, Afghanistan, Pakistan India
UN	The United Nations
UNEP	United Nations Environment Programme
UNESCO-IDH	United Nations Educational, Scientific, and Cultural Organization- International Hydrological Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIFTPA	United Nations Interagency Framework Team for Preventive Action
USA	United States of America
EUWFD	European Union Water Framework Directive

CHAPTER 1

1. INTRODUCTION

This chapter introduces the conceptual framework of the thesis in order to set the stage for presenting the arguments in following chapters to establish the relationship of development with environmental security in the context for environmental diplomacy in South Asia. The last decade of 20th century has seen a paradigm shift in wider security discourse from cold war influenced geopolitical context to resource context and the concept of environmental security incorporated by researchers in broader studies of security to ensure wise utilization of resources. Emerging threats such as damage to environment, exploitation of natural resources and migrations due to resource scarcity equally damage and disturb the national security, and effect economic growth and development (Myer, 2004; Ehrlich *et al.*, 2001).

1.1 Environmental Security

Ecological and environmental threats have been classified under three categories: threats associated with scarcity of natural resources, environmental externalities and environmental refugees or social upheaval. Natural resources scarcity underpins the issues arising from inadequate availability, access and supply of water and energy, exploitation of minerals and oil, food security and use of marine passages. Environmental externalities include problems from trans-boundary air pollution, illegal movement and trading of toxic waste and upstream river pollution etc. The concerns relating environmental refugees and social upheaval consist of a chronic shortage of natural resources and migrations resulting from resource insecurity along environmental disasters (Rwabizambuga, 2007).

The development is strongly linked to environmental security and human security. Experts consider this link particularly strong in developing countries where livelihood and human security rely on access of people to natural resources. It has been reported in a number of case studies that the communities in developing countries have increasingly endured sufferings associated with scarcity of natural resources and environmental damage. It has been recommended that any efforts to alleviate poverty and better the lives of people

have low probability of success without conserving, improving essential resources and life support system (Khagram *et al.*, 2003; Rwabizambuga, 2007)

Diverse environmental challenges such as water quality and scarcity, air pollution, climate change, secure energy supply, loss of biodiversity and waste management have threatened both developed and developing countries (Houghton, 2009). Further, environmental changes are raising the severity of impacts from poor health, livelihood and economic growth to political instability. They are affecting a variety of subjects ranging from individuals, families, communities, society, different identity groups, various biological species and the governments (Khagram *et al.*, 2003).

Among environmental challenges, energy, water and climate change has particular importance and are inter-connected with each other. The survival and prosperity of human society is being centered by energy (Sovacool, 2014). The energy induced environmental degradation has increased due to economic growth in this era. The emergence of global environmental agenda has interconnected the energy systems and environmental protection in the second half of 20th century. Particularly, the threat of disruptive climate change has thrown the spotlight of core role of energy in shaping the impregnable future relationship between natural environment and society. Sovacool (2013) says if the 20th century was about energy, then the 21st century could very well be about energy governance and climate change. The importance of energy has been significantly increased in environmental perspective after the rise of global environmental politics as a sub-discipline of International Relations that linked energy with environmental concerns, global governance and sustainability. Climate change has attained greater urgency to global environmental politics-oriented research on energy. The gradual emerging of climate change and energy has been recognized climate stability as one of main concern into the global energy systems (Falkner, 2014).

The climate change is continuously affecting the water availability and water cycle in both direct and indirect ways by changing the pattern of consumption as well as disturbing evaporation/precipitation cycles. The rapid drop in per capita water availability and insecurity is being experienced by some courtiers. Water-related vulnerabilities happen through different mutually reinforcing linkages between energy, health and food, ultimately leading to physical and socio-economic vulnerabilities. Climate change is accelerating the complex vulnerability dynamic and challenge of water availability and management for many countries especially developing countries. It looks to be an undeniable effect on

development, progress and achievement of sustainable development goals (UNWWAP, 2009).

Apart from impacts of climate change on water, many countries are reliant upon the water originates outside their border. International basins cover almost half of the Earth's surface. They are shared by more than one countries (UNEP, 2002). The frequency of extreme weather events such as floods and droughts intend to increase at global level in accordance with predictions of available climate change scenarios (IPCC, 2001a). It requires adaptable water management mechanism at both national and regional level. The uncontrolled land and water development in the upper basin has stressed the downstream riparian states. They are at an imminent danger of rising intra- and inter-annual flow variability (UNEP, 2006).

Environmental change and violent conflicts have globally accepted relationship (Khagram *et al.*, 2003). Environmental insecurity and conflicts are the results of migration, overuse of fragile land, misuse of natural resources and other environmental effects. The survival of state remains threatened without considering the source of insecurity, i.e. broadened and predominant environmental factors (Khagram *et al.*, 2003). However, the developing countries have more severe impacts of environmental problems than developed countries due to poor governance, poverty, political instability, drop in foreign assistance and mobilized anti-state activists, who are capturing resources to sustain their military activities (NA, 2000; Le Billon, 2000; Reno, 1998). Environmental degradation in combination with climate change, energy security, water security and depletion of natural resources put fundamental threats to human security. The lack of capacity of local and national institutions to settle conflicts over the depletion and degradation of natural resources is the emerging problem (UNIFTPA, 2012). The cold and proxy wars have realized the governments that national security is not an exclusive matter of military terms or the struggle between conflicting ideologies (Figure 1.1). After the United Nations Conference on Environment and Development in Rio de Janeiro, national security has been modified by integration of a cluster of the interconnected element of environmental aspects with military terms that getting more importance day by day (Swain and Öjendal, 2018).

National security is being destabilized by both direct environmental disasters and the sociopolitical along technological impacts on overall scenario of national security. Historically, former Soviet Union has endured the cost of 15-17 % of their GNP due to pollution, subsequent deterioration of human health and inadequate use of natural

resources, which depict that the resources acquire to tackle this problem would equal or exceed the country's defense budget allocation. The interaction between the political and environmental forces will direct the Third-World development in unprecedented ways in future. While, environmental issues assume greater political importance but there is a persuasive need of an analytical approach for incorporating political and environmental understandings (Bryant, 1992).

Pakistan is ranked among environmentally vulnerable countries on the top of the list. The ecosystem of Pakistan has suffered serious changes due to rapid population growth and urbanization. The massive depletion of natural resources has threatened biodiversity, food, water and energy security (GoP 2015). The ecosystem and resources of Pakistan are more likely to be depleted or degraded due to environmental stress, the fragility of the ecosystem and political structure than more resilient states subject to same pressures. Pakistan is subject to both structural and demand -induced scarcity in current perspective of the environment. Demand-induced scarcity stems from per capita use and growing population of Pakistan and structural scarcity originates from lack of stewardship, inadequate use, inequitable distribution of natural resources and social discrimination (Kugelman and Hathaway, 2009)

Furthermore, lack of capabilities and resources is leading towards the worse condition. Apart from natural resources insecurity, climate change is increasing the variability of monsoon, resulting in frequent massive floods and drastic droughts. The extreme weather events like the floods of 2010, 2011, 2013, 2014, worst drought during 1999-2003 and 2014-2016 in Thar, two cyclones in one month in Karachi/ Gwadar coasts in 2008, Attaabad Lake and increasing incidents of Glacial Lake Outburst Floods (GLOFs) and landslides in northern areas of Pakistan confirm the threats of climate change (GoP 2015). The natural resources and environment of Pakistan are stressed due to increasing demand and population growth. The increasing demand and droughts are dwindling the abundant water supplies. However, energy crises, water scarcity, effects of climate change, natural disasters and food insecurity are conducing environmental concerns of Pakistan. The environmental stress in combination with other political and socio-economic stress has the potential to further destabilize the Pakistan (Vaughn *et al.*, 2010).

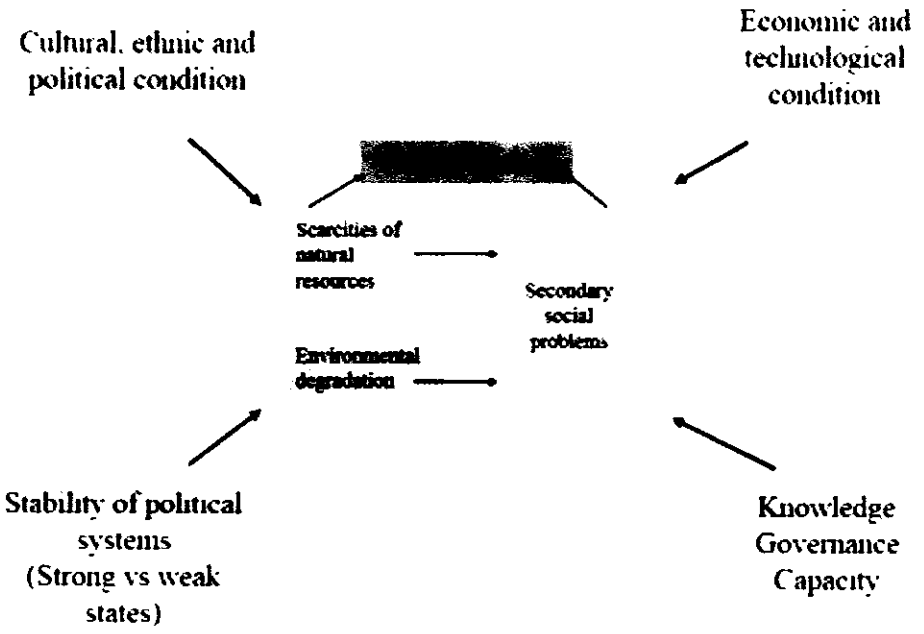

Figure 1.1 Environment and security in an international context (Source: Redrawn from Carius et al., 1996)

1.2 Environmental Diplomacy

Environmental diplomacy is an integration of approaches and tools to assist parties in dispute, create opportunities for confidence building, cooperation and resolving conflicts by conveying joint environmental and natural resources issue (UNEP, 2014). It is considered as a neutral term, non-aggressive in character, not against countries or anybody and effective for settling both intra- and inter-state conflicts (NA, 2000; Moomaw et al., 2017). The environmental diplomacy has much broader prospects than to harmonize the interest of states or each other. It is belonging and common to all states, communities, individuals, humanity and more comprehensively to conservation and protection of the natural conditions of the existence (Ioan, 2013). The traditional diplomacy covers the sign of reciprocity and aspires to equilibrate as accurately as possible between the obligations of the state and interests of each other. Unlike traditional diplomacy, the environmental diplomacy intends at promoting common interests in protection, management of shared natural environment, heritage and enhancing awareness. It expresses the definite solution problems by involving all parties regardless of geographical positions as we are living on the same planet and equally affected by anthropogenic environmental problems (Ioan,

2013). The United Nations Environment Programme (UNEP) (1972), the Global Environment Fund (GEF) (1990), and the Commission on Sustainable Development (1992) is a permanent international institutional framework, providing an opportunity for conducting negotiations and utilizing other diplomatic approaches at ecological issues. The United Nations have been accepted the environmental protection as core responsibility since 1992 (Ioan, 2013).

1.3 Rationale

The conflict management related to natural resources is now more crucial than ever before. The economics and population growth have transformed the global consumption pattern. Many countries are facing growing shortage of dynamic renewable resources including cropland, wildlife and fisheries, forests, rangelands, fresh water and energy (UNIFTPA, 2012). The availability, secure supply and distribution of energy and water is a consistent matter of inter-provincial and regional conflict for Pakistan since independence. Some analysts consider that dissension over water distribution could exacerbate existing tensions between two nuclear states i.e. Pakistan and India. The droughts due to climate change can stress the supply of the Indus River, which would increase the probability exacerbate tensions between Pakistan and India. The droughts can dwindle the hydropower supply and foster the social pressure and protests in the area experiencing rolling blackout, which ultimately upshot to decrease in productivity of agriculture and economic stress (Vaughn *et al.*, 2010). Moreover, there are inter-provincial issues on water distribution and construction of new dams. The construction of Kalabagh Dam on the Indus River in shared territory of Punjab and Khyber Pakhtunkhwa (KPK) is a cause of ongoing dispute and intra-Pakistan tension over water resource sharing. The Punjab supports the construction of this dam and considers it as a solution to water shortage and energy problem, while other provinces are not in favor of Kalabagh Dam (Vaughn *et al.*, 2010). The resolution of conflicts and sustainable management of natural resources to ensure ownership, management and control of resources is putting pressure on fragile states, emerging economies and the governments of developing countries (UNIFTPA, 2012).

1.4 Significance

Although, Pakistan as a country and South Asia as a region are also blessed with diverse natural resources but many research studies highlight the environmental stress due to population growth, increasing demand, climate change, resource depletion and scarcity, water scarcity, energy crises, poor management, biodiversity loss, inadequate distribution, poor governance due to ineffective legal and institutional framework, ambiguous provincial rights and social inequity. There are many inter-provincial conflicts regarding allocation, rights, management and use of natural resources as well as with neighboring countries. These conflicts are complicating the nexus of economic development and its undeniable relationship with environmental factors such as water, energy and climate change. Therefore, environmental diplomacy provides a channel for interest and conflict resolution along integration of foreign policy.

The quantitative analysis of energy policies in Pakistan was attempted in this study to explicitly crave the multiple objectives. This study has also identified the suitability of energy policies with technical, political and sustainability criteria for environmental security and sustainable development. It seems that there is a knowledge gap on sustainability assessment of energy policies in context of regional energy trade. Therefore, this study was conducted with the objectives to analyze adequacy of energy policies of countries in the region for trade and development as well energy and environmental security. It is hoped this research will offer a new paradigm for assessing the need for environmental diplomacy in South Asia. The conflict on water resources likely to affect about eight billion people around the globe and threatening national security of many countries (Busby, 2017). Therefore, sustainable water resource management is one of most important requirement to hamper future development. South Asia is globally recognized for water scarcity, water conflicts and environmental insecurity. MCDA was implied to analyze the national and regional water resource policies, and treaties in South Asian region in context of water security, environmental security and development. Climate change has hampered water scarcity, shocks to food production, violation of treaties, conflicts and adverse impacts on livelihood, environmental security and development in South Asia. Therefore, this study has attempted to highlight knowledge gap in climate change policies and plans in South Asia through Multi-criteria Decision Analysis (MCDA). The study presents climate change scenario in South Asia, the analysis of climate change policies and

plans in the South Asian countries, its relationship with environmental security and quest for environmental diplomacy as a pursuance to cooperation.

As the world's population grows exponentially, the climate changes, pressure on the planet's scarce and diminishing resources is increasing. These trends are increasing the potential of natural resources in either strengthen the cooperation or contribute to conflict depending on how these risks are anticipated, mitigated and managed through environmental peacemaking (UNEP, 2014). Therefore, it is critically important to prevent, manage and resolve the conflicts, tensions and disputes over natural resources for sustainable future of the world. This study will assess the need for environmental diplomacy in resource security, energy security, water security and climate changes in South Asian context. It will be helpful in assessing the drivers of conflict in the context of environmental security, trade and development opportunities, inter-provincial and inter-state conflict resolution, improvements in foreign policy and relations of Pakistan with other countries. This study assessed the need for environmental diplomacy for resource security, energy security, water security and climate change associated with the viable development and environmental security at national and regional level. It is hoped that findings of this study will be helpful for researchers in understanding the relationship of environmental security and development.

1.5 Aim and Objectives

This study aimed to provide scientific basis and theoretical framework for promoting environmental diplomacy for peace, security and development at national and regional levels. Following were the specific objectives for this study:

i. Analysis of available energy, water and climate change policies and plans of countries in South Asia in the context of environmental security for sustainable development.
ii. Coherence analysis of bilateral and regional treaties in relation to multi-lateral environmental agreements.
iii. Capacity mapping of national and regional institutions like South Asia Co-operative Environment Programme (SACEP), and South Asian Association for Regional Cooperation (SAARC) to promote environmental diplomacy.
iv. Assessment of potential of above policies and plans for regional cooperation to combat climate change, trade in energy and water for development in Pakistan and South Asia.

v. Assessment of potential of environmental diplomacy in energy, water and climate change policies of Pakistan in comparison with other South Asian countries.

1.6 Research Question

The global community demonstrated their commitment towards cooperation on environmentally sound economic development at The United Nations Conference on Environment and Development (The Earth Summit 1992) and later on the UN Sustainable Development Summit 2017 in New York. However, geo-political narratives among many countries are hindering cooperation on environmental security and sustainability. The relationship of environmental diplomacy with development and environmental security in terms of climate change, energy and water security beyond game theory is to be established. This study attempted to resolve the question, whether energy, water and climate change policies, plans and treaties in Pakistan and other South Asian countries are equipped with instruments and provisions needed for energy and water security, and to combat climate change in national context and may be employed for environmental diplomacy and cooperation in the regional context?

1.7 Limitations

The South Asia being a densely populated region is a huge consumer market and consisted of countries in transition economies. The study although, covers the regional context and seeks consideration of environmental diplomacy in a complex and dynamic relationship of environmental security and development but is limited to energy, water and climate change related issues, policies and their relationship with environmental security, trade and development. Whereas, environmental security, trade and development are not only limited to these three sectors, nor environmental diplomacy is required only in conflicts associated with water, climate change and energy. However, this study is expected to contribute to develop an insight in relation to environmental security and development.

1.8 Outline of thesis

Chapter 2 provides the review of literature on environmental diplomacy and relationship of environmental security with development. Chapter 3 describes the methods to assess relationship of environmental security with development. Chapter 4 presents the results and discussion while conclusions and suggested policy implications were demonstrated in chapter 5.

CHAPTER 2

2. REVIEW OF LITERATURE

2.1 Environmental security and development

Global environmental politics is an emerging agenda and discipline within International relations to ascertain environmental security. Global environmental politics conceptualized three core lenses including the study of ecological limits, environmental impacts, the notions of sustainable development and the concept of global environmental governance (Falkner, 2014).

Trombetta, (2008) analyzed the emerging discourse of environmental and climate security transformation into national security practices and broaden the security agenda along international relations. It seems to spread the confrontational logic of security instead of traditional approach associated with exceptional decisions on the logic of war existence. The securitization of environment articulated the logic, practices and provisions of national security, legitimate the contingency prevention and management to economic development.

Rwabizambuga, (2007) awakened the policy development community to link environmental security, human security and development as an important dimension of development policies. The lifestyle and human security are closely cohesive and strongly linked with access to natural resources in developing countries. The deterioration and resource scarcity is increasing the hardship of the people and impeding development, as the states are unsuccessful to conserve the resources and enhance life support system. The environmental threats have detrimental and endure impacts on development and national security as war. The consideration of environmental threats and its firm integration with a development policy agenda will accelerate the development.

Bochi *et al.* (2006) determined the relationship between environmental security, social unrest, and development. The environmental security and scarcity are linked social unrest and state insecurity endowed with the scarcity of renewable resources and violence

in developing countries. The scarcity of renewable resources, including cropland, forests and water along with demographic pressure, structural ingenuity impedes the development and resulting in clashes between the tribes.

Khagram *et al.* (2003) emphasized on sustainable environmental security and sustainable development and consider both as a threat as well as the opportunity. There are numerous significant threats arising from human and environmental interactions at the local and regional level. Human security and development could be made more sustainable by building political advocacy and action learning coalitions among concerned stakeholders which look difficult in short time. Moreover, the individuals and organizations must have enough political will and practical openness to uphold and promote the traditional field of security and development. The sustainable environmental security, human security and development will forge a common agenda, practical goals to achieve and change the relations of power.

The dwindling sponsorship of Cold War compelled armed groups to rely on revenues from natural resources such as oil, gems or timber to sustain their activities. It has the conventional notions of abundance or scarcity and increasing resource dependence stressed the vulnerability. The exploitation of resources resulted in opportunities for armed insurgents and linked the risk of violence to the conflict of natural resource political economies. They justified the excessive resource extraction and predation with the subjugation of the rights of people to determine the use of their resources and environment. It impeded the peace and development beyond demonstrating the economic agenda of belligerents (Le Billon, 2001).

Graeger, (1996) reviewed the relationship of environment to security and high politics. The securitization of the environment has resulted in a sense of urgency and the political awareness to settle environmental problems to meliorate the national security. The accomplishment of environmental security is likely to be part of the daily political debate in the long run. The security-environment linkage determines the violence circumstances by considering environmental degradation or change. The activities that may damage the environment in addition to military preparedness, industrial and technological installations, as a component of environment security leading to security threat and conflict. A dynamic framework of actions in policy and decision making may reshape subnational, national, regional and global environmental security as well as security perspective to assure future development.

The environmental security is interconnected with decision-making patterns, anthropogenic threats to ecosystem health, the effect of the global system and state institutions and the normative context to achieve sustainable development. Energy resources and planning is an imperative challenge which requires a framework in the context of environmental security for development. However, the international system is not only limiting the ability to deal issue in the long-term pattern, but also attempts to transform that system itself (Stoett, 1994).

The spatial and inter-temporal externalities consideration in policy and institutional framework in case public goods could render environmental security and sustainability. Internationally unique areas, phenomena and public goods including biodiversity, oceans and atmosphere can be protected and maintained by regulatory arrangements equipped with standards and rules at national and international level. The international communities have to establish, accept and oblige these rules to protect international goods and prevent externalities (Rowe, 1991).

2.2 Environmental security: Climate change, water and energy security

The emerging economies such as Brazil are striving to cope with the challenge of reconciling of economic growth, secure energy supply, environmental protection and reduction in greenhouse gas emissions. The development energy security standards compatible realistic economic growth projections keeping in view climate change requires complex calculation of risk to avoid future energy shortages and economic crises. The planning and decision making for construction of hydroelectric power plant in Amazon region require the evaluation of complex nexus of energy security, water, climate change, environmental protection and economic growth (Almeida *et al.*, 2016)

Ching, (2016) studied the resilience to climate change in a paradox of water security. The study considered adaptation and mitigation antithetical to each other; adaptation refers to the capacity to continue "business as usual" activities while mitigation rejects business as a usual paradigm and emphasized new realities. The Singapore has suffered severe drought and conceptual difficulty due to this antithetical approach in policy formulation. Therefore, resilience requires the teleological approach which focused on speaks to the desired ends i.e. communities to ensure water security in both infrastructure and human development.

Gohar and Cashman, (2016) studied the potential impacts on water resources and food security caused by climate change and variability. This particular problem has attained growing attention in areas which are facing challenging growth in meeting water demand for environmental uses, agriculture and domestic consumption. Rain-fed agricultural areas are under stress due to aquifer storage and food security and considered as more vulnerable to climate change and variability. An integrated framework on precipitation data, aquifer characteristics and farm budget was employed to investigate impacts including economic development. The significant negative and synergetic impacts on future water and food security were predicted in Barbados, Eastern Caribbean. However, the adaption by taking into account technological boundaries show a positive response and fiscal opportunity for farmers.

The Mediterranean region has faced distinct and manifold impacts of climate change. The trends and projections indicate a strong vulnerability and susceptibility to changes in hydrological regimes, consequent threat to availability and management of water and water scarcity in the future (Ludwig and Roson, 2016)

Rivera *et al.* (2016) investigated the regional legal disputes on water rights in Chile. Water demand and climate change has triggered the tension and competition between water consumers such as industries, agricultural sector, mining, hydropower and local communities. Although Chile has the Water Code since 1981 to allocate rights and foster distribution mechanism but there are legal disputes in different region. The diverse water market, water use organizations, water rights, region, regulation and water users define the context of conflicts. Water conflicts are shaped by the concentration of resources and abstraction activities, hydrological condition, communities and institutional structure. Agriculture, mining and local communities are main actors with limited access to water in Northern region of Chile. There are conflicts on water use among mining, hydropower and agriculture sector in central region along with substantial competition between consumptive and non-consumptive users. The fewer disputes are observed in Southern Chile due to low demand and abundant resources.

Climate change resulting in loss of income from agriculture, livestock, economic hardship, loss state revenue and inter-elite competition, increase in food prices in urban areas, shortage of commodities and migration. The conflicts among agricultural producer, the government, pastoralists, and urban communities may be outcome these challenges (Seter, 2016).

Zheng *et al.* (2016) highlighted that China has different regional conflicts due to water scarcity and power generation. The reliance of thermoelectric plants on water, water supply stress incorporated with climate and power generation was assessed in North China. Seven hotspots were identified as power-vulnerable to water scarcity in North China. The water management and rights allocation in the trans boundary basin are recommended as the adaptation.

Taniguchi *et al.* (2015) measured the security of food, water and energy for thirty-two countries in the Asia Pacific region. The region is connected to the Pacific Ocean in terms of diversity of origin, self-production and amount of each resource. A diversified water use analysis of surface and ground water resources was carried out in the region for energy (geothermal, solar, bioenergy and hydropower) and food (fish, meat, cereals and vegetables). The US and the Philippines have high diversity of sources of water while the US, Canada and Indonesia are among those countries contain a low diversity of food. The water security in current regime shows new hydrological insight for Asia-Pacific Region.

The variability in rainfall and cyclones is an undeniable evidence of the anthropogenic rise in temperature, global warming and climate change in a 20^{th} century. The varying degree of fuzziness between the seasonal atmospheric flow during monsoon and global warming has been observed in Southeast Asia. There were frequent changes and a shift of Indian summer monsoon. However, the precipitation (70%) was observed below normal level but the intensity of rainfall will be affected by the topography of the area. The shifted phenomenon will delay the monsoon for 15 day resulting intermittent floods and threatened agriculture and development (Yi *et al.*, 2015).

Milman and Arsano, (2014) realized the quest for climate adaptation policy agenda that is subtle to a social, political and ecological condition of highly vulnerable regions in African Sahel. However, most of the studies on climate change have focused on development, vulnerability and adaptation but not acknowledged the contradictions arising due to the implementation of development, vulnerability reduction and adaptation strategies. The politics of climate change, development and adaptation pose differential and contradictory impacts on four major elements of human security including water security, temporal aspects of water security and livelihoods security, economic security, personal, state and community security. The complex outcomes of political economy have increased the tension instead of neutralizing the relations African region (Gambella, Ethiopia).

The internal conflict, trans boundary sharing of water and development is linked in the states of Sudan and South Sudan. The internal conflict of water abundance, development, resource scarcity and trans boundary water of Nile could empirically link conflict and water in Sudans. However, the local environmental abundance is more intimating the conflicts than sacristy in geographical perspective. The agricultural interest in Upper Nile Valley rationalized the construction of Jonglei Canal to capture abundant resources of Sudans. The relationship of water with political and economic nexus is not the primary driver of conflicts in Sudans as oil in political economy. The political dynamics is main proximate determinants of environmental related conflicts than changes in resource availability in Sudans. Therefore, the future pattern of environment-related conflicts will not determine the level of Nile, nor by climate change but embedded by the political economies, interests of local elites and global dynamics in both countries (Selby and Hoffmann, 2014).

Odgaard and Delman, (2014) predicted that future energy needs of China can be covered by own conventional/unconventional sources and pointed out the need of energy import from neighboring countries. China is dependent on import of coal, oil and gas since last twenty years to secure energy supply. China looks to contribute to a fourth of the global net growth in international gas consumption and more than half of the net growth in oil consumption until 2035. The import of natural gas through pipelines from neighboring countries has potential of more than half demand and oil contribution (only 10 %) to secure demand by 2030. The territorial disputes regarding areas with water, oil, and gas reserves are leading toward regional conflicts with neighboring countries and lams active engagement in energy diplomacy and regional cooperation.

The drought-like conditions in different regions around the world and the US are resulting in water shortage leading to power failures and socio-economic impacts. The electricity, water and climate change are interlinked in the complex nexus. The prices of electricity will increase with the adaptation of water and carbon tax (Nanduri and Saavedra-antolínez, 2013).

The climate change is potentially changing the runoff of many rivers, precipitation pattern, and demand for river waters due to frequent droughts and stress on water resources. The resulting strain on trans boundary rivers leads to international tension and military conflicts. The ability of adaptation of river treaties to cope with water stress will depend on the institutional design due to climate change that covers joint monitoring mechanism,

treaty enforcement, conflict resolution and powerful intergovernmental organizations (Tir and Stinnett, 2012).

The energy trade seems feasible in south Asia due to growing energy demand, outstripping domestic supply and supply gap in India, Pakistan, Bangladesh, Afghanistan and Sri Lanka. Meanwhile, some economies including Tajikistan, Kyrgyzstan, Nepal, Bhutan, Myanmar, Turkmenistan and Iran have excessive energy than demand due to the endowment of their natural resources. The trade of energy will provide the substantial benefits to exporting economies and enhance the national energy security of emerging importing economies. Furthermore, the energy trade will be a relief from energy constraint, cash flow implications and reduce the supply cost e.g. Nepal has dramatically reduced its cost of the power supply by optimizing its power system with the sale of hydropower to, and import of thermal power from, India. The trade of energy has the environmental imperatives and abatement of climate change especially for India having high CO_2 emissions due to coal burning (The World Bank, 2008)

Sahir and Qureshi, (2003) conceptualized the global and regional energy security in future. The geopolitical conflicts, terrorism, disruption of energy supply and availability of tradable resources will endanger the regional and global energy security in future. The energy security of Pakistan is emasculated by both role and geostrategic position. Pakistan has the capability to serve energy security as well as trade corridor in Asia due to logistic potential, unique location and creating the opportunities for global regional actors. However, balance geopolitical approach and regional economic cooperation may help to secure individual and global energy security.

2.3 Environmental diplomacy, environmental security and development

The environmental security is firmly linked with development and peace building. The integration of resilience with environmental security, peace building, development and its application by the nongovernmental organizations (NGOs) can effectively settle the environmental conflicts in developing countries, build peace and cooperation as well as hamper development (Schilling *et al.*, 2017).

Moomwa *et al.* (2017) recommended the sustainable development diplomacy as an effective process of negotiation for implementation of sustainable development goals, practices and policies. The study analyzed the socio-ecological systems, global

environmental and climate change governance and determined need-based approach to engage stakeholders, devise flexible solutions to cope with the challenges.

The complexity of water security and social implications nexus has challenged the policy implications in context of local conflicts. The applications of prevailing reductionist approach and integrative approach has been used to develop the understanding of this nexus. A prevailing reductionist approach unfolds uncertainty through calculable risks, interlinks national GDP, diversity, politics in society and hydro-climatological causes. An integrative approach seeks to cover a range of uncertainties including explicitly identify the diversity in the environment and the society, its integration with difficulty to control water resources and adaptive approaches beyond conventional supply prescriptions (Zeitoun *et al.*, 2016).

Koukis *et al.* (2016) examined that the disasters have significant impacts on environmental security. The disaster-related activities may reduce the conflicts and increase cooperation. The Turkey and Greece are historical rivals and faced earthquakes in 1999. The disaster diplomacy after this earthquake resulted in the multilateral, bilateral and local examination of disasters, cooperation at government level and risk reduction in Greece and Turkey.

Barquet (2015) rationalized the utilization of trans boundary conservation as an effective initiative and tool for taming interstate relations for environmental peacemaking and neutralizing environmental issues on sound basis for cooperation. The trans boundary conflicts between Costa Rica and Nicaragua on the use of San Juan River within International system of Protected Areas for Peace (Si-A-Paz), oil and land are damaging the relations between two states rather than fostering peace. The emergence of environmental issues are a new arena for geopolitical play. The actors involved, utilize the environmental discourse to justify their actions and avail international support.

Fao, (2015) considered energy security management as complex and fragmented inter-relation with urbanization, population growth, the environment and economic development. The energy security is a corner stone for economic development. Apart from endowment of natural resources, Malaysia requires to adopt an integrated, coordinated, participatory approach, adaptive, environmentally-oriented agenda, plans to protect renewable resources and secure the energy. The green technology application and cooperation at the regional level has the prime and indispensable contributor to secure sustainable reliability of energy supply.

According to Siska and Takara, (2015), many aspects of human life including development are affected by water in a good or bad way. The capacity of the human population to protect themselves against water-related hazards, obtain benefits to life support and conserve environment guaranteed water security. Although, many developed countries have achieved water security compatible with economic development by prior planning and investing in both water infrastructure and institutions. The lack of investment in protection and access to water, global environmental changes including increasing magnitude, frequency and uncertainties of extreme weather events, population growth, economic development, deteriorating water quality and quantity has put pressure on the governments of developing countries to achieve water security. The comprehensive analysis of decision support system in hydro-economics and strategically fiscal investment in water sector would be helpful for developing countries to cope with the challenge of water security.

Hong, (2015) evaluated the current climate change talks to achieve a meaningful treaty. The climate change talks have deadlock due to high expectations and delaying the specification of binding and commitment to a future negotiation. The ongoing negotiation will provide the basis for future negotiation. A binding and effective climate change treaty seems to emerge, as the current talks have convinced many countries to mitigate greenhouse gas emissions. Therefore, environmental diplomacy is required for worthwhile maintaining of high expectations.

Guanacaste and Costa Rica are facing water conflicts and impacts of climate change. A formative and participatory approach with diversity analysis and system consistency were used to develop five alternative governance scenarios to address water and climate change conflicts. The scenarios recommend the involvement of the community, devise the scheme fit for dry tropical regional context, top-down scheme, broader transformational planning process, trust, active participation and stakeholder collaboration to solve the problem (Kuzdas and Wiek, 2014).

The South China Sea was one of more volatile maritime areas of the world but the efforts of United Nations Environment Programme (UNEP), the Association of Southeast Asian Nations (ASEAN) and China have made this as an example of environmental diplomacy and cooperation through South China Sea Project which was funded by Global Environment Facility (GEF). UNEP has played as the instrumental and inductive role in addressing the maritime environmental problem, information sharing, confidence building

between ASEAN and China, mediating and facilitating environmental cooperation. UNEP has convinced neighboring countries to negotiate at a table by framing environmental protection as a neutral and a political issue (Chen, 2013).

DeCanio and Fremstad, (2013) plotted the relationship between game theory and climate change diplomacy. There is a need of side payment or enforcement mechanisms to global abatement of greenhouse gas emissions outside the game framework. The negotiations on climate change may offer the opportunities to alter payoff ranking and strategic choice of players. The order of preference is subject to environmental diplomatic negotiation, diffusion of scientific and technical information. The imperatives of economic development and poverty reduction seem to favor the improvement in participation of developing countries due to the transfer of low-carbon energy supply technologies. The investment in these technologies has a potential to disrupt or destabilize Great Powers relationships. Power competition due to diffusion of the technologies could spread the influence of powerful nations without resort to coercion or war.

Ioan, (2013) highlighted the main development regarding environmental and green diplomacy due to the natural solidarity of environmental factors, affirmation of global ecological issues and trans boundary pollution. Furthermore, ozone layer depletion, climate change, desertification and biodiversity conservation is possible through bilateral, regional and global cooperation. Therefore, green diplomacy is a neutral, more flexible and an effective instrument to promote environmental protection and development.

Papa and Gleason, (2012) recognized the role of emerging powers such China, Russia, India and Brazil in sustainable development diplomacy. They have a transformative effect on the world politics and economy. The emerging powers are engaged in policy coordination in the sustainable development realm through BRICS (Brazil, Russia, India, China and South Africa) and BASIC (Brazil, South Africa, India and China). They have started to utilize their influence to create incentives for other stakeholders in the system. They are involved in skillful diplomacy to obtain the support of their coalitions and forge consensus in global policy making. The sustainable development diplomacy is required to exert leadership by emerging powers for clean energy.

The water treaties usually acknowledged the flow variability than a variety of mechanisms that govern flow variability. The majority of treaties used subtle and open-ended approach to explicitly address variability. They reflect trade-offs between flexibility and enforcement due to a deviation of adopted mechanism from an ideal state being flexible

in face of change but binding in enforcement (Drieschova *et al.*, 2008). However, the flow variability remains unacknowledged in the Indus Water Treaty which is fostering conflicts between India and Pakistan since decades.

Gaillard *et al.* (2008) used the disaster diplomacy framework to address the impacts of tsunami disaster on the conflict between the Free Aceh Movement and the Government of Indonesia. The Free-Aceh Movement has created informal networking and disaster diplomacy to consolidate reconstruction activities. Although, the tsunami disaster is not only the sole vector of peace in Aceh but a powerful catalyst to retrieve peace through the negotiations and diplomatic talks between both stakeholders which favored the recent changes in a political environment. The non-disaster and political factors are likely to have a significant impact on long-term conflict resolution and peace after the tsunami catastrophe.

Climate change has speculated the likely of violent conflicts and security problem. The vulnerability of local places and social groups to climate change is integrated with the role of the state to harmonize peace, development and livelihood into emerging relationship between conflict, human security and climate change. Climate change will undermine the security and the capacity of the state to provide services and opportunities to sustain livelihood by reducing the access and quality of natural resources (Barnett and Adger, 2007).

Fischhendler and Feitelson, (2003) appreciated the environmental diplomacy and wisdom on resolving trans boundary water basin issue between USA and Mexico by understanding the spatial discrepancy, benefits and costs of cooperation at the basin scale. The integration of negotiations and Mexican demand over the Rio Grande and Colorado's river water weaken the position in an upstream and downstream conflict. The agreements between the parties precluded the previous basin negotiation and trade the water of Rio Grande River with Colorado River to offset the spatial discrepancies.

Mumme, (2003) studied more than thirty years old environmental politics and policies at the US-Mexican border, development, trends and achievements. The integration of environmental politics and policies had ameliorated the understanding of institutions, practices, resources deployment according to environmental demand and awareness of the social and governmental ramification of environmental conservation in the border area to achieve sustainable development. Water has dominated the environmental politics and numerous initiatives by both countries attempted to cope with the problem. However, the

political analysis of still episodic and underdeveloped concerns including wildlife, land use, air quality, solid and hazardous waste acquires serious practical measures.

Giordano *et al.* (2002) interconnected the international water relations, conflicts and regional cooperation instead of trans boundary water conflict and riparian cooperation. Water interactions are dynamically linked with geographical scale and border international affairs. Furthermore, data from the Middle East, Southern Africa and South Asia has demonstrated the evident national and international conflicts over water distribution, allocation and management complicated by political historical conflicts.

The disaster diplomacy increases the collaboration between historical and conventional rivals such as interstate response to earthquake and cooperation between Greece and Turkey in 1999 (Kelman and Koukis, 2000; Ker-Lindsay, 2000), hurricanes monitoring between Cuba and USA (Glantz, 2000), and drought prevention across Southern Africa (Holloway, 2000). Similarly, rapprochement between India and Pakistan in 2001, 2005 earthquakes in Kashmir (Kelman, 2003; Kelman, 2006), the USA aid to Iran after Bam earthquake (Waarner, 2005), international funding to USA after Katrina Hurricane (Kelman, 2007) and 1998 famine in Sudan stimulate the international political will to seek political solutions to civil war (Buchanan-Smith and Christoplos, 2004; Autesserre, 2002).

2.4 Environmental conflicts and diplomacy in case of South Asia

Ali and Zia, (2017) studied the environmental security, need for effective regional planning in Indus basin, trans boundary data sharing, academic research and environmental/science diplomacy. The study also focused resilient scenario, vulnerability of energy and water to climate change, risk management and role of regional organizations to build cooperation.

Ahmed *et al.* (2016) reported that the China, India and Pakistan contain around 40% of the global population. These countries are desperately looking for intensive energy resources to meet the requirements of improving economy. Despite huge energy potential, these three countries have nuclear capability and having opportunities of sharing of energy in the region to bring socio-economic prosperity. The energy sharing opportunities have potential dwindle the tension in relations between the countries in regional peace context and security situation. It might contribute to global peace and prosperity.

The geopolitics, pirate attacks and territorial disputes are challenging the China's seaborne foreign oil supply via the strait of Malacca. The Pakistan-China Energy and Economic Corridor (PCEEC) is providing an alternative option of constructing the secure oil pipeline to shunt the Strait of Malacca. The cost, supply timeframes, greenhouse gas emissions and energy consumption of all existing and proposed oil supply routes from the Middle East and Africa to the border of China was assessed by weight-based model. The construction of an oil pipeline in PCEEC would be not only compatible with the existing routes in energy, environmental perspective and economically viable but also ensure the shortest time for supplying oil to China's border. Further, this corridor has potential for strengthening regional connectivity, commercial, fiscal, geopolitical and social benefits associated with energy and economic connectivity for both countries (Shaikh *et al.*, 2016).

Azad, (2014) studied trans-boundary water resources between Pakistan and Afghanistan. Pakistan and Afghanistan share 700 kilometers long Kabul River that originates from the Hindu Kush and ends in the Indus River. The Pakistan and Afghanistan have no water treaty but water dispute is arising between both countries. The regional cooperation on shared water resources seems necessary to improve the pace for development in both countries, regional stability and security through a water treaty. Diplomatic negotiations should be initiated between both countries to legitimate the International Water Law and ensure equitable use of water (Tir and Stinnett, 2012).

Isaksen and Stokke, (2014) studies the climate change discourse and policy in India since 2007 through a case study. The discourses were evaluated in terms of interests, climate change exposure, identity and climate policy orientations of India. The general discursive shifts and changes in domestic and foreign climate change policy have been identified during the last decade. The international climate change discourse of ecological modernization supports alignment climate change policy and international climate politics. The Indian climate discourse is linked with international environmental discourses for interests, identity, position in international relations, international negotiation, domestic and foreign climate change politics.

IUCN, (2014a) conceptualized the need to promote cooperation and understanding of benefits from Indus Basin for India and Pakistan. Both countries had practiced hydro-diplomacy which resulted in Indus Water Treaty to achieve cooperation. The tension between the both countries, political factors, climate change, population and economic growth resulting in emerging conflict in a current situation. Hydro-diplomacy is not one-

time exercise and can be institutionalized to resolve conflict associated with dynamic nature of water. The capacity building of relevant institution through technical experts, training and knowledge development would result in effective hydro-diplomacy.

IUCN, (2014b) endured the shocks to food production and water availability due to climate change in South Asia likely to challenge the access to safe drinking water and water for hydropower, industry and irrigation. Pakistan is vulnerable to impacts of climate change including increasing extreme weather events (floods and droughts), rising temperature, intense cyclones and water security. It is necessary to formulate comprehensive sustainable and effective national policy for integrated water resource management supported by sustainable associated policies including drinking water, sanitation, irrigation, agriculture and environment. There is also need of to analyze and review existing policies and institutional mechanism.

Khalid *et al.* (2014) had centered the issue of water and trans boundary flow in world politics. The surface and groundwater are under immense stress due to urbanization, industrialization and scarcity of fresh water resource. Interstate hydro-politics is among the top of agendas and an important issue in South Asia. The conflicts on water resources are eminent between Pakistan and India since partition. As India is the largest country by area in South Asian region and share its border with almost most of countries. There is another constant rift over water between India and other states of South Asia including Nepal, Bhutan and Bangladesh. These conflicts are increasing the intensity of water scarcity and tension in regional relations. The internal management of water recourses and regional issues could be resolve by strengthening water governance.

Mahmood *et al.* (2014) addressed that Pakistan is facing serious energy crises despite of blessed huge potential for energy. The threat of energy security may result from overwhelming dependence on import of fossil fuels to meet the energy demand. Therefore, energy import options have obtained serious attention. The energy imports options like Turkmenistan, Afghanistan, Pakistan India (TAPI), Iran, Pakistan and India (IPI) gas pipelines, and Liquefied Natural Gas import from Qatar should be evaluated to secure notational interest as well as regional cooperation.

South Asia has been listed in one of the eminent vulnerable regions to climate change in the world. The change in crop productivity, fluctuations in food prices and food security had been identified in South Asia. The main five countries including India, Pakistan, Bangladesh, Sri Lanka and Nepal had faced the negative impact on crop

production and price. Further, these countries are dependent on agriculture for economic development and employment generation. The climate change-induced yield losses will have an ultimate impact on the livelihood of people and development. There is a need to develop climate change policy and adaptation measures at the regional level (Bandara and Cai, 2014).

Singh, (2014) believes that the 21st century is for bringing the nations closer and shortening of geographical distance. The initiatives for peace resulted in a comprehensive policy to interact for partnership and development. The partnership and cooperation are essential to get wider existence and stability for developing countries. Development and partnership between countries could be in economic development, social, political, cultural and environment sustainability. India and Bangladesh share the long border and developing countries. Therefore, cooperation and partnership are essential for the development of both countries.

IUCN, (2013a) pointed out that the development of hydropower projects on western rivers have a direct effect on rights of Pakistan in the legitimation of Indus Water Treaty and creating conflicts. The environmental issues, climate change and water shortage is increasing complexity of apportioned water issue. The treaty is silent on water apportionment during dry periods while the entitlements of India on western rivers are fixed. The ecosystems and biodiversity in low riparian have been threatened during dry seasons. Meanwhile, the agricultural growth, cropping pattern, productivity, food security, and economic development is at the risk during dry seasons. The flow of western rivers particularly Chenab is being affected by extensive Indian government plans of dams and hydropower projects. The fixed entitlements do not look ironic due to a variable flow of rivers. Moreover, there is a famous perception that India is not implementing the treaty in true spirit which is catalyzing conflict.

Water disputes between the provinces are date back to a hundred years. Although, Pakistan Water Apportionment Accord was introduced by the government of Pakistan in 1991 and signed by all Chief Ministers. There is still growing inter-provincial dispute on water share particularly in dry seasons due to inadequate interpretation, lack of new large dams and environmental factors. The major dispute is between Punjab and Sindh (lower riparian) on distribution and sharing of shortage in compliance of entitlements. The upper riparian has an ability to take a larger share in the time of shortage and hardly accept the rights of lower riparian in water shortage proportion. Furthermore, the lower riparian is at

more vulnerable to extreme events i.e. water shortage in dry periods and receive floodwaters during a period of excess (IUCN, 2013b).

The water has a fundamental role to pursue industrial, agricultural and economic development and peace in the country. The misuse and mismanagement of water resources, as well as inequitable access to a user, undermine welfare and economic growth, leading to violent conflicts and human insecurity in South Asia. The water security has been considered as an important national security interest and political agenda beyond environmental and development concerns. The climate change and glacier melting are directly affecting the flow of Himalayan Rivers system and threatened the supply and access to water resources including Indus Basis in South Asia. India and Pakistan are already scarce and struggling to overcome an overwhelming pressure to meet future water demand as a shared riparian. If we analyze the Indus Water Treaty carefully, it is actually water sharing treaty and even does not address usual water sharing. The unsustainable use, massive demand, and low storage capacity will trigger the conflict and new treaty between both countries (Swain, 2013).

South Asia, with its legacy of suspicion, mistrust, ethnic sectarianism, and political parochialism would have fallen off the global map, it had not been for its large and growing populations. A large number of people in South Asia do not have access to commercial energy due to poverty. This is, perhaps, the greatest challenge that governments of the region face. Energy security is a prerequisite to prevent widespread unrest, the economic development and critical to national security. The political elites mismanage the energy from decades and fail in providing energy resources to people (Ebinger, 2013).

Singh, (2013) highlighted the South Asian region endure growing imbalance between energy demand and its secure supply from indigenous sources. Energy endowments vary among South Asian countries and lack regional cooperation to energy resources in neighboring countries. The cost of energy supply is increasing and reducing energy security of individual countries and overall the region. The cooperation and improved connectivity by strengthening the mechanism of energy could significantly benefit the people and economic development. Therefore, regional cooperation within South Asia is key to deal the energy deficiency and security in the region.

South Asia remains energy deficit in aggregate and lacking energy cooperation. The economic initiatives, mutual contingencies, confidence building measures and reliability of energy could be increased by efficient use of regional resources. Energy engagement has

yet untapped and immense potential for geopolitical tension at a bilateral level. The intra-regional energy trade is only limited to India, Nepal and Bhutan. Overcoming inertia, assessing further possibilities, and harnessing them is key whilst taking into account the geopolitical, economic and technical risks. The governments of the region are engaged in bilateral energy dialogue to sustain economic development. Apart from development, political mindsets and state policies to address energy security seem to hinder energy trade. The regional cooperation requires overcoming overwhelming variables including political will, investment cost, the right of way, private participation, affordability, climate change and environment (Iqbal and Tabish, 2012).

Malik *et al.* (2012) brief the Pakistan-India trans-boundary cooperation. Indus basin river system consists of five tributaries and the main Indus. The demarcation of boundaries at partition did not consider headwaters, their command areas and went under Indian control resulting in the water dispute. Later on, both countries sign comprehensive Indus Water Treaty with the mediation of the World Bank. The provisions of the treaty were allocating rivers, data exchange, dispute resolution and constitution of Indus Water Commission. The treaty works well over decades but population growth, food security, energy demand, climate change and environmental degradation coupled with water scarcity gave rise to differences and dispute during the last couple of decades.

Tripathi, (2012) considers South Asia as least integrated region due to many persistent problems which are creating hurdle, despite of having common culture and heritage. Energy subsequently can be a functional area for regional cooperation by linking demand and supply through functional theory. The role of various actors including international agencies, civil society and particularly SAARC Energy Centre is essential for promoting cooperation, utilization of energy rings and development of SAARC Energy grid to ensure energy security in South Asia.

Begum and Nosheen, (2011) identified the stress on Indus Water Treaty due to ecological threats to Indus Rivers system and increasing water scarcity in India and Pakistan. The Indus Water Treaty mandate the opportunity for future cooperation on trans-boundary water issue but no project has been undertaken according to a treaty by India. The water issue is being politicized between both countries due to water insecurity and climate change resulting in the violation of the treaty. The continuous construction of many large hydropower projects on Jhelum and Chenab rivers, attention to divert flow, lack of engineering design and information sharing has endured the Pakistan's apprehension. All

these things are resulting in a vacuum of mistrust, environmental concerns, economic development and manipulation of water in relations between riparian states.

Biswas, (2011) ranked trans-boundary Himalayan rivers as a golden opportunity for Bhutan, Bangladesh, Nepal and India to improve the living standard of the largest number of poor people in the world. India and Bhutan are successfully using water as an engine for economic development and settle the concerns over water by trust and goodwill. However, the deadlock and lack of trust between Bangladesh, Nepal and India are multiplying with the poverty and underdevelopment resulting in poor living standards

Cheema, (2011) considered the availability of energy resources as a key component for economic development. The development process steadily increases the demand of energy at regional and global scale over the decades. The increasing energy demand has stimulated the countries to intensify exertions for procurement of energy from domestic resources and abroad. The successful procurement depends on the secure and safe corridor for transporting energy from resource-rich states to deficit states. Pakistan can play an effective energy corridor for central and South Asia in the spotlight of an existing project in the context of operative and political constraints.

Uprety and Salman, (2011) consider the development of cooperation with respect to the Ganges-Brahmaputra-Meghna river basins and the Indus river as a source of apprehension, ongoing dispute and tension among Bangladesh, India, Nepal and Pakistan. The riparian communities across borderland endure with unique concerns of hydro-politics including transference, allocation and diverging position on bilateral, multilateral, national and regional fronts. The implementation of official water discourses, an international legal instrument associated with water governance and management of water sharing can avert dispute and enhance regional cooperation and collaboration.

According to IUCN (2010), the conflict on the trans-boundary water of Kabul River is looking to be a severe challenge for both states in future. The flows of Kabul River are rapidly declining at Attock in Pakistan. The joint studies by both counties are required to unfold the reasons. Pakistan will be adversely affected being a lower riparian due to new development in Afghanistan, hydropower projects and absence of water treaty with Afghanistan. Therefore, both basin states should reframe perception of water security, encourage the involvement of agreements in the framework of SAARC, regional cooperation, initiate dialogue, environmental diplomacy and negotiation to support the treaty.

The four major river basins are originating from the Himalaya, which are irrigating the water-stressed region of South Asia to sustain livelihood and edibles. India-Pakistan and Bangladesh-India-Nepal are main riparian states in west and east which depend on trans-boundary water sharing. The environmental degradation, climate change, growing industry, agricultural expansion, burgeoning population and domestic use have commuted the consumption pattern and leading to inter-state conflicts. The commercial irrigation and hydropower generation to guaranteed economic development synergizing the concern. A multidimensional and coordinated strategy is required to eradicate these challenges (Khalid, 2010)

Vaughn *et al.* (2010) reported the potentially destabilizing effect on Pakistan in combination with demographic trends, food security, limited arable land, water scarcity, energy security climate change and economic development. Environmental stress in Pakistan has radicalized internal and destabilized international political and security environment. Environmental factor has a potential to stoke conflict and war between two nuclear-armed states of India and Pakistan.

Khan, (2001) referred to modify the concept of security from the defense of the sovereign state against internal or another state violent attack by incorporating environmental security as a subset of human security. The anthropogenic activities are impairing earth systems due to rapid geochemical changes. These changes are directly affecting sustainable development and indirectly social equity and justice. A marked degree of injustice, inequity and rapid environmental degradation have devoid the performance of Pakistan to achieve sustainable development. The issues like Dir-Forestay case and Kalabagh dam foster the conflict and violence due to a paradox of social, economic, environmental, and political factors. Pakistan and India had attained rapid growth and successful utilization of natural gas.

What may be synthesized form review of the above literature is that the environmental security and economic development of countries in South Asia are under stress due to politicizing environmental issues, mismanagement of natural resources, population growth, increasing demand, poor connectivity, lack of regional cooperation and ineffective regional institutions. Regional energy trade has the massive ability of regional connectivity, geopolitical and socioeconomic benefits, yet the endowment and use of energy resources regionally need trust, collaboration, and regional cooperation. Given that climate change is resulting in variability of river flows, affecting water availability, food,

and energy insecurity, water-related conflicts among Bangladesh, Nepal, India, Pakistan and Afghanistan are pregnant with tension. The upshot is the multiplication of poverty and hindering development in the region. Sustainable development in South Asia derives the need of a neutral and non-aggressive tool for trust building, collaboration and regional cooperation. Therefore, environmental diplomacy as a tool to initiate negotiation, trust building, and regional cooperation is of great importance to achieve environmental security for sustainable development. Previous studies identified the significance of energy trade, impacts of climate change, water and environmental insecurity. However, there is a knowledge gap on the importance of environmental diplomacy and understanding the significance of capacity assessment of energy, water and climate change policies and plans in South Asian countries for environmental security and development. Hence, this study will fill the gap and provide the significant knowledge on promotion of environmental diplomacy as well as relationship of environmental security with development in South Asia.

CHAPTER 3

3. RESEARCH METHODS

3.1. Scope

South Asia encompasses diverse sovereign states of different sizes including Afghanistan (AFG), Bangladesh (BGD), Bhutan (BTN), India (IND), Maldives (MDV), Nepal (NPL), Pakistan (PAK) and Sri Lanka (SKL) (Figure 3.1). The region has a vast geographical space stretching from Himalayan mountain ranges in the north to Indian Ocean in South along with the Indus valley in west to the plains of Brahmaputra in the east. South Asia is home of nearly two billion (about 25 % of global population) teeming population (Bose and Jalal, 2004). This region has a long cultural heritage and endowed with natural resources (SEC, 2016). According to the World Bank, this region is experiencing a long period of robust economic development of about 6% a year over the past 20 years (The World Bank, 2016).

South Asian region consist of transition economies and vulnerable to climate change, facing energy crises, resource exploitation and water scarcity along with rapid increase in demand of water and energy. Moreover, increasing demand, economic development, mismanagement of resources, lack of regional cooperation, inadequate polices and environmental factors are resulting many conflicts associated with water and energy security, impeding trade, development and environmental security. This study was designed to link environmental security by particular attention on energy, water and climate change with development in the context of Pakistan and South Asia. Furthermore, the need of environmental diplomacy was assessed in national and regional context to resolve conflicts and achieve development goals.

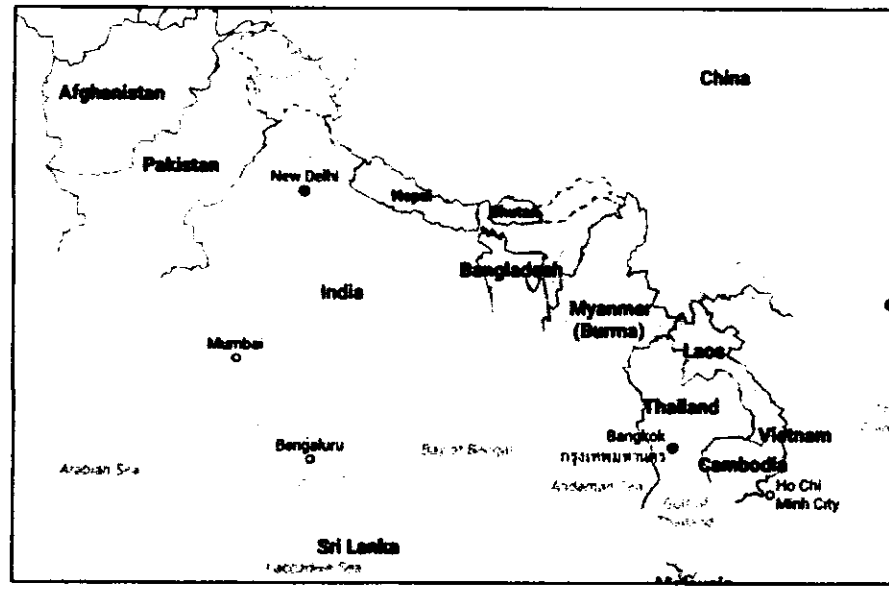

Figure 3.1 Map of South Asia (Source: Google maps)

3.2. Research methods and approaches

The environmental security has not only changed the state security and geopolitical discourse but also affecting the trade, economy and development. The environmental security is being governed by various factors but climate change, energy and water security has attained unique importance in complex nexus of economic development, geopolitical and International Relations. The relationship of peculiar environmental factors (energy, water and climate change) with development was assessed through both empirical and multi-criteria based analysis of national and regional policies.

The criteria were selected based on technical, political and sustainability aspects of energy, water and climate change policies interlinked with environmental security, development, environmental diplomacy and capacity mapping of regional forums keeping in view the objectives. The criteria for analysis of energy, water and climate change policies, treaties and plans have been established from previous studies, recommendations of relevant international organizations like the United Nations, recent research trends and obligations of multi-lateral agreements. The data used in this study was educe from the quantitative analysis of energy, water and climate change policies, treaties and plans based on established technical, political and sustainability criteria using a rating technique (Ganoulis *et al.*, 2008; Diam *et al.*, 2009; Connelly *et al.*, 2016: den Herder *et al.*, 2017; Mi *et al.*, 2017; Runfola *et al.*, 2017). This quantitative analysis has constituted logical relationship of environmental security with development in Pakistan and South Asia as

well as rationalized environmental diplomacy. The rating of technical, political and sustainability criteria was accomplished by different experts from South Asia. The experts of different academic and professional background (employees of relevant ministries, departments, NGOs, academia and independent observers) have selected to elicit valid response. The local experts were approached personally but experts from other countries were approached via email or Skype though different platforms like SAARC Energy Center, South Asia Co-operative Environment Programme, Center of Excellence in Environmental Studies, King Abdulaziz University, Jeddah and Heritage Consultants, UAE. The response rate of experts from India and Bangladesh was initially low when were contacted directly but they respond positively when they were contacted through different forums. The experts rated the significance and existing consideration of individual criteria in energy, water and climate change policies, plans and treaties linked with environmental security and development in context of Pakistan and South Asia. The compatibility of existing ranking was different in individual energy, water and climate change policies, plans and treaties due to difference in consideration, priorities and goals of each state. The data was interpreted using significance and existing ranking of each criteria and Pearson correlation between significance and existing ranking. Meanwhile, questionnaire has provided the overview of relationship of environmental security with development and highlight the role of non-state stakeholders (business community, NGOs and media).

3.2.1. Questionnaire

The questionnaire can provide a good response rate and high quality usable data which increases the validity of research (William, 2003). The questionnaires (40) were used to assess to identify the role of non-state stakeholders (Business, industry, media and NGOs) in environmental security, development and promotion of environmental diplomacy. The questionnaire was formulated by following the SAGE Publications Limited's guide for social science students and researchers (Ritchie and Lewis, 2003; Tashakkori and Teddlie, 2010). The questionnaire is attached in annexure 4.

3.2.2. Interviews

The semi-directive interview method for gathering information in an open-ended format (Briggs, 1986), was used to collect relevant information for honest response. The interviews were used to study used to assess the role of South Asia Co-operative

Environment Programme, SAARC, institutional capacity, and role of non-state stakeholders (Business, industry, media and NGOs) for environmental security and diplomacy. Standardized instructions developed by SAGE Publications Limited for social science students and researchers was followed using checklist. (Ritchie and Lewis, 2003; Tashakkori and Teddlie, 2010).

3.2.3. Multi-criteria Decision Analysis for energy, environmental security and development in national context

Energy security is core pillar of economic growth and well-being of people. An empirical analysis, and Multi-criteria Decision Analysis (MCDA) in combination with Patton's policy analysis cycle were used for exploring the relationship of energy security, environmental security and development as well quest for environmental diplomacy in context of Pakistan. A multi-criteria decision analysis provides an opportunity to choose appropriate policy measures as well as identifies needs of taxes, incentives provisions, implementation of global treaties, reduce emissions and combat climate change (Munda, 2016, Rahman *et al.,* 2016; Odgaard and Delman, 2014; Raza, 2013; Patton *et al.*, 2012; Wang *et al.*, 2009). MCDA methods are conceived suitable for multi-perspective analysis of complex decision problems. It provides an opportunity to decision makers for rationalizing promises and conflict evaluation (Amer and Diam, 2011). MCDA is based on the identification of criteria and sub-criteria by assigning a numerical value to evaluate the importance of criteria (Diam *et al.*, 2009). The MCDA approach is depicted in figure 3.2.

3.2.3.1. Identification of goal

MCDA was applied to the energy policies of Pakistan, keeping in view the goal of energy security and environmental sustainability to meet the modern requirements of development.

3.2.3.2. Selection of criteria

A transparent representation of different quantifiable parameters is an imperative for linking policy elements with energy policy (Lee and Shih, 2010). Hence, the national policies were censoriously analyzed in terms of technical, social, environmental, political and economic aspects to secure sustainable energy as well as assess the prospects of environmental security and development. The government of Pakistan had articulated and implemented the National Power Policy 2013, the Alternative and Renewable Energy

Policy 2006 (short-term policy), the Alternative and Renewable Energy Policy 2011 (mid-term policy), the Power Generation Policy 2015 and the Energy Conservation Bill 2016.

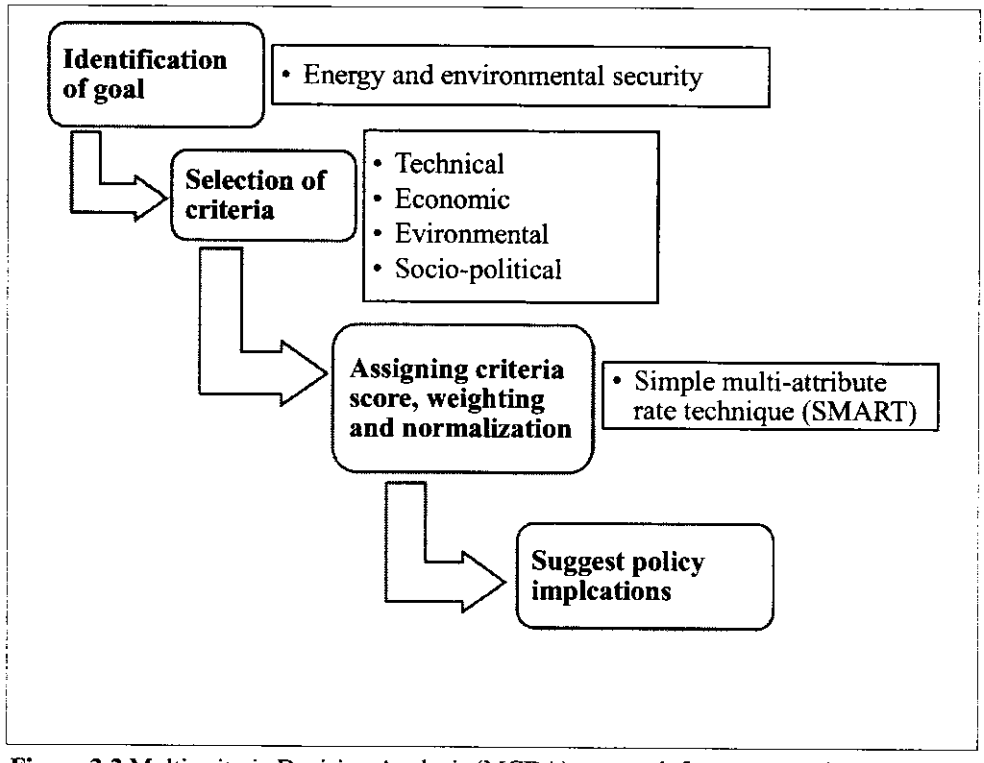

Figure 3.2 Multi-criteria Decision Analysis (MCDA) approach for energy and environmental security in national context

The National Power Policy (NPP) 2015 had mainly focused on the challenges and overcome the shortfall till 2017. The National Power Policy had centered the yawning supply-demand gap, efficiency, and sustainability but there are many gaps to achieve targets. The Ministry of Water and Power (now the Ministry of Energy) has implemented the Power Generation Policy (PGP) 2015 for the endowment of indigenous resources, significant power generation capacity at low cost and protection of the environment from power generation. The ministry has authorized the Private Power and Infrastructure Board and relevant entities in provinces, Azad Jammu and Kashmir (AJK) and Gilgit-Baltistan (GB) for implementation of this policy. Furthermore, the Ministry of Water and Power excogitated and implemented the midterm policy for alternative and renewable energy in 2011 in the extension of short-term policy for alternative and renewable energy 2006 with a target of at least 5% of total commercial energy supplies through alternative and renewable energy by 2030. The Alternative and Renewable Energy (ARE) Policy had mainly concentrated on alternative and renewable energy technologies. It has identified the

potential sources of alternative and renewable energy in Pakistan. The targets look to achievable by demonstrating commitment, strengthen institutional framework and providing the resources.

The criteria were selected from different studies on energy policy (Munda, 2016, Rahman *et al.*, 2016; Odgaard and Delman, 2014; Raza, 2013; Patton *et al.*, 2012; Wang *et al.*, 2009) and joint publication of United Nations (UN) and International Atomic Energy Agency (IAEA, 2005). The economic, technical, environmental, political and social are most common indicators of modern energy policy (Martín-Gamboa *et al.*, 2017). A low carbon and sustainable energy paths can potentially directed in energy policy elements by these criteria (Rahman *et al.*, 2013b). Therefore, quantification of energy policies (National Power Policy, Power Generation Policy and Alternative and Renewable Energy Policy) were carried out using economic, technical, environmental, social and political criteria. The schematic presentation is given in figure 3.2 and detail of criteria is given in table 3.1.

3.2.3.3. Assigning criteria score, weighting and normalization

Simple multi-attribute rate technique (SMART) is processed to rate alternatives and weighting criteria (Edward, 1977). SMART is being recommended and used for assigning criteria, weighting, and normalization for energy systems and policies. The participants (40) of different professional background including technical experts, policy experts (20%), economists (10%), relevant government official (25 %), NGOs representatives (20%), academia (15 %), and environmentalist (10 %) were asked to rank (out of 100) significance of each criterion for energy policies and environment sustainability. They had assigned minimum 10 points to important criteria and increasing the number with improving significance (Wang *et al.*, 2009; Taylor and Love, 2014; den Herder *et al.*, 2017). The correlation was applied on results to find out the relationship of significance ranking with consideration in existing policies.

3.2.3.4. Policy implications

The study had recommended the policy implications based on the finding for improvement in existing policies and rationalized the future national energy policies and environmental security.

Table 3.1 Evaluation criteria for energy policies analysis in national context

[redacted]	1. Identification of potential (C1) 2. Future energy demand (C2) 3. Efficiency (C3) 4. Primary energy ratio (C4) 5. Reliability (C5) 6. Maturity (C6) 7. Safety (C7)
[redacted]	8. Investment cost (C8) 9. Operation and maintenance cost (C9) 10. Fuel cost (C10) 11. Net present value (C11) 12. Payback period (C12) 13. Service life (C13) 14. Equivalent annual cost (C14) 15. Affordability (C15) 16. Subsidies (C16) 17. Compatibility with industrial growth (C17) 18. Tax (C18)
[redacted]	19. Emissions (C19) 20. Land use (C20) 21. Noise (C21) 22. Water security (C22) 23. Climate change (C23) 24. Sustainable development goals (C24) 25. South Asia Co-operative Environment Programme (C25)
[redacted]	26. Access to energy as basic human right (C26) 27. Social acceptability (C27) 28. Job creation (C28) 29. Social benefits (C29) 30. Political will and cooperation (C30)

3.2.4. Multi-criteria Decision Analysis for energy, environmental security, and development in regional context

The sustainable procurement of energy at regional level is gaining the importance due to low cost and low carbon energy goals. The strong policies with clear vision, stakeholder engagement and cooperation are key to governance structure for connecting

the actors (Binder *et al.*, 2017). The regional planners require multi-criteria analysis to determine the pertinent of energy policies for secure supply and environmental sustainability (Parkinson *et al.*, 2017). Multi-criteria Decision Analysis (MCDA) offers a suitable methodology with requisite structure that stay on track towards objectives and requirements (Seager *et al.*, 2017). MCDA provide the basis to policymakers for long-term sustainable decisions by analyzing the different perspectives of multiple sustainability criteria for regional energy transitions (Volkart *et al.*, 2017). MCDA was applied to energy policies in the region to assess the energy trade feasibility, environmental diplomacy, development and environmental security nexus (Figure 3.3).

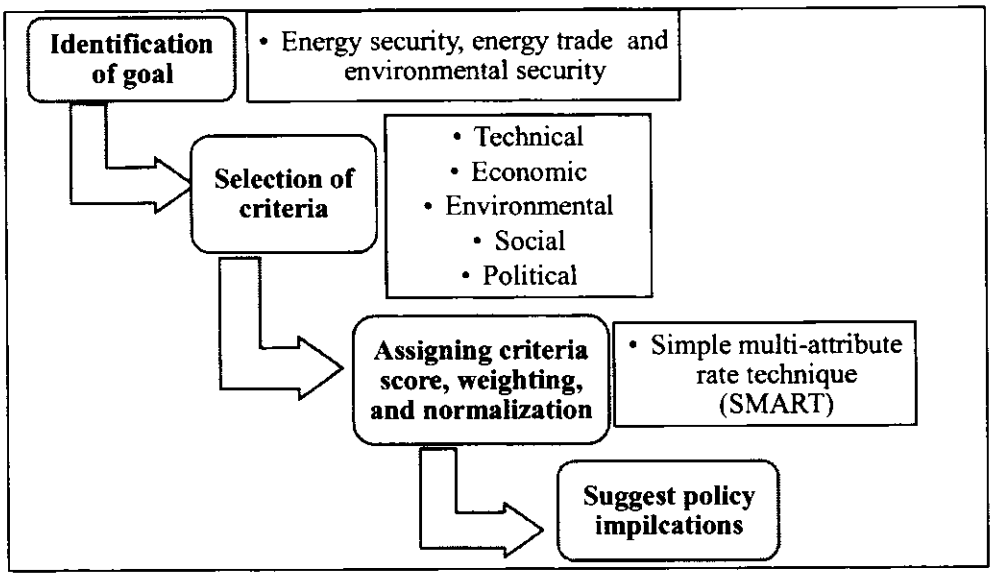

Figure 3.3 Multi-criteria Decision Analysis (MCDA) approach in regional context

The primary goal was successful procurement of energy, cooperation, regional energy security and environmental sustainability. The evaluation criteria were selected from studies focused on regional energy transitions and joint publication of United Nations (UN) and International Atomic Energy Agency (IAEA 2005). The technical, economic, environmental, social and political criteria were used to assess the requirements regional energy trade, security and environmental sustainability (Rahman *et al.*, 2016; Volkart *et al.*, 2017). The detail of selected criteria is depicted in figure 3.4. Simple multi-attribute rate technique (SMART) is well-known for assigning criteria score, weighting, and normalization for energy policies (Edward, 1977). The data was collected from forty (40) experts. The participants were selected from different professional background (Technical (15%), policy experts (15%), energy experts (22%) NGOs representatives (20%), academia

(10%), government officials (11%), and environmentalists (7%) from entire region. The experts ranked significance ranking and existing ranking (out of 100) for each criterion, dispensed minimum 10 points to least consider criteria and increased rating with improving significance (Wang *et al.*, 2009; Taylor and Love, 2014; den Herder *et al.*, 2017). The policy implications had been recommended based on the finding for improvement in existing policies and streamlined the future energy policies in regions, energy trade and environmental security.

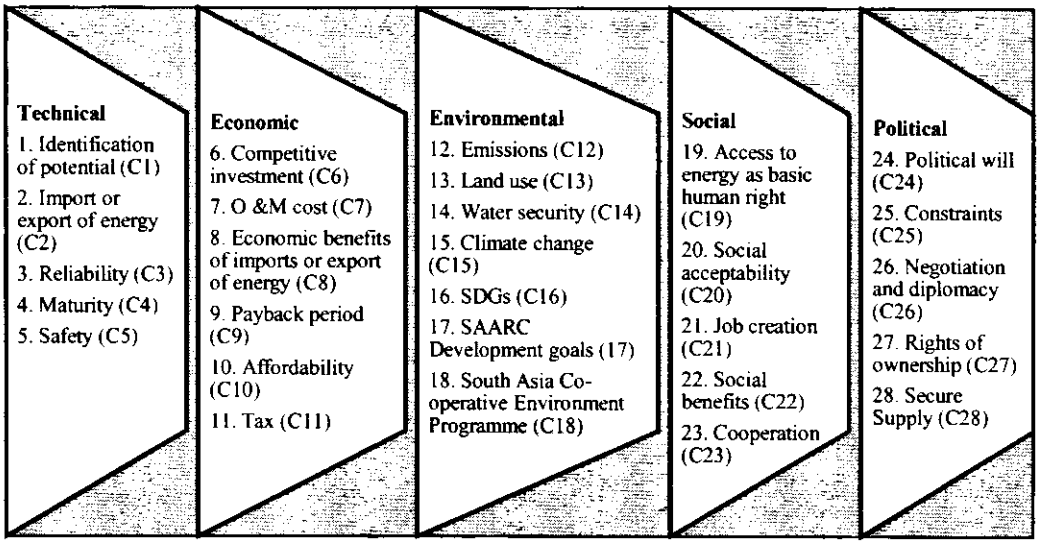

Figure 3.4 Evaluation criteria for analysis of energy policies in the region

3.2.5. Multi-criteria Decision Analysis for water, environmental security and development

Water scarcity is inextricable colligated with development, environmental and national security. It endures effects on water supply, ecosystem, hydropower development, livelihood, income downturns, agriculture, and industry. Meanwhile, history monstrance inevitable conflicts, migrations and civil unrest due to water scarcity and extensive sharing between countries. The conflict on water resources are likely to affect about eight billion people around the globe and threatening national security of many countries (Busby, 2017). Therefore, decision-making in water resource management is one of most important requirement to hamper future development. Different approaches are available for intuitive and logical analysis of water management related treaties and policies (Dong *et al.*, 2013; Safavi *et al.*, 2016). Multi-criteria Decision Analysis (MCDA) technique helps in depth

analysis of policies before implementation. It has been adapted as a methodology for identification of potential conflicts, their management, water resource policy and treaties analysis to adhere the goals set by different countries (Ganoulis *et al.*, 2008).

The application of MCDA for water resource policies, treaties and trans-boundary water conflict management is evident from various studies (Messner et al., 2006; Ganoulis *et al.*, 2008; Hajkowicz and Higgins, 2008; Ma *et al.*, 2008; Connelly *et al.*, 2016). MCDA was implied to analyze the national and water resource policies in the region, treaties, relationship between water security, environmental security and development. The MCDA approach is entailed in figure 3.5.

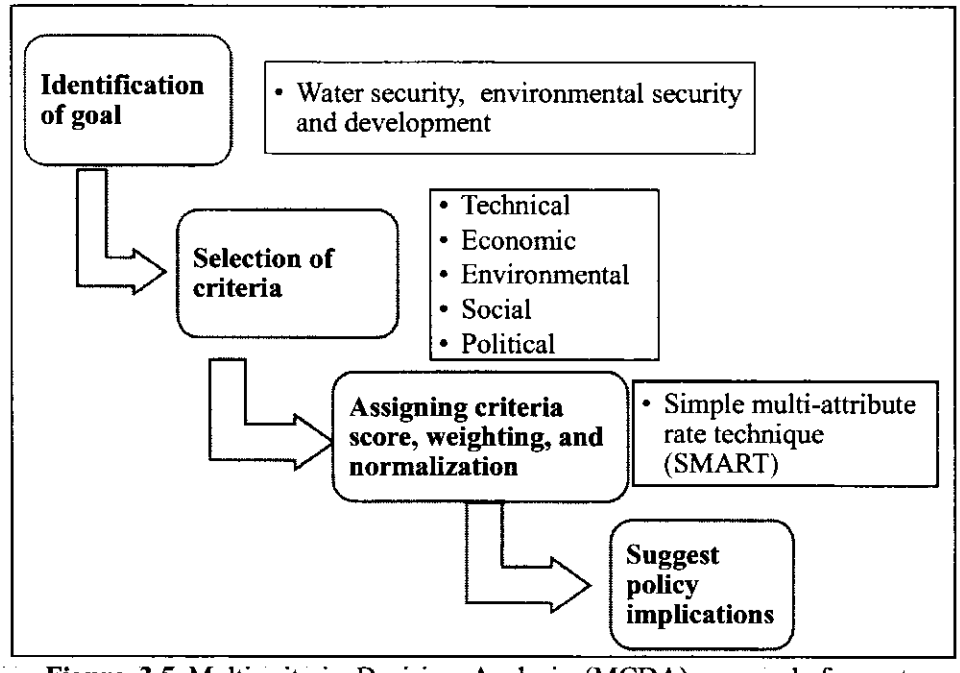

Figure 3.5 Multi-criteria Decision Analysis (MCDA) approach for water security, environmental security and development in South Asia

3.2.5.1. Identification of goals

Pakistan and other regional states have their own social, economic, political and environmental goals related to water resource development, conservation and management. These goals vary from food production, sustainable water supply for industry, economic development, ecosystem conservation, pollution control, hydropower development to national security. South Asia is fed by trans-boundary Himalayan rivers as well as known for eminent conflicts due to water resources distribution. This study entailed the goal to analyze the relationship between water security, environmental security and development in national and regional context.

3.2.5.2. Selection of criteria

Water resources management involves the multiples objectives and stakeholders having different preferences and interests. The use of multi-criteria analysis provides a discrete choice to decision makers to achieve the objectives (Hajkowicz and Higgins, 2008). The evaluation of economic, social, technical, environmental and political criteria reflects the balance and fairness in water resource policy and treaties (Safavi *et al.*, 2016). The technical, economic, environmental, social and political criteria were selected for analysis of water resource policies, treaties and assessment of environmental diplomacy. The criteria used were delicate from numerous research studies (Messner *et al.*, 2006; Ganoulis *et al.*, 2008; Hajkowicz and Higgins, 2008; Ma *et al.*, 2008; Bekchanov, 2014; Connelly *et al.*, 2016; Safavi *et al.*, 2016) and United Nations Educational, Scientific, and Cultural Organization- International Hydrological Programme (UNESCO-IDH) water resource policy guidelines (UNESCO, 2014). The detail of selected criteria is exhibited in figure 3.6.

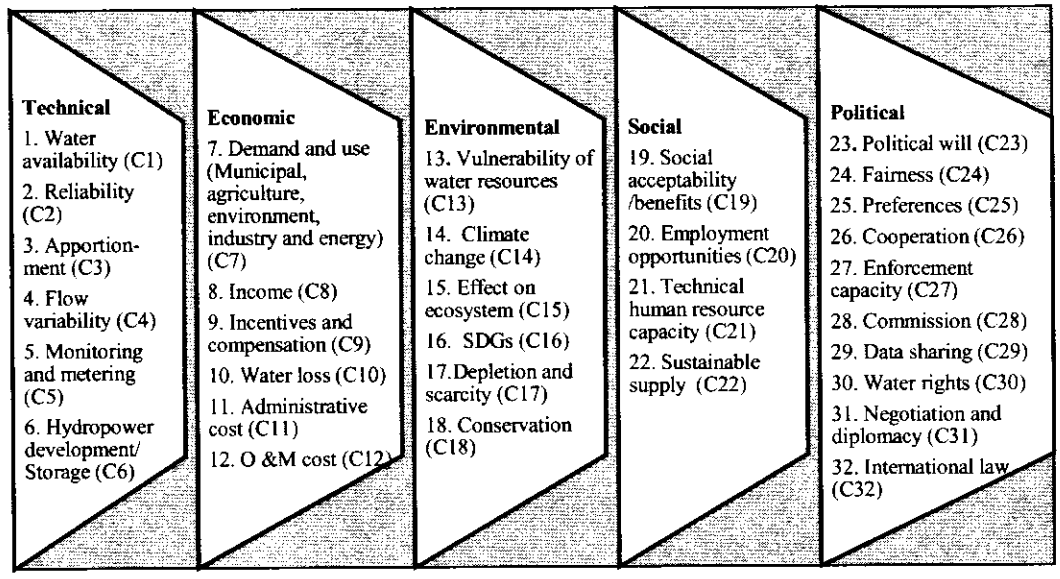

Figure 3.6 Evaluation criteria for analysis of water policies, accord and treaties

3.2.5.3. Weight determination and ranking

The weight was assigned to each criterion for evaluation of relative importance. Simple multi-attribute rating technique (SMART) was employed to assign weight, rank and normalize each criterion. The experts from various fields (water resource management (25%), international relations (17%), NGOs representatives (12%), academia (10) environment (16%) and government officials (20%)) were implored to dispense

significance out of 100. They have to assign minimum rating of 10 to least considered criterion and increase the ranking with accruing significance (Onu *et al.*, 2017).

3.2.5.4.. Policy implications

The policy implications had been suggested after evaluation of water policies, accord and treaties for improvement in water policies as well as treaties. Additionally, it will vindicate the future water security, environmental security and development in both national and regional context.

3.2.6 Multi-criteria Decision Analysis for climate Change, environmental security and development

The climate change policy domain has endured high conflicts and controversies among political parties, states, government agencies, universities, and environmental organizations for decades (Bernauer, 2013; Kukkonen *et al.,* 2017). This disagreement prestige impact of climate change, conflicts, environmental damage, economic cost as well as damage the mitigation efforts. Policy orientation needs to define priorities, vulnerabilities, seriousness of problem, basic causes and practicable solutions (Jenkins-Smith *et al.,* 2014). Hence, successful adaptive strategies are required to cope climate change immediately. Therefore, Multi-criteria Decision Analysis (MCDA) offers a considerable support in development of such complex and multi-disciplinary climate change strategies involving complex interactions with natural systems, many stakeholders, immediate response, and cooperation (Michailidou *et al.,* 2016).

The diligence of MCDA for climate change policies, plans, impacts, conflicts, its mitigation and adaptation is manifested from various studies (Qin *et al.*, 2008; Calvin *et al.*, 2012; Van Sluisveld *et al.*, 2013; Mi *et al.*, 2017; Runfola *et al.*, 2017). Consequently, MCDA was applied to climate change policies and plans in South Asia and assess its relationship with environmental security and development (Figure 3.7).

3.2.6.1. Identification of goals

Climate change has reshaped the social, economic, environmental, development and political goals worldwide. It is considered as a potential driver of change in energy, water, food, development and stability dynamics. This study has set the goal to analyze climate change policies and plans in South Asia, assess gaps and its relationship with environmental security as well recommend policy implications.

3.2.6.2. Selection of criteria

The Intergovernmental Panel on Climate Change (IPCC) has stressed the both developing and developed countries to ponder economic instruments, regulatory mechanism, public health, international agreements and government programmes in their climate change policy for mitigation and adaptation of climate change (IPCC, 2014). Thirty-two different technical, economic, environmental, social and political criteria were selected to conduct this study. The criteria used were selected from Fifth Assessment Report of IPCC (summary to policy maker) (IPCC, 2014) and various research studies (Qin *et al.*, 2008; Calvin *et al.*, 2012; Van Sluisveld *et al.*, 2013; Barker, 2017; Daksiya *et al.*, 2017; Mi *et al.*, 2017; Runfola *et al.*, 2017). Figure 3.8 had illustrated the detail of selected criteria.

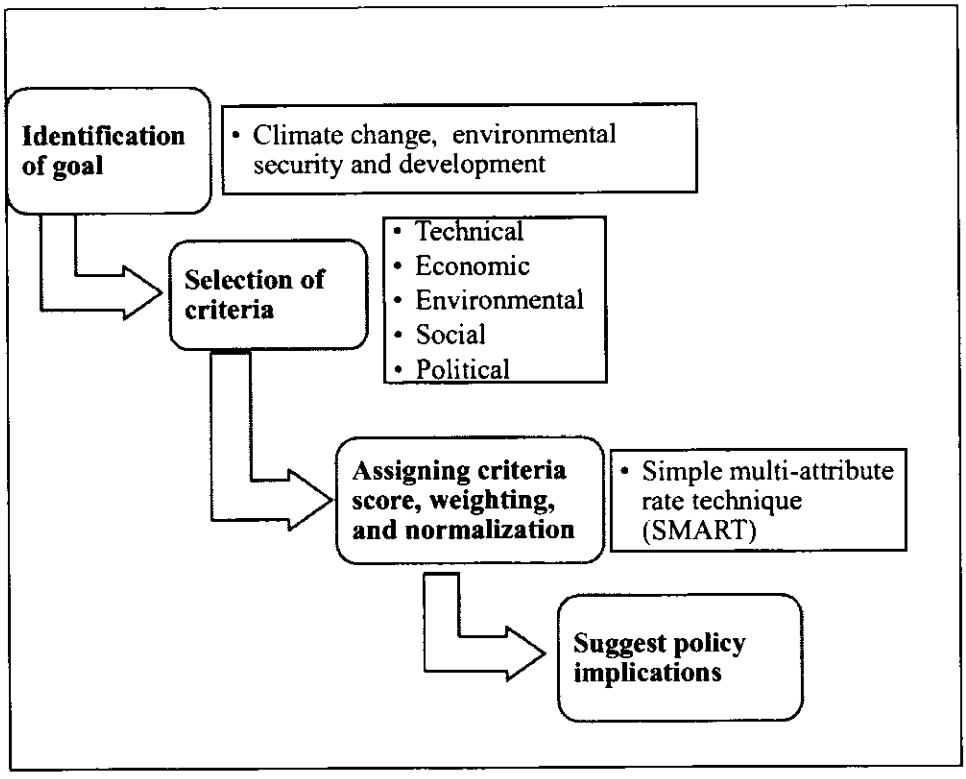

Figure 3.7 Multi-criteria Decision Analysis (MCDA) approach for climate change and environmental security and development in South Asia

3.2.6.3. Weight determination and ranking

Each selected criterion has different significance and contribution in climate change policies and it adaptive capacity. There is an essence to assign weight, rank and normalize each criterion selected for climate change policies and plans (Qin *et al.*, 2008; Senapati and

Gupta, 2017). The study employed Simple multi-attribute rating technique (SMART) to rank, weight and normalize selected criteria. There have been selected experts (40) from different backgrounds including climate change experts (27%), international relation expert (10%), government representatives (20%), environmentalists (18%), NGO representatives (10%), energy and water experts (15%). They have to endorse significance ranking out of 100, begin with 10 (minimum rating) to least considered criterion and increment the rank with increasing significance.

3.2.6.4. Policy implications

The policy implications had been suggested after evaluation of climate change policies, and plans in the region for improvement on policies as well as mitigate the future impacts of climate change, environmental security and sustainable development in both national and regional context.

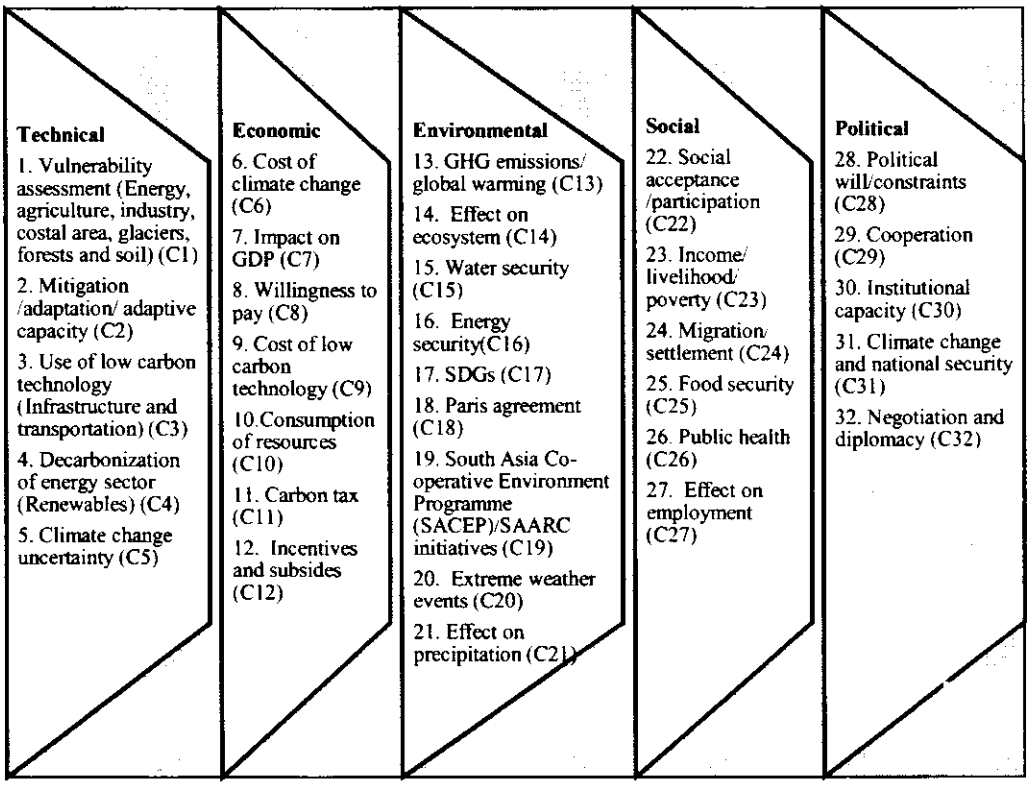

Figure 3.8 Evaluation criteria for analysis of climate change policies and plans

3.3. Statistical analysis

The Origin (Pro 9.0), Statistical Package for the Social Sciences (SPSS version 17) and Excel 2016 were employed for statistical analysis and plot figures. The Pearson correlation and Chi-square test were applied to data from policy analysis and questionnaire respectively to gauge statistical validity. Since, this study is based on a pair of variables i.e. existing consideration of individual criteria and significance of each criteria in energy, climate change and water policies in relation with environmental security and development. Hence, the Pearson correlation is suitable choice to assess the relationship in a linear direction. As the Chi-square test provides the general relationship between two variables and p-value of average sample size. The questionnaires (40) contained overview of relationship of environmental security with development and highlight the role of non-state stakeholders (business community, NGOs and media). Therefore, this test applicable on the data collected through questionnaires.

CHAPTER 4

4. RESULTS AND DISCUSSION

4.1. Environmental security: Energy security and development

The energy security has a central place in environmental security and development nexus due to the relation of the energy system with environmental protection, climate change, water security and global environmental politics. The development, prosperity and climate change is being centered on energy security (Sovacool, 2013; Sovacool, 2014). According to Sovacool, if the 20th century was about energy, then the 21st century could very well be about energy governance and climate change (Sovacool, 2013).

Furthermore, the Global Sustainable Development Goals have stressed the collective efforts for the prosperity of human society and sustainable development (The United Nations, 2016). The Goal 7 has particularly focused on the access to affordable, reliable, sustainable, and modern clean energy for all. The achievement of this goal is inclusively interconnect with the accomplishment of other goals including poverty reduction (Goal 1), food security (Goal 2), water security and sanitation (Goal 6), economic growth and development (Goal 8), combat the impacts of climate change (Goal 13), terrestrial ecosystem sustainability (Goal 15) and sustainable development for justice and global peace (Goal 16). Therefore, it is the responsibility of the state to provide the affordable and accessible energy for all keeping in view the environmental security to sustain the development.

Pakistan is facing energy crises and shortfall, slacken the economic devolvement. The government of Pakistan is striving to ensure the affordable energy by the endowment of both conventional and renewable resources along with improvement in energy governance to achieve energy security, environmental security, and the Sustainable Development Goals. The quantitative analysis of technical, social, economic, political and environmental aspects refers to a more holistic view of energy provision and guides policymakers to make better-informed decisions regarding sustainable energy policies (De Clercq *et al.*, 2017).

4.1.1. Environmental security: Energy security and development in context of Pakistan

4.1.1.1. The evaluation of technical criteria

The experts opined technical criteria an essential element of energy policies for sustainable energy supply and environmental security. They ascribed the significance ranking of 84 to identification of energy potential (C1), 80 to future energy demand (C2), 79 to right primary energy mix (C3), 85 to efficiency (C4), 77 to reliability (C5), 69 to both maturity (C6) and safety (C7) as shown in figure 4.1. The National Power Policy 2013 had addressed the efficiency in terms of merit order, transparency and accountability. The merit order covered the payments, dispatch, tariff efficiency, fuel allocation based on efficiency, retire high cost contracts and power and mix. The policy considered access to information through a public website as a tool for transparency and optimization of the transmission system. Accountability will be ensured by zero tolerance towards corruption and poor performance along with the hiring of professionals and contractors on the basis of performance and competency. Furthermore, the policy has a goal to decrease transmission and distribution losses from 23-26% to 16 % by 2017. The Alternative and Renewable Energy Policy had focused efficiency by the achievement of systematic and sustained deployment and growth of alternative and renewable energy technologies (ARETs) through effective federal and provincial coordination to achieve the target as set in ARE policy 2011 and global access to alternative and renewable energy technologies (ARETs) across the country. The low cost and efficient renewable energy will be achieved by assistance in the institutional, technical and operational capacity building of all parties involved in the ARE sector. The development of prototype contractual framework and business models, which may also be used by the Provinces/ AJK/ GB in the development of their respective ARE programs. Besides, the improvement in local technical skills and service had been considered to reduce cost. The creation of employment opportunities by facilitating the establishment of domestic ARET manufacturing basis in the country without discouraging foreign investment or collaboration. The National Energy Conservation Act 2016, authorized the Energy Conservation Authority (established under Section 6) to prepare national energy conservation policy (Section 7 (c)) for the approval of Energy Conservation Board and recommend energy efficiency standards (Section 7 (e)) (Figure 4.1 and Annexure 1.1).

The National Power Policy 2013 and Power Generation Policy 2015 did not articulate the energy potential and compatibility with industrial growth as well as energy demand. The market for energy efficiency is rapidly developing due to an understanding of its value, rising energy demand, global growth aspiration and need to limit emissions and climate change (IEA, 2014). According to State of Industry Report 2015, there is a slight improvement in transmission and distribution losses in some distribution companies (NEPRA, 2015). Therefore, it seems difficult to achieve this goal by 2017. Furthermore, the policy reflected only output efficiency but it did not ponder high plant reliability, efficient and low-cost production. The National Power Policy 2015 did not mediate the efficient power productions and aims to the exploitation of indigenous resources rather than sustainable endowment of indigenous resources. The Alternative and Renewable Energy policy mainly nidus on the alternative technologies through import and transfer of technology. The policy had the objective to develop the integrated ARET based solutions to optimize the impacts ARE deployment in the underdeveloped area. The productive use for income generating activities but optimization is not appropriately addressed (Figure 4.1 and Annexure 1.1).

Maturity is cogitated in all policies by import and transfer of standardized equipment, No Objection Certificates (NOC) from relevant Environmental Protection Departments, Alternative Energy Development Board (AEDB) and Private Power and Infrastructure Board (PPIB). Additionally, the reliable equipment and system reduces the emissions and ensures the efficient utilization of resources which protect the environment. The distribution system of Pakistan is Alternate Current (AC) based but the alternative energy sources (the wind and solar) generates Direct Current (DC), it is an important technical barrier. The energy policies of Pakistan had demonstrated the reliability to improve environmental security. The energy policies (National Power Policy, Power Generation policy and Alternative and Renewable Energy Policy) of Pakistan did not visualize the safety of energy systems which is a potential threat to employees, public, and environment (Figure 4.1 and Annexure 1.1).

The results demonstrated that National Power Policy and Power Generation Policy have very least consideration of identification of energy potential, future energy demand, and right primary energy mix. On the other hand, ARE policy meets the full expectations for identification of potential and partially in terms of future energy demand and right primary energy mix. The existing significance ranking efficiency is showing dearth in

National Power Policy and Power Generation Policy but acceptable in ARE Policy. The existing ranking of reliability and maturity seems closer or as per significance ranking in all policies. Safety is among scant criterion in all energy policies of Pakistan. The technical criteria for significance and existing ranking are depicted in Figure 4.1 and Annexure 2.1. Furthermore, significance ranking is conferring positive Pearson correlation with existing ranking of technical criteria. There was a weaker relationship in case of National Power Policy and moderated correlation in Power Generation Policy and ARE Policy (Tables 4.1). The inadequate solicitude of technical aspects will produce costly, low payback, inefficient and environment unfriendly energy. The energy inefficiency would lead to environmental challenges including an increase in emission, cost, climate change and indoor pollution which is threatening environmental security and development. Hence, the less significance to technical criteria in energy policies would neither secure sustainable energy supply nor protect the environment.

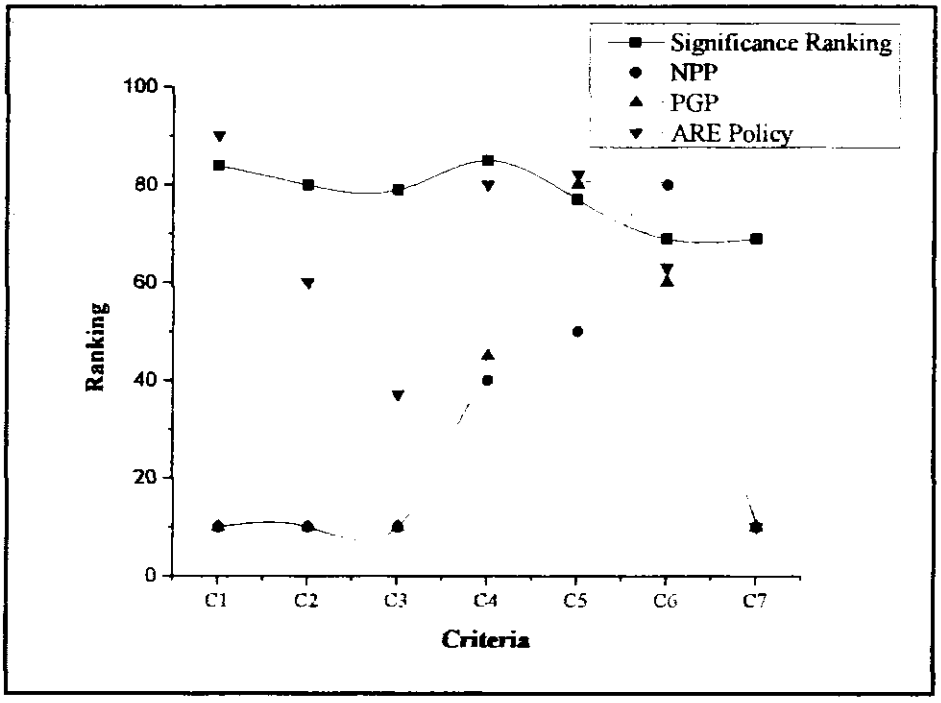

Figure 4.1 Ranking of technical criteria in energy policies in Pakistan

4.1.1.2. The evaluation of economic criteria

The experts allocated the highest significance ranking of 80 to affordability (C15) followed by 78 to compatibility with industrial growth (C17), 76 to payback period (C12), 74 to both competitive investment (C8) and service life (C13), 73 to operation and maintenance cost (C9), 71 to fuel cost (C10), 70 to subsidies (C16), 68 to net present value (C11), 65 to equivalent annual cost (C14) and 63 to tax (C18) (Figure 4.2). The government

of Pakistan had pondered all aspects of investment cost including development, net metering, interconnection cost and benefits for both government and private projects in the National Power Policy 2013 (The Build-own-operate-transfer (BOOT), interconnection, bidding and security package requirement), Power Generation Policy 2015, and Alternative and Renewable Energy Policy 2011 (Alternative & Renewable Energy Distributed Generation and Net Metering Regulations, 2015) (Figure 4.2 and Annexure 1.1).

The National Power Policy 2013 did not elaborate the issues regarding operation and maintenance. The Power Generation Policy 2015 had addressed the operation and maintenance as a component of Energy Purchase Price (EPP) and Capacity Purchase Price (CPP) in tariff section. The Energy Purchase Price encompass variable operation and maintenance cost, fuel cost or water use charge. The Capacity Purchase Price comprises of return of equity, debt servicing, cost of working, insurance and fixed operation and maintenance cost. The tariff will be adjusted by National Electric Power Regulatory Authority (NEPRA) on a quarterly basis during the life of the project operation. Furthermore, the National Power Policy has considered the fuel cost. It emphasized to rely on the gas or liquefied natural gas (LNG) by decreasing the dependence on the coal and oil, reduce the emission and combat the impacts of climate change. The Alternative and Renewable Energy Policy had also considered operation and maintenance as a component of Energy Purchase Price (EPP) and Capacity Purchase Price (CPP) in tariff. The government shall introduce a specific Energy Purchase Agreement (EPA) between the ARE-IPP and AEDB as a security package. The policy addressed the defined tariffs (Direct or through bidding) along feed in tariff on alternative energy projects and fixed rates with the reference rate of US dollars. The premium on ARE projects was also invoked in this policy to ensure the fastest growth. Further, the policy covered the all required procedures for approval of ARE project. The policy introduced the concept of energy services to meet the energy requirements in affordable cost and generate income (Figure 4.2 and Annexure 1.1). The National Power Policy 2013, Power Generation Policy 2015 and Alternative and Renewable Energy Policy 2006 had partially taken into account the net present value and equivalent annual cost in up-front tariff in terms of rates, charges, return of equity, debt servicing, penalty and benefit under Tariff Standards and Procedure Rules, 1998 and Section 7 (3) of the NEPRA Act on quarterly basis (Figure 4.6 and Annexure 1.1).

The National Power Policy had just considered financial viability and collection in payback period. The policy had demonstrated the commitment to increase collections to

85-95% by 2017 and set maximum delay limit for payables (Gas 30-45 days/ oil 45-60 days). The Alternative and Renewable Energy Policy had recognized the rate of return in preferential order and excess of that available to conventional power produces during the life span of alternative and renewable energy project. Furthermore, additional benefits of premium to tariff had been introduced in this policy (Figure 4.2 and Annexure 1.1).

The government had pondered affordability in energy policies of Pakistan to harmonize them with the Global Sustainable Development goal. The National Power Policy 2013 had identified the high cost of energy (12-18 PKR per unit) and targeted to reduce to 10 PKR per unit by 2017. According to the State Industry Report 2015, the about 9.84 PKR per unit cost was noted in 2015 (NEPRA, 2015). The government is striving to further reduce the cost by reliance on low-cost fuel (gas and LNG), introducing subsidies and incentives. The State Bank of Pakistan has introduced a scheme for Financing Renewable Energy Projects in 2009 and amended in 2015 to define the financial mechanism for banking to attract borrow, financing and promote alternative and renewable energy. The scheme is available for power generation from alternative and renewable sources. It has two categories; Category I covers the prospective sponsors interested in alternative and renewable energy power projects having capacity from more than 1MW and up to 50MW. Additionally, it has met the prescribed requirements of all relevant Government Departments/Authorities and Alternative Energy Development Board. The refinance of such project will 100% at the rate of 2.00%, Bank DFI's spread at 4.00% and 6% end user rate. The maximum finance of 6 billion is available for a tenor of up to twelve years. Category II enshroud the consumers (Domestic, commercial or industrial) willing to set alternative and renewable energy power projects with capacity from 0.004 MW to 1 MW. The maximum finance of 6 billion is available for a tenor of up to ten years for category II. The refinance of Category II project will 100% at the rate of 2.00%, Bank DFI's spread at 4.00% and 6% end user rate (SBP, 2016). The subsidies and incentives supposed to motivate to investor and deliver cost efficient energy to consumer (Michalena and Hills, 2016). The National Power Policies 2013 and Power Generation Policy 2015 had introduced the subsidies and incentives to encourage private partnership and investment in energy sector. The government will relax the 5% custom duty on import of technology for power projects. This policy will be applicable to all new power projects after February, 15, 2015 (GoP, 2015a). The GoP recognized that access to financing is a critical issue for many ARE projects, particularly small and medium scale projects. The government had

interposed both general and specific incentives. The general incentives include guaranteed market to buy all electricity and grid connection. Electricity shall be purchased from ARE power projects at 220 kV at the outgoing bus bar of the power station of the project company if the power station is located within 70 km of an existing 220 kV transmission line, or at 132 kV if it is within 50 km of an existing 132 kV transmission line, or at 11 kV if it is within 5 km of an existing 11 kV distribution feeder, or at 400 V if it is within 1 km of a 400 V distribution feeder. The minimum average power to be supplied in each case would be 1,250 kW/km, 250 kW/km, 100 kW/km, and 20 kW/km, respectively (GoP, 2011b). The specific incentives wrapped the licensing procedure for ARE projects up to 5 MW, Energy Purchase Agreement (EPA) and assistance of provinces in land acquisition (Figure 4.2 and Annexure 1.1).

The National Power Policy 2013 and Power Generation Policy 2015 had authorized NEPRA and provinces to agree on tax. Taggart, 2016 found that many countries (like the USA) has opted diverse tax incentives to eliminate cost barrier and encourage renewables and the adaptation of energy efficient technologies. The Alternative and Renewable Energy Policy had introduced tax rebate on alternative and renewable energy technologies. Meanwhile, the National Power Policy has endorsed the fuel cost and subsidies per allotted significance criteria. While other sub-criteria were partially imputed expect energy intensity, service life and equivalent annual cost which were least ruminated. Fuel cost, service life, equivalent annual cost and energy intensity were least reflected sub-criteria in Power Generation Policy. The existing ranking of affordability, operation and maintenance cost were compatible with significance ranking. Although, Power Generation Policy had speculated the competitive investment, net present value, subsidies, and tax but lagging the significance ranking. Unlike other policy, ARE policy had more entertained the economic criteria. Competitive investment, operation and maintenance cost, equivalent annual cost, affordability and subsidies meet the expected significant ranking in ARE policy. Fuel cost, net present value, payback period and tax were looking for improvement in ARE policy. Affordability and energy intensity were among top-ranked criteria. But, energy intensity was least ruminated sub-criteria in all energy policies of Pakistan (Figure 4.2 and Annexure 1.1). The weaker positive Pearson correlation between significance ranking and existing ranking of economic criteria was found in National Power Policy and Power Generation Policy. There was a negative correlation between significance ranking and existing ranking in ARE policy (Table 4.1).

The economic criteria are essential for sustainability, secure energy, affordable energy and environmental protection. Affordable, low cost and carbon energy can redundant fossil energy, an adaptation of renewable energy and protection of the environment. Some gaps were identified including lack of net present values in National Power Policy and Power Generation Policy, less attention on service life and equivalent cost in both policies. There was a need to opt measure to reduce power generation cost in all policies because about 10 PKR per is still unaffordable for a large number of population and higher than many countries.

The policies had authorized the NEPRA and provinces to set the tax. The tax and collection are most conflicting issue in energy sector of Pakistan. The provinces had authority to introduce tax after 18th amendment in national constitution and National Finance Commission Award. The consumer is paying dual tax with different ratios in different provinces. Furthermore, the consumer is paying additional 2.5% tax due to high distribution and transmission losses. Therefore, there is need to negotiate the state entities to overcome the gaps and provide affordable, clean and accessible energy.

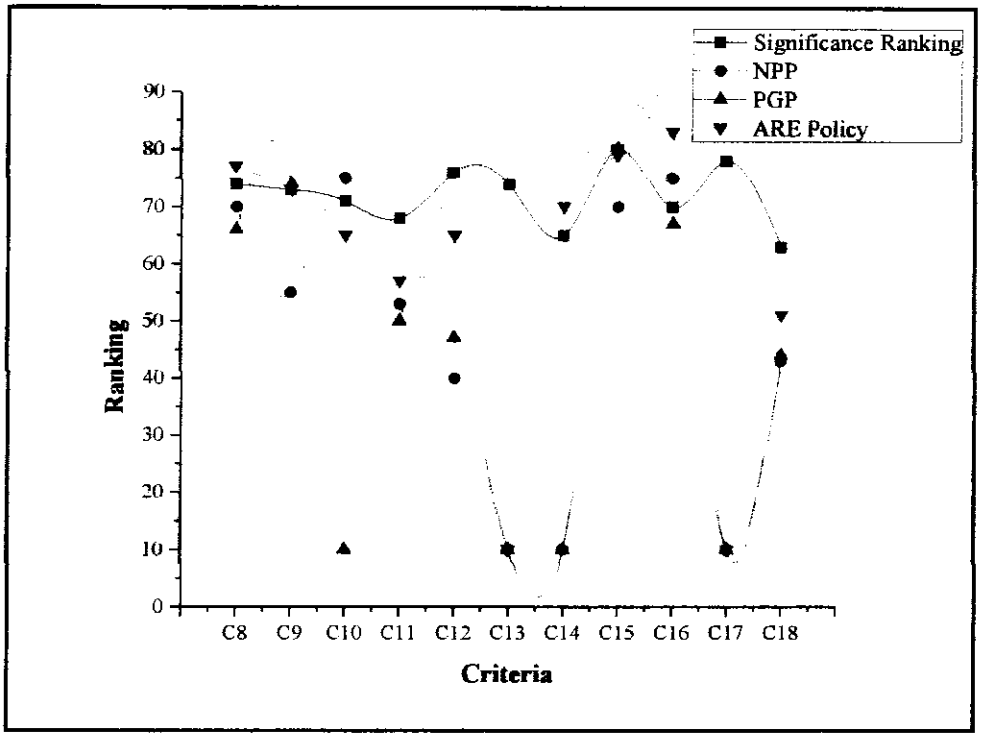

Figure 4.2 Ranking of economic criteria in energy policies in Pakistan

4.1.1.3. The evaluation of environmental criteria

The experts attributed the significance ranking of 80 to emissions (C19), 70 to land use (C20), 65 to noise (C21), 85 to water security (C22), 70 to climate change (C23), 75 to the Sustainable Development Goals (C24) and 60 to role of South Asia Co-operative

Environment Programme (SACEP) (C25) (Figure 4.3). ARE policy considered the greenhouse gas emissions. Being a signatory of Kyoto Protocol, the policy broached the importance of emission reduction and requirements of Clean Development Mechanism under Kyoto Protocol through carbon crediting. The National Power Policy and Power Generation Policy did not contemplate the emissions from energy generation and system which is an eminent threat to environmental security (Figure 4.3 and Annexure 1.1).

The energy policies of Pakistan are silent on noise pollution associated with power generation like many other environmental criteria. The energy policies in Pakistan exclusively essence on land acquisition but did not gist the criteria, type of land use and effect on landscape. However, environmental impact assessment (EIA) is mandatory for energy projects prior to development which considers impacts of project on flora and fauna (Figure 4.3 and Annexure 1.1).

The energy policies in Pakistan were neither considered water security nor the clime change except the alternative and renewable energy policy addressed climate change in terms of Kyoto protocol and clean development mechanism (CDM). The significant lack of integration of energy policy, water security, and climate change is threatening environmental security and development. Energy, water, and food security without degrading natural resources in growing population, development and climate change paradigm is a major challenge for South Asia. The South Asia has adopted the Sustainable Development Goals along with global community since 2015. The SDGs are critically important for South Asia to ensure environment sustainability, development, energy and water security. Therefore, greater policy coherence among energy and water sector along with other goals is mandatory for development and sustainable future (Rasul, 2016). The government of Pakistan had signed the Sustainable Development Goals, adopted them as Pakistan Development Goals, and demonstrated the commitment to the United Nations towards their implementation. The energy policies in Pakistan just consider the affordability in terms of cost reduction, ban on inefficient technology and tax incentive but accessibility is not properly addressed. Furthermore, the National Power Policy 2015 addressed the sustainability in terms of low cost, fair level playing field and demand management which cover economic factor only. The environment and social pillar of triple bottom line were not pondered. The energy policies in Pakistan had the least coherence with the SDGs due their formulation and implantation before the SDGs summit by UN statistical commission in September 2015. The lack of coherence with energy policy is

hindering sustainable development and environmental protection (Figure 4.3 and Annexure 1.1).

The SAARC secretariat finalized the SAARC Development goals to localize the Millennium Development Goals (MDGs) in 2007. The SAARC Development Goals conceptualized the strategic regional response as a road map for the implementation of the SAARC Social Charter to the urgent imperative of riding South Asia poverty and development by 2015 (Shiekh and Mir, 2016). The Millennium Development Goals were later transformed into the Sustainable Development Goals. Unfortunately, the SAARC Development Goals neither consider energy as primary goal nor amended after the implementation of the Sustainable Development Goals. Therefore, the energy policies in Pakistan did not mandate the SAARC Development goals. The experts pointed out South Asia Cooperative Environment Programme (SACEP) as a forum to reconcile the regional environmental concerns. Meanwhile, they were worsened due to its low institutional capacity and role (Figure 4.3 and Annexure 1.1).

Environmental criteria were meagre in energy policies of Pakistan. ARE policy being little tamed with greenhouse gas emission, climate change and the Sustainable Development Goals. The National Power Policy and Power Generation Policy had just considered SDGs in terms of affordability. Greenhouse gas emissions, land use, noise, water security, climate change, and the role of South Asia Cooperative Environment Programme were totally overlooked in the energy policies of Pakistan. Greenhouse gas emissions and water security were among highly recommended criteria. The experts coerced the integration of energy security, water security and climate change for sustainable future and development. The significance ranking and existing ranking of environmental criteria had evinced positive Pearson correlation and least contemplation in energy policies of Pakistan (Table 4.1).

Overall, environment was among trifling criteria in energy policies in Pakistan. The emissions, noise, land use, water security, climate change and the SDGs which confer national, regional and global environmental security and sustainable development were mainly overlooked in the energy policies of Pakistan. Furthermore, the South Asia Co-operative Environment Programme provides comprehensive approach for regional environmental protection in divergent dimensions. Its role was frivolous in the energy policies. The environmental insecurity had the ability to derail overall development and compatibility with regional and global environmental criteria for energy sector. This

paucity of environmental criteria is an eminent threat to environmental security and sustainable development. Furthermore, energy shortfall, climate change, water scarcity, international pressure and sanctions could be other consequences.

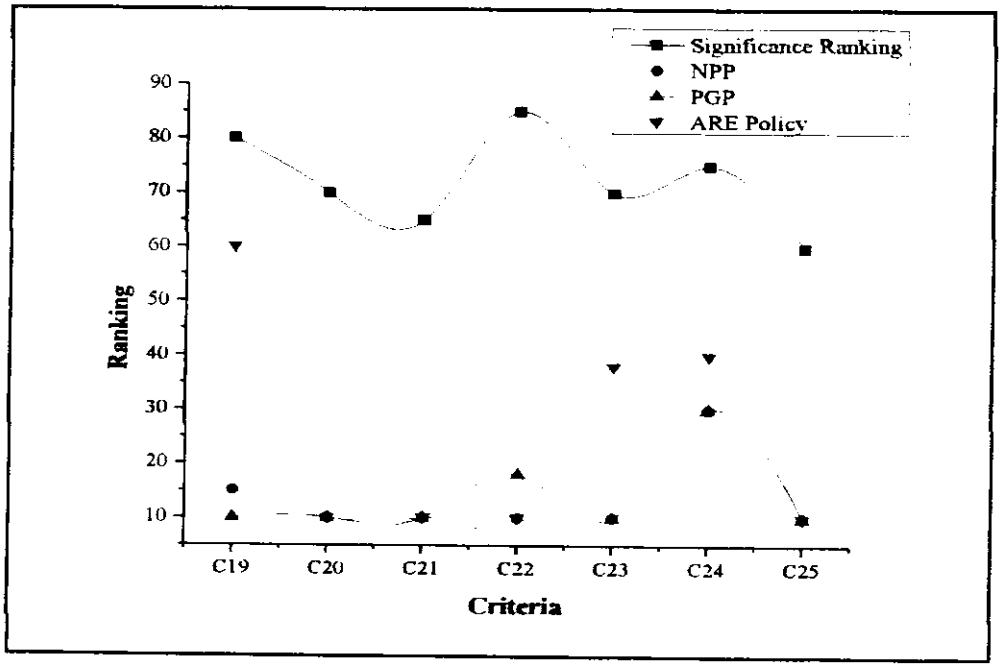

Figure 4.3 Ranking of environmental criteria in energy policies in Pakistan

4.1.1.4. The evaluation of socio-political criteria

The experts secured the relatively high significance ranking to socio-political criteria. They ranked value of significance ranking of 83 to access to energy as basic human right (C26), 78 to social acceptability (C27), 80 to both job creation (C28) and social benefits (C29), and 77 to political will, participation and cooperation (C30) (Figure 4.4). The existing ranking of social benefits (70), political will and cooperation (70) was tiered on top followed by social acceptability (60), access to energy as basic human right (10) and job creation (10) in National Power Policy. The social criteria were closer or according to significance ranking in Power Generation Policy except access to energy as basic human right (least rated). The existing ranking of access to energy as basic human right (60), social acceptability (75), job creation (60), social benefits (65), participation, political will and cooperation (75) in ARE policy were much closer to significance ranking (Figure 4.4). The access to energy as basic human right had been considered as social criteria energy policy to enhance social acceptability. The National Power Policy 2013 and Power Generation Policy did not frame access to energy for all as basic human right while the Alternative and Renewable Energy Policy had partially conceptualized in terms of universal access to modern technologies in all regions of country (Figure 4.4 and Annexure 2.1).

The National Power Policy 2013 had partially apprehended social acceptance in terms of affordability. The Power Generation Policy 2015 had encompassed social acceptance in social soundness assessment as a part of Environmental Impact Assessment (EIA), Corporate Social Responsibility and Community Welfare Development. The Alternative and Renewable Energy Policy had invoked the social equity, social impacts of alternative and renewable energy, social development, social assessment, and benefits (Figure 4.4 and Annexure 2.1).

The National Power Policy did not contemplate the employment and job creation. The Power Generation Policy 2015 demonstrated the preference of skilled manpower over semi-skilled manpower on merit basis and focused on internships on merit basis with preference of local personnel. The Alternative and Renewable Energy Policy had encouraged the employment in off-grid employment in alternative and renewable energy technologies, creating employment and enhancing the local technical skills. However, the policies were devoid the calculation, evaluation and prior long-term planning of employment opportunities (Figure 4.4 and Annexure 2.1).

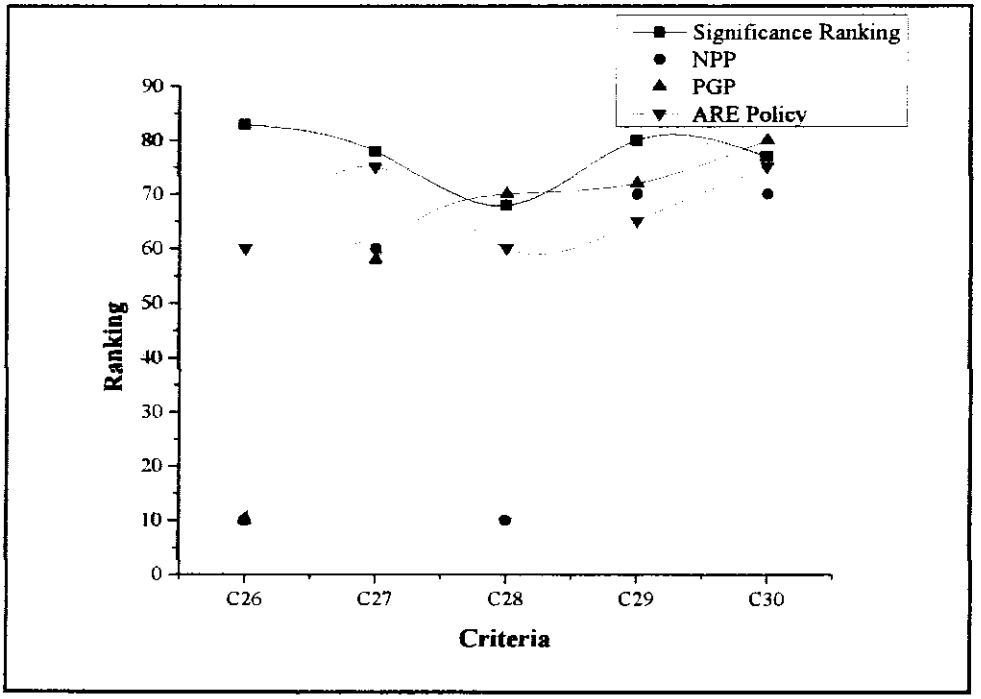

Figure 4.4 Ranking of socio-political criteria in energy policies in Pakistan

The energy policies in Pakistan had particularly focused on cooperation between federal and provincial entities but the other actors were least considered which may devoid successful procurement of energy and environment sustainability. Similarly, the Government of Pakistan has demonstrated good political will towards energy security. The

Ministry of Energy has been created on 4 August 2017 and energy projects are priority of both federal and provincial governments in this regard. The social benefits were partially rendered through social acceptance in social soundness assessment as a part of Environmental Impact Assessment (EIA), Corporate Social Responsibility and Community Welfare Development and job opportunities as discussed above (Figure 4.4 and Annexure 2.1).

The access to energy as basic human right and social benefits were among top recommended criteria but access to energy as a basic human right is least reckoned in National Power Policy and Power Generation Policy. Furthermore, the results had demonstrated the positive Pearson correlation between significance ranking and existing ranking of socio-political criteria in National Power Policy and ARE policy. A negative Pearson correlation between significance ranking and existing ranking of socio-political criteria in Power Generation Policy (Table 4.1). The adequate representation of social criteria not only increase the social benefits, social and legal acceptance but also ensure sustainability, ecological balance, environmental protection and compatible development. The energy policies in Pakistan had gaps in socio-political criteria which needed the improvement. The socio-political considerations are key pillar of environmental security, sustainability, and economically viable development.

Table 4.1 Correlation of significance ranking with existing ranking of energy policies in Pakistan

Criteria	**NPP**	**PGP**	**ARE Policy**
Technical	0.25	0.41	0.4
Economic	0.07	0.2	-0.16
Environmental	0.14	0.15	0.39
Socio-political	0.27	-0.56	0.13

(*** $p < 0.01$, ** $p < 0.05$, *$p < 0.1$) (Very weak= 0.00-0.19, Weak= 0.20-0.39, Moderate= 0.40-0.59, Strong= 0.60-0.79, Very strong= 0.80-1.0)

4.1.1.5. Discussions

The expansion of sustainable energy is likely to accomplish through meditating potential, demand, maturity, efficiency, safety and availability as technical aspect (Janda and Tan 2017). The technical aspects consider efficiency, maturity, reliability, safety and identification of resources. The affordable energy and accessible to all is possible by riveting on technical aspects in energy policies to achieve environmental security and sustainable development. Efficiency means to how much useful energy is produced from

the endowment of energy resource. Prindle *et al.,* (2007) and Wang *et al.*, (2017c) conceived energy efficiency as the one of the important mainstay in sustainable energy policy. While, Beer, (2007) considers the consistency with high plant reliability and low-cost production from economically beneficial resources to improve the efficiency. Maturity is the measurement of how widespread technology is referred at both national and international level (Wang *et al.*, 2009) and staple criteria for energy policy (Bukarica and Tomsic, 2017). Reliability measures the capacity of a system or device to perform as designed, the ability to fail without catastrophic consequences, the potential of a system or device to perform required output under stated conditions for a particular time duration and the resistance to failure of device (Wang *et al.*, 2009; Moeini-Aghtaie *et al.*, 2017). Some research studies contemplate reliability as an important criteria for policy analysis of energy (Dinda *et al.*, 2007; Chatzimouratidis, 2008; Chatzimouratidis *et al.*, 2008). Safety of energy systems is becoming more critical due to the changes in environmental regulations, technology, public safety concerns. It is the combination of related disciplines including reliability, quality, maintainability, availability and sustainability of energy systems. Wang *et al.* (2008); Mamlook *et al.* (2005), Huang *et al.* (2005), and Wang *et al.* (2017b) previously used safety as a technical criteria for energy systems. Energy efficiency, identification of energy potential, future energy demand and right primary energy mix were ranked among top ten significant criteria for sustainable energy policies for Pakistan (Annexure 1.1). Although the Government of Pakistan has identified diversified and massive ARE resources (Figure 4.5). The endowment of these resources can hamper economic growth, development and substantially overcome the yawning energy gap. The energy requirements of Pakistan (Table 4.2) are consistently increasing every year with a variable growth rate due to change in oil prices, reliance on oil and gas as a major source as shown in table 4.3.The primary energy supply was 50.9 million tons of oil equivalent (MTOE) during July-March 2015 with a growth rate (4.4%) as collated to this part of last fiscal year (GoP, 2015a). There was an increase in energy supply from 58.8 MTOE to 66.8 MTOE during fiscal years 2005-2006 to 2013-2014 respectively (GoP, 2006; GoP, 2014). The economic surveys of Pakistan have demonstrated a consistent increase in primary energy supply except 2008-2009. A decrease in energy supply and negative growth rate was observed during 2008-2009 due to a lower level of economic activities and high circular debt in the energy sector (GoP, 2008a).

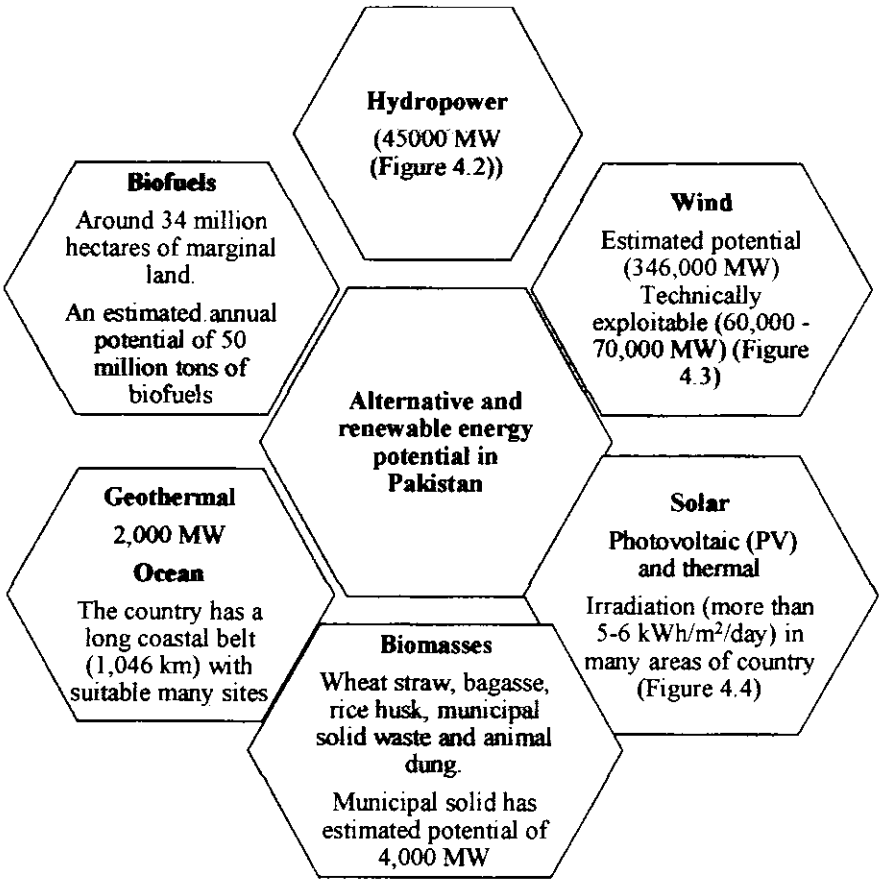

Figure 4.5 Infographic of ARE potential in Pakistan

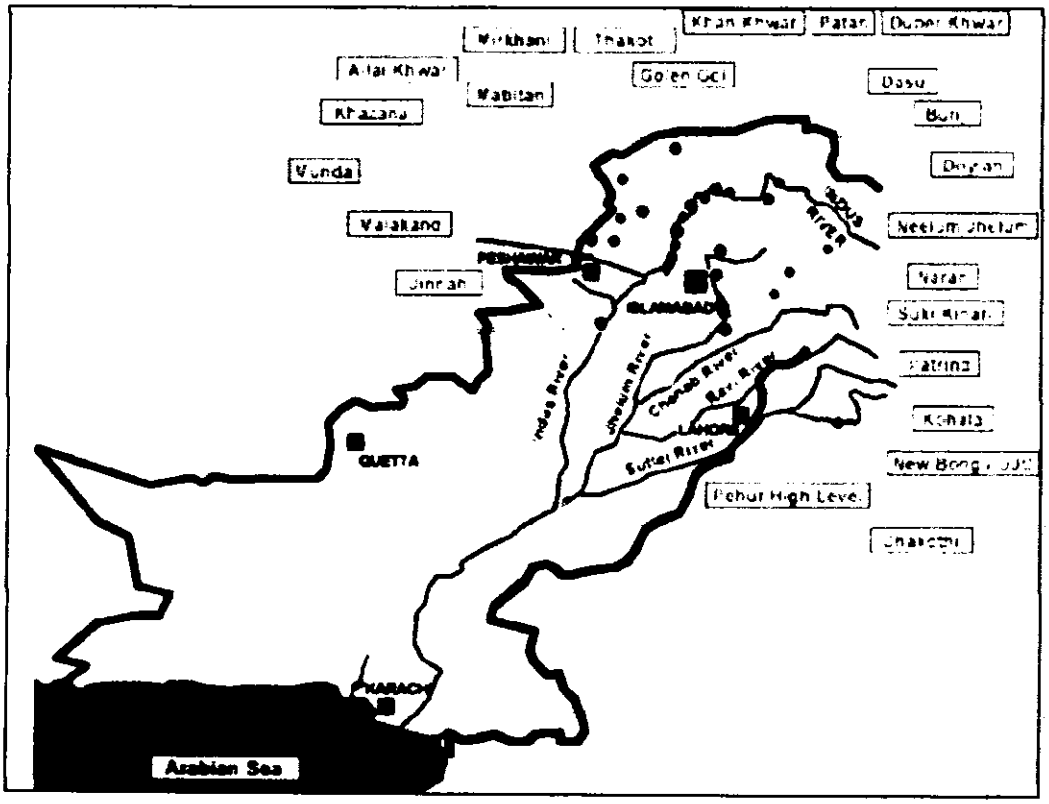

Figure 4.6 Identified potential of hydropower (Asif, 2009)

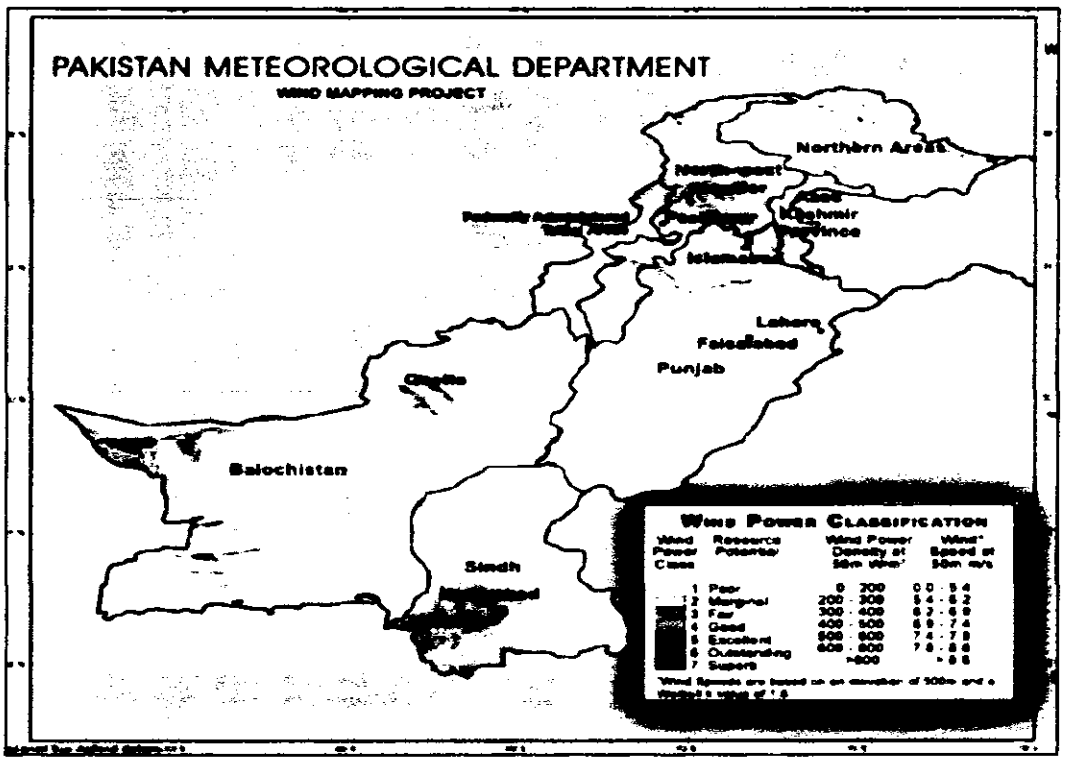

Figure 4.7 Map of wind energy potential in Pakistan (Asif, 2009)

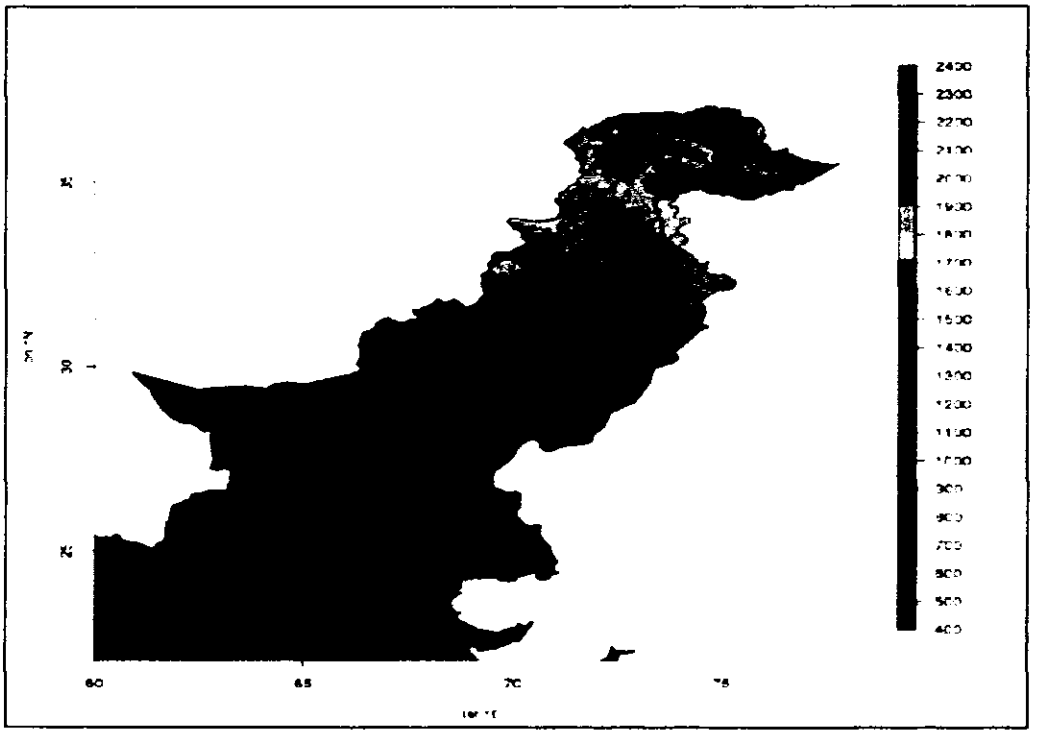

Figure 4.8 Multi-year mean (2000-2012) of annual Global Horizontal Irradiance (GHI) for Pakistan in kWh/m² (AEDB, 2016)

Table 4.2 Infographic of energy requirement of Pakistan (GoP, 2006-2016)

Year	Primary Energy Supply (MTOE)	Growth Rate (%age)
2015-2016	**74.8**	**4.7**
2014 -2015 (July-Mar)	50.9	4.4
2013-2014	66.8	3.6
2012-2013	64.727	0.35
2011-2012	**64.522**	**0.32**
2010-2011	64.5	2.1
2009-2010	63.1	0.85
2008-2009	62.55	-0.58
2007-2008	**62.92**	**3.78**
2006-2007	60.62	4.33
2005-2006	**58.06**	**4.18**

The conventional energy sources (gas, oil, coal and electricity) prevail more than 90% primary energy supply (Sheikh, 2010), whereas the contribution of alternate energy sources (solar, wind and bioenergy) is increasing gradually. The contribution of oil in primary energy supply varies from 28 % (2010) to 33 % (2017) during 2016-17 due to fluctuation in price in the global market as illustrated in table 4.3. Natural gas is leading contributor to meet primary energy supply. The highest contribution (46%) was marked in 2016 and 2017, while lowest contribution (40%) was recorded in 2008 during 2008-2009 (Table 4.3). The contribution to primary energy supply of coal was 9 % (lowest) in 2012 and 14 % (highest) during 2008, whereas electricity contributed 11 % (lowest) in 2014 and 16 % (highest) in 2011, 2016 as well as 2107 during 2008-13 (Table 4.3). However, LPG contributed around 1-1.5 % during 2008-17 to meet primary energy supply (GoP, 2008a-2017). Pakistan is ambitious to shift on renewable energy gradually to meet primary energy supply. However, hydroelectric power is a main renewable energy source in electricity generation along insignificant contribution from solar energy, biogas, and wind energy (480 megawatt (MW)) (GoP, 2016).

The contemplation of economics is a notable component of energy policy and successful procurement of energy into the system. Economic pillar of energy policy covers competitive investment, operation and maintenance cost, net present value, fuel cost, life cycle cost, equivalent annual cost, subsidies, energy intensity (Janda and Tan 2017), affordability and payback period (Prakash and Bhat 2009). Chiang *et al.* (2016) refer development cost, plant cost, foundation, integration systems, transmission, grid interface and collection system as a key component of investment cost. The investment cost is among

foremost used criteria for energy policy analysis in numerous studies (Jovanovic *et al.*, 2009; Doukas *et al.*, 2007; Wang *et al.*, 2009) due to the direct relationship with benefit (Wang *et al.*, 2009), loan rate fluctuations, inflations, changeable policies and foreign exchange rates in developing countries (Kim *et al.*, 2016).

Table 4.3 Infographic of share of different sources in energy consumption (GoP, 2008a-17)

	Oil	Gas	Coal	Electricity	LPG
2008	30	40	14	14	1.5
2009	30	43	10	15	1.5
2010	28	42	13	15	1.5
2011	30	42	10	16	1.5
2012	31	43	9	15	1
2013	31	42	10	15	1.3
2014	32	44	11	11	1
2015	29	44	10	15	1
2016	32	46	N/A	16	N/A
2017	33	46	N/A	16	N/A

The operation and maintenance cost could be a fixed or variable. The operation cost comprehends the product cost, wages of employees, service's cost for operation of the energy system and the fund's utilization for the energy. The maintenance cost covers to avoid failures which would result in operation suspension and prolong energy system lifespan (Wang *et al.*, 2009). According to Wu *et al.* (2016) and Kim *et al.* (2016) operation and maintenance cost is imperative in decision making and energy policy of developing countries due to relatively unstable economies, variable tariff, high inflation and interest rate. Net present value is the total present value of cash flow based on time series. It is a standard method for widely throughout economics, shortfall or excess of cash flow, financing charges, budgeting, time value of money to appraise long-term energy projects (Wang *et al.*, 2009). It is most momentous criteria for investment on the project (Pasqual *et al.*, 2013; Petković *et al.*, 2016) and planning, production, control and policy of energy system (Naim *et al.*, 2007; Petković *et al.*, 2016). The equivalent annual cost of energy project is the cost of operating and owning an asset per year during its entire life period. Papadopoulos and, Karagiannidis, (2008) as well as de Mello, (2016) rendered as useful life and a decision-making instrument in policy and capital budgeting of energy projects.

Dieterle *et al.* (2003) highlighted that it is difficult to predict annual net cash flow and accurate investment layout in the uncertain economic environment. According to Bas, (2013), Gollier, (2010) and Petković *et al.* (2016) conviction of money streams through speculation evaluation procedure is the common approach in deciding the distinctive choice of a project. Papadopoulos and Karagiannidis, (2008), Doukas *et al.* (2007) and Bhandari *et al.* (2015) argued that energy payback time and return should represent the time period required for the project to return the investment on the project, the sum of the original investment and energy performance of different technologies. Furthermore, Bhandari *et al.* (2015) also determined the how much energy is obtained from a system of energy source in comparison with how much of that energy is create, and returned to society as a component of energy payback period. Rajoria *et al.* (2016) depicted energy payback period as one of the main criteria used for viability of energy system and technologies. It is a responsibility of the state to affordable clean energy and accessible to all under the Global Sustainable Development Goals (Goal 7) (The United Nations, 2016). Szulecki *et al.* (2016) and Tongsopit *et al.* (2016) suggested that affordability is among key pillars of modern energy policies along with energy security, availability, accessibility and sustainability to achieve environment security and development. Meanwhile McFadden and Wells, (2016) had advised the states to introduce tax laws to manipulate economy.

Energy security has a complex nexus with environmental security and climate change (Zhou and Feng, 2017). Different policy packages cogitated affordability, energy security and mitigating environmental contamination as well as social benefits and climate interactions for different policy supports and mechanism (Casisi *et al.*, 2015). The energy consumption and production in an unsustainable and unclean way is leading to a rapid deterioration of the environment and threatening environmental security (Guo *et al.*, 2016). The environmental criteria include emissions, land use, noise (Rahman *et al.*, 2016), water security, climate change, Sustainable Development Goals (SDGs) (adopted as Pakistan Development Goals) and SAARC Action Plans on Environmental Protection. The energy policies of developed countries like the USA have three main dimensions: regulations to enhance renewable energy share, fuel economy and environmental protection (Onel *et al.*, 2015; Gençer and Agrawal, 2016). The global energy sector is mainly reckoning on the fossil fuels and render 87% of global energy consumption (EIA, 2015) resulting in devastate environmental impacts (Wang *et al.*, 2017a). The research studies pointed out extensive utilization of fossil resources and continuous increase in atmospheric greenhouse

gasses which are metamorphosing the global temperature and climate (Dlugokencky and Tans, 2013; Gençer and Agrawal, 2016). According to base case scenario, the greenhouse gas emissions from energy sector of Pakistan would be increased by 9 times (1.543 million tons) in 2050. The CO_2 emissions will lead the scenario followed by SO_2, NO_X, PM, CO and methane (Anwar, 2016). Dogan and Turkekul, (2016) pertained increasing emission level as a threat to the environmental security and development in long-term. Therefore, it is contiguous to consider environmental aspects and greenhouse gas emissions in energy policies of Pakistan (Anwar, 2016) with particular focus on CO_X (Dogan and Turkekul, 2016), NO_X (Løken *et al.*, 2009; Uddin *et al.*, 2016), SO_X (Uddin *et al.*, 2016), PM (Uddin *et al.*, 2016), methane (Balcombe *et al.*, 2017) and volatile organic compounds (Chatzimouratidis and Pilavachi, 2009). The machines at power projects are creating unpleased sounds resulted in the negative impacts on human beings (psychological and physiological), animals (displacement and breeding problem) and ecosystem (disturbances) (Kaldellis *et al.*, 2016). The noise is consistent problem from both non-renewable (noise at night from thermal) (Boddu *et al.*, 2016) and renewable (Wind and hydro) power generation (Kaldellis *et al.*, 2016). The noise pollution is begetting a difficulty for energy planner during selection of suitable sites and future development (Kaldellis *et al.*, 2016). Therefore, the energy policies reflected it as environmental criteria (Fast *et al.*, 2016). The energy systems require land which directly affects the environment and landscape, historical places, flora, and fauna. The energy policy should define the criteria, type and less use of land (Van Vuuren *et al.*, 2016). Energy security is colligated with water security and climate change. The strain of energy supplies and water security is aggrandizing as a result of growing total demand and population. The economic and lifestyle changes are dilating per capita consumption. According to Khan *et al.* (2017), all phases of the energy cycle including extraction and mining, cooling in thermal power plant, irrigation of biofuel crops and hydropower generation are highly dependent on water use. Similarly, all phases of water supply including water extraction, pumping, purification, desalination and distribution is dependent on energy. The world energy generation had withdrawn 583 billion cubic meters (15%) of total global water withdrawals in 2010, which of which about 66 billion cubic meters (10%) was consumed (IEA, 2012). Furthermore, the availability patterns are being reshaped by climate change (Khan *et al.*, 2017; Lubega and Farid, 2014). The reconciling energy supply, economic growth, reduction in greenhouse gas emissions and environmental protection complexes with climate change is a major challenge for

emerging economies (Prado *et al.*, 2016). Khan *et al.*, 2017 proposed an integration of energy policy with water security and climate change due to energy forecasting, planning of water constrains, power sector alternatives, biofuels expansions, hydropower vulnerability to climate change, water sustainability, alternative water sources, energy demand and inter-sector, regional and stakeholder conflicts. The United Nations Sustainable Development Goals visualized the improved access to health and sanitation services, food security, improved infrastructure, economic and industrial development, cost, environment and international policies, water security, affordable and accessible energy to all (Ki-Moon, 2014). The water and energy are two key pillars and shared resources between all pillars (Howells and Rogner, 2014). The SDGs are serving to efficient utilization of resources, investment and efforts for post-2015 global development. They will support the different stages of policy cycle including policy formulation (issues, objectives, and vision), policy legitimation, implementation, evaluation and change to legitimate environmental security and sustainable development (Hák *et al.*, 2016).

Socio-political criteria are the core of sustainability, participatory approach, decision making, alternatives and policies (Diaz-Balteiro *et al.*, 2017). The evaluation of this criteria leads to wide acceptance of multidimensional task, reflects different opinions, goals and constraints (Kowalski *et al.*, 2009). Socio-political criteria reflect access to energy as basic human right, social acceptability, social benefits, job creation and cooperation (Haddad *et al.*, 2017). The social incorporation is increasing in energy policy and planning (Pokehar and Ramachandran, 2004; Strantzali and Aravossis, 2016) due to preferences, interest and resources of multiple actors, influence and different point of view of various interested parties including groups of individuals, communities, local authority, government, investors and academic institutions (Mateo, 2012; Strantzali and Aravossis, 2016). According to social contract theory, the access to energy resources is a basic component of human right (Schneider, 2016). The access to energy is a lynchpin for future development and milestone in developing economy (Schneider, 2016). Batel and Devine-Wright, (2016) and Rahman *et al.*, (2016) recognized the representation of people, response to various energy systems and projects to ensure environmental justice, sustainability and public satisfaction during deployment for social acceptance. The major energy projects and large-scale infrastructure initiatives are considering social acceptance due to prominent evidence in recent debates. It has been adopted as a key concept for opinion exchange on a range of issues through participatory and analytical approach (Rahman *et al.*, 2016; Fournis

and Fortin, 2016). According to Rahman *et al.* (2016), many stakeholders are involved in energy policy and needs to invoke their requirements and interests which have increased the mediation of social acceptance in energy policies. The different phases of energy systems during their life cycle, from construction, operation and decommissioning create employment opportunities for community (Pahle *et al.*, 2016). The creating and maintaining the employment is a significant social aspect and objective of energy policy (Dvořák *et al.*, 2017). The modern energy systems particularly renewable energy sector has a complex relationship with different stakeholders including investors, community, utilities, sole traders, farmers, agricultural land owners, independent power producers, federal governments, provincial, state and local governments (Seyfang *et al.*, 2014; Oteman *et al.*, 2014; Dóci and Gotchev, 2016). Dóci and Gotchev, (2016) argued that sustainable energy transition, as well as efforts to combat climate change and achieve environmental sustainability, requires importance and cooperation of all actors. The social benefits and equitable benefit-sharing approach balance the project related risks, benefits, and community support. The social benefits in existing explicit policy framework not only guaranteed the advantage (monetary and non-monetary) to community but also ensured the cooperation at each stage. Hammami and Triki, (2016) stressed to include social benefits like revenue sharing, job creation, improved local road network and other public services in energy policy.

4.1.2. Environmental security: Energy security, trade and development in regional context

The South Asian countries are facing different environmental concerns and priorities which have significant trans-boundary impacts and dimensions (Chatterjee *et al.*, 2000). The environmental security is directly linked with energy security and both are among important issues on the national security agenda in different regions of the world. This is perhaps, due to the relationship of recent energy trends in exploration, consumption of oil and natural gas, water security, air pollution, global warming and climate with environmental security (Fonseca and Rosen, 2017). Additionally, the economic growth and burgeoning population in South Asia are inducing rapid changes in the environment profile of the region, energy security, and human vulnerability. These minor environmental stresses have a high ability of consequential conflicts and civil strife. On other hand, appropriate planning, decision making and policies of energy and environmental security

nexus might metamorphose conflict into cooperation and binding mechanism in South Asia (Ali and Zia, 2017). There is an urgent need for individual response and regional cooperation to complement environmental security (Chatterjee *et al.,* 2000). Therefore, energy policies (Table 4.4) in the region were critically analyzed in terms of technical, economic, environmental, social and political aspects to assess the link between environmental security, development, energy trade and environmental diplomacy.

Table 4.4 Infographic of energy policies and institutional framework in South Asia

Countries	Energy Policies	Institutional framework
Afghanistan	Energy Sector Strategy 2008, Afghanistan Rural Renewable Energy Policy 2013	Ministry of Energy and Water (MEW) Ministry of Rural Rehabilitation and Development (MRRD) Inter-Ministerial Commission for Energy (ICE)
Bangladesh	National Energy Policy 2004, Renewable Energy Policy of Bangladesh 2008	Ministry of Power, Energy and Mineral Resources (MoPEMR) Sustainable Energy Development Agency (SEDA)
Bhutan	Bhutan Sustainable Hydropower Development Policy 2008 Alternative Renewable Policy 2013	Ministry of Economic Affairs (MEA) Department of Energy
India	National Electricity Policy 2005 Strategic Plan for New and Renewable Energy Sector for the Period 2011-17 Policy for Repowering of the Wind Projects 2015	Ministry of Power (MOP) The Central Electricity Regulatory Commission (CREC) Ministry of Petroleum and Natural Gas (MoPNG) Ministry of Coal Ministry of New and Renewable Energy(MoNRE) Department of Atomic Energy (DAE)
Maldives	Maldives National Energy Policy and Strategy 2010	Ministry of Housing and Environment (MHE) Maldives Energy Authority (MEA)
Nepal	The Hydropower Development Policy 2001 Rural Energy Policy 2006	Ministry of Water Resources (MoWR) Ministry of Environment, Science, and Technology (MoEST) Department of Electricity Development Alternative Energy Promotion Centre (AEPC)
Pakistan	National Power Policy 2013 Power Generation Policy 2015 Alternative and Renewable Energy Policy (Short-term) 2006	Ministry of Energy Private Power and Infrastructure Board (PPIB) Alternative Energy Development Board (AEDB)

	Alternative and Renewable Energy Policy (Mid-term) 2011	National Electric Power Regulatory Authority (NEPRA) Pakistan Atomic Energy Commission (PAEC) Water and Power Development Authority (WAPDA) Ministry of Petroleum and Natural Resources (MoPNR) Oil and Gas Regulatory Authority (OGRA)
Sri Lanka	National Energy Policy & Strategies of Sri Lanka 2008	Ministry of Power and Energy (MPE) Ministry of Petroleum and Petroleum Resources Development (MPPRD) Ceylon Electricity Board

4.1.2.1. The evaluation of technical criteria

Technical aspects refer to the identification of potential and availability of resources, reliability, maturity, safety, security and import or export of energy (Büyüközkan and Güleryüz, 2017). The experts assigned the exceptional significance ranking to the identification of potential (C1) (83). The results presented that South Asian countries partially comprehend the importance of significance of installed capacity, identification and availability of energy resources (Figure 4.9 and 4.10). They partially contemplated potential and availability of the both renewable and non-renewable energy resources in their energy policies except Maldives. The experts believe that energy trade is not only feasible in South Asia but has a potential to provide affordable energy, reduce the dependence on fossil fuel and protect the environment. The energy trade (C2) was ascribed significance ranking (79) in terms of feasibility, affordability, reliance on fossil fuel and mitigation to climate change. Although, all South Asian nations are intended to import or export of the energy but some countries demonstrated it as part of their foreign policy rather than their energy policies. According to the results, the Afghanistan, Bangladesh, and Sri Lanka had contemplated the import of energy being deficit countries. Bhutan and Nepal had pondered the energy export as a source of revenue. However, energy policies of India, Maldives, and Pakistan did not consider the import or export of energy but they apprehend it as a pillar of their foreign policy (Figure 4.9 and Annexure 1.2). The results demonstrated main focus of renewable energy policies in the region on energy trade in terms of decentralized energy and technology transfer from developed countries to reduce dependence on fossil fuels (Figure 4.10 and Annexure 1.3).

The results illustrated that all alternative and renewable policies consider reliability (C3) at a national level. However, the reliability of energy systems at a regional level is not mediated in the energy policies and did not comprehend regional energy security. Meanwhile, non-reliable energy systems had adverse impacts on environmental security (Figure 4.9 and 4.10). The experts placed the significance ranking (68) to maturity (C4). The existing ranking of maturity varies among energy policies in the region (Figure 4.9 and 4.10).The results had shown that the concept of maturity is also limited to the national level, but the regional maturity of energy projects is uncommon. Safety is particularly demanding due to the involvement of multiple stakeholders, preferences, intensive investment of capital and safety concerns. The results revealed the significance ranking (71) to safety (C5) while Afghanistan, Bangladesh and Bhutan had contemplated the internal safety concerns while energy policies of other regional states are silent on safety concerns and posing divesting impact on sustainable development (Figures 4.9 and 4.10).

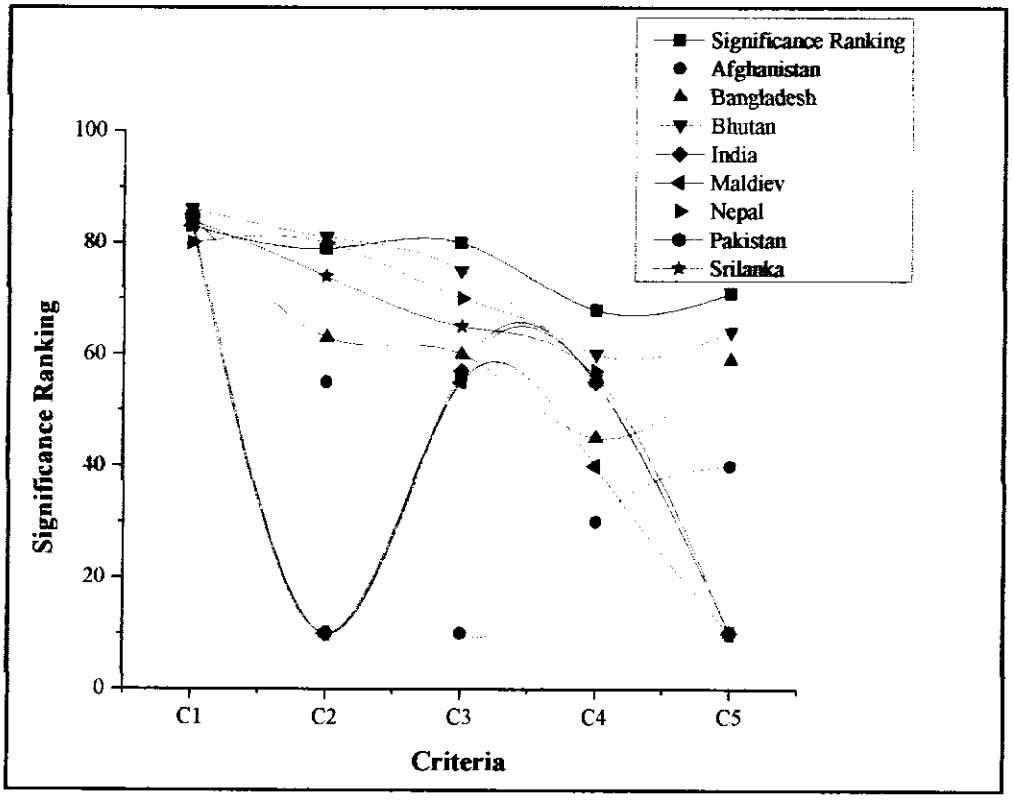

Figure 4.9 Ranking of technical criteria in energy policies in the region

The significance and existing ranking of technical criteria were imparting very strong positive (Bangladesh and Bhutan), strong positive (Nepal and Sri Lanka), moderate positive (Afghanistan and Maldives), and weak positive (India and Pakistan) between significance and existing ranking of technical criteria in energy policies in the region (Table 4.5). Furthermore, the alternative and renewable energy policies of Afghanistan,

Bangladesh, Bhutan, and Nepal were pertaining positive Pearson correlation except alternative and renewable energy policies of India and Pakistan (Table 4.6).

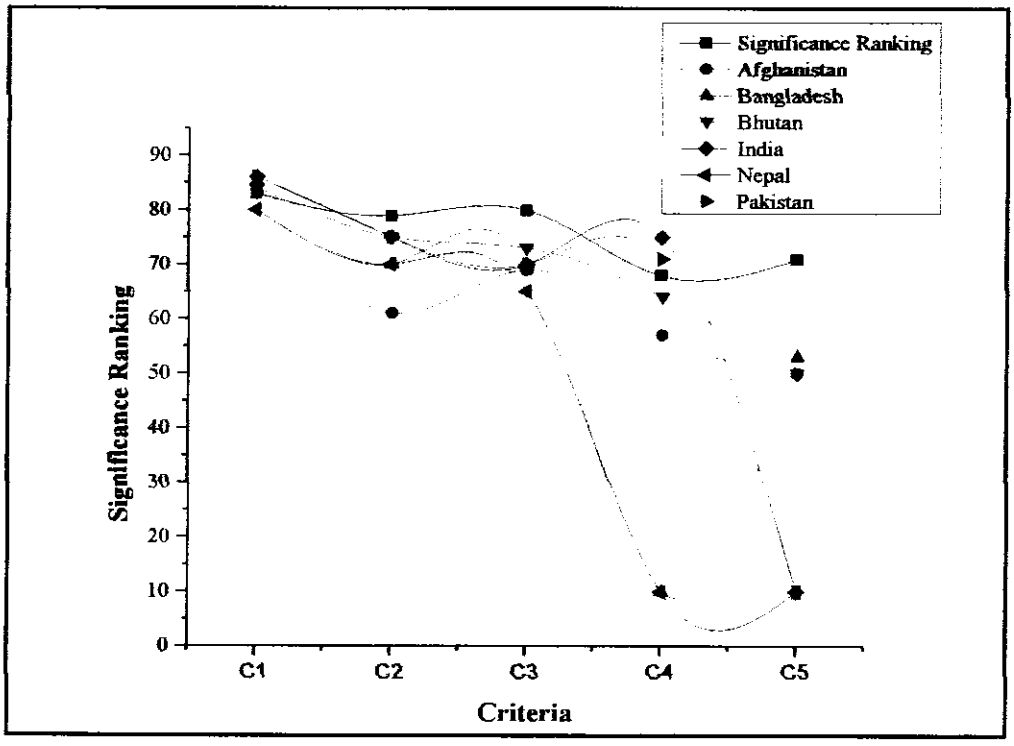

Figure 4. 10 Ranking of technical criteria in ARE policies in the region

The experts consider technical aspects ineluctable in energy policies in regional perspective for energy trade, sustainable development and environmental security. However, it is corroborated by energy policies analysis that South Asian countries accounted technical aspects in their energy policies at national but they omit different technical aspects required for regional trade.

Table 4.5 Pearson correlation between significance ranking and existing ranking of selected criteria in energy policies in region

Criteria	AFG	BGD	BTN	IND	MDV	NPL	PAK	SLK
Technical	0.44	0.83*	0.96**	0.38	0.53	0.69	0.37	0.7
Economic	0.03	0.59	0.94***	0.5	0.42	0.57	0.51	0.8**
Environmental	0.00	-0.03	-0.09	0.51	-0.03	-0.03	0.21	-0.03
Social	0.46	0.6	0.16	0.62	0.5	0.9**	-0.55	0.13
Political	0.38	0.91**	0.15	0.91**	0.91**	0.59	0.91*	0.63

(*** $p < 0.01$, ** $p < 0.05$, *$p < 0.1$) (Very weak= 0.00-0.19, Weak= 0.20-0.39, Moderate= 0.40-0.59, Strong= 0.60-0.79, Very strong= 0.80-1.0)

The alternative and renewable energy policies had pondered the technical aspects for attracting foreign investment at a local level but still away from the export of alternative and renewable energy. This less assiduity would not only reduce the regional energy trade

feasibility but harnessing of energy, without technical aspects threatened environmental security and sustainability.

Table 4.6 The correlation between significance ranking and existing ranking of selected criteria in ARE policies in region

Criteria	AFG	BGD	BTN	IND	MDV	NPL
Technical	0.83*	0.92**	0.83*	0.5	0.98***	0.55
Economic	0.12	0.2	0.5	0.43	0.56	0.51
Environmental	-0.03	-0.03	-0.09	0.48	-0.03	0.12
Social	0.67	0.33	-0.11	0.45	0.71	0.31
Political	0.48	0.91**	0.43	0.76	0.61	0.75

(*** $p < 0.01$, ** $p < 0.05$, *$p < 0.1$) (Very weak= 0.00-0.19, Weak= 0.20-0.39, Moderate= 0.40-0.59, Strong= 0.60-0.79, Very strong= 0.80-1.0)

4.1.2.2. The evaluation of economic criteria

Economic aspect is a cardinal pillar of environmental sustainability and security. The experts dispensed significance ranking (80) to competitive investment (C6). The results exhibited that competitive investment (trade cost, connection cost, infrastructure cost, operation and maintenance cost) for regional energy procurement has been incorporated in only Bhutan Sustainable Hydropower Development Policy 2008 with existing ranking (77) (Figure 4.11). It has a shallow type of energy policies in which investor or developer will be responsible for all costs. Unfortunately, other South Asian countries did not define the competitive investment. However, most of the alternative and renewable policies in region have contemplated investment cost in case of foreign investment in respective countries (Figure 4.12). The experts assigned the significance ranking (71) to operation and maintenance cost (C7). Alike competitive investment, Bhutan Sustainable Hydropower Development Policy 2008, Alternative Renewable Policy 2013 of Bhutan, the alternative and renewable policies of Bangladesh, India, and Pakistan speculates the supply cost. The Royal Government of Bhutan has an authority to accede the supply cost with investor or importer. Furthermore, other South Asian states have different trends to acquiesce supply cost in different projects. There are mainly two trends, every partner country bears supply cost within their territory like India, Iran, and Pakistan gas pipeline projects and second trend is of sponsorship against more supply like India and Bhutan, India and Nepal, Central Asia and South Asia (CASA-1000) electricity

transmission between Afghanistan, Pakistan, India and Central Asia. Therefore, it is an urgent need to define supply cost in energy policies of the region.

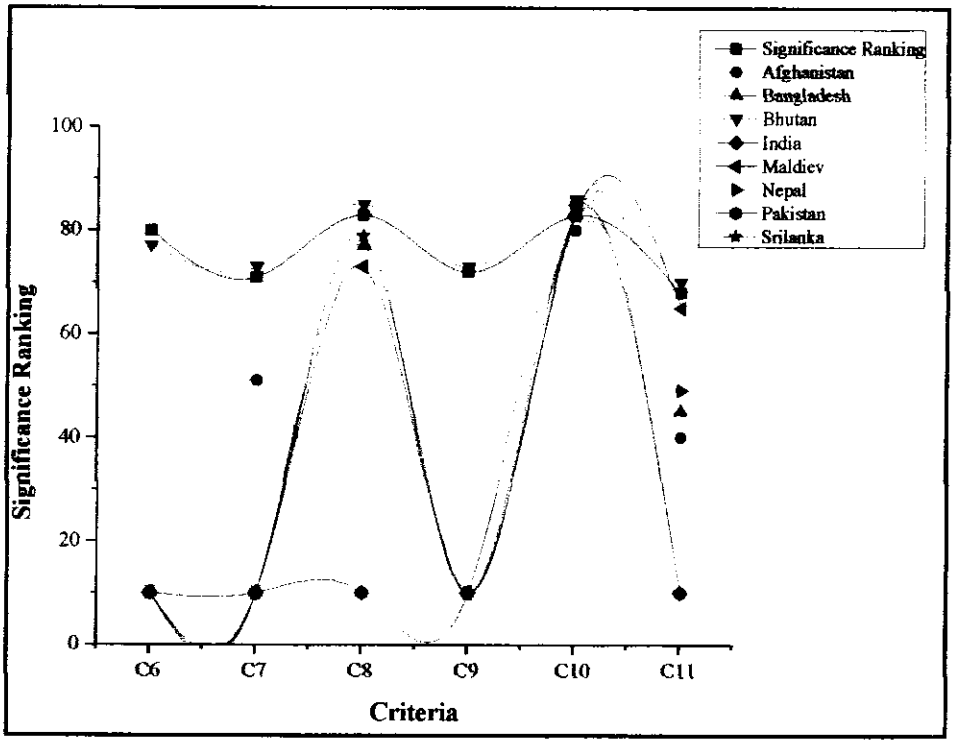

Figure 4.11 Ranking of economic criteria in energy policies in the region

The experts believe in addressing the economic benefits of trade in energy (C8) and ascribed significance ranking (83). The analysis of energy policies in the region has expressed that National Energy Policy 2004 of Bangladesh, Maldives National Energy Policy and Strategy and National Energy Policy & Strategies of Sri Lanka 2008 has visualized the economic benefits of energy import due to limited indigenous resources. On other hand, Bhutan Sustainable Hydropower Development Policy 2008 and The Hydropower Development Policy of Nepal are reflecting the economic benefits of energy export (Figure 4.11). Both countries commensurate energy export as a valuable source of revenue due to a limited industry. The energy policies of Afghanistan, India, and Pakistan did not visualize the economic benefits of energy trade.

The experts believe in considering the payback period from an investment perspective as well as trade and affordability. They accredited the significance ranking (72) to payback period (C9). It is a notable economic criterion in energy policies. The results confirmed that The Royal Government of Bhutan has contemplated the payback period in their policy with existing ranking of 73. Bhutan Sustainable Hydropower Development Policy 2008 solely vouching of payback period for rationalizing regional energy trade.

However, all other energy policies in the region are silent on payback period which limiting the trade opportunity and feasibility (Figures 4.11 and 4.12).

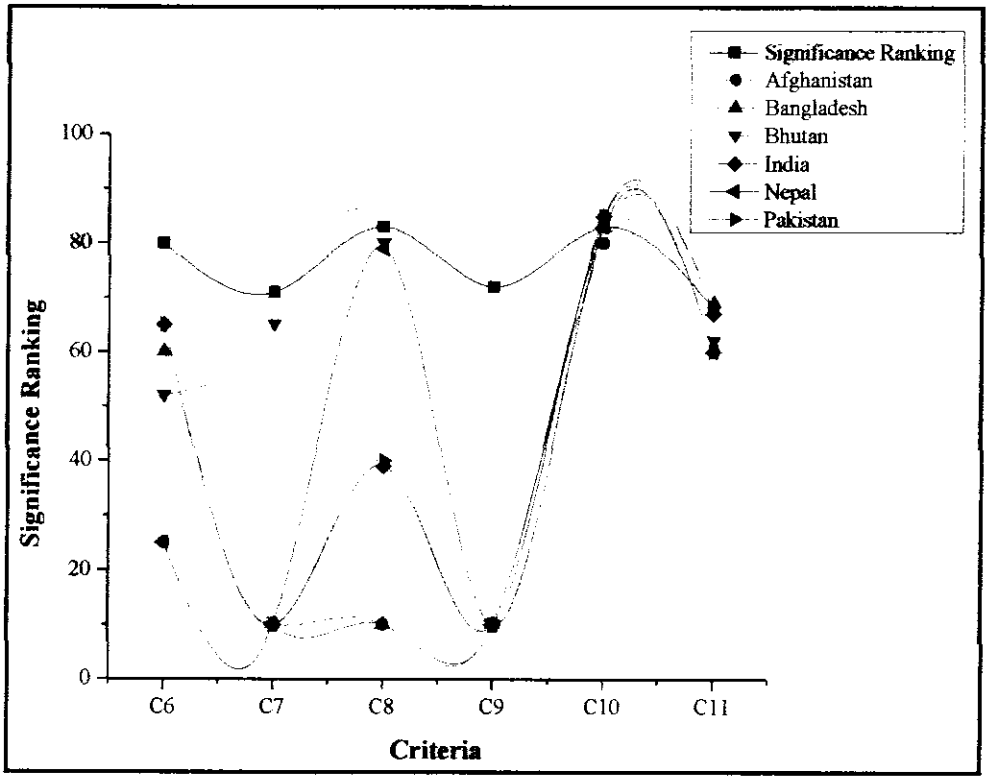

Figure 4.12 Ranking of economic criteria in ARE policies in the region

The experts allotted significance ranking (68) to tax (C11). The South Asian countries riveted on tax on trade as a source of revenue but contempt the carbon tax (Figure 4.11 and Annexure 1.2). However, the existing ranking of tax is comparatively better in alternative and renewable energy policies in South Asia due to tax rebate on the import of ARE technologies (Figure 4.12 and Annexure 1.3). There is need to mediate clear tax ratio and direction to facilitate regional energy trade. Furthermore, a carbon tax can promote renewable energy, decrease in emission, mitigate climate change and environmental security. The economic criteria narrated the positive stronger or moderate Pearson correlation between significance ranking and existing ranking. Afghanistan Rural Renewable Energy Policy was the only regional policy which manifested very weaker positive correlation (Table 4.5 and 4.6).

The economic parameters ought to adeptly address for successful procurement of energy, environmental sustainability, and security. The cost of sustainable energy should not be higher than non-renewable and fossil fuel energy. The affordable long-term is an imperative to continue development, industrial operation, and sustainable development.

However, there were the gaps in economic criteria, poorly or moderately addressed except Bhutan, rendering contemptible potential to viable energy trade and environmental security.

4.1.2.3. The evaluation of environmental criteria

Environmental criteria are nisus mainstay to evaluate the relationship between energy security, economic growth, and environmental security. Both energy production and consumption are fundamental inputs in economic growth and environmental security (Özokcu and Özdemir, 2017). The experts confer significance ranking (68) to greenhouse gasses emission (C12) from energy processes and threat to environmental security. They expected that energy trade can reduce greenhouse gasses emission by revoking unsustainable energy in South Asia. The energy policies in the region fiat greenhouse gasses emission partially at national level except Afghanistan and Pakistan (Figures 4.13 and 4.14). On other hand, all renewable energy policies in South Asia consider the greenhouse gasses emission.

The experts envisage the significance of land use (C13) for energy trade and rank significance ranking (67). The results anticipated the land use criteria only in Bhutan Sustainable Hydropower Development Policy 2008 and Alternative Renewable Policy 2013 of Bhutan (Figures 4.13 and 4.14). While land use criteria were overlooked in all energy policies in the region. The abstraction of this criteria pose eminent threat to energy trade feasibility and environmental security. It deems likely to misuse of land, damage arable land and stresses natural ecosystem. Meanwhile, experts consigned significance ranking to water security (C14) (80) and climate change (C15) (69). The results stated that South Asian states did not envision water security and climate change in energy policies except Alternative and Renewable Energy Policy of Pakistan which partially consider climate change. However, the Government of India has formulated the integrated strategy for energy, water security and climate change (Figures 4.13 and 4.14). The South Asian countries are intended to generate through hydropower for energy trade after the natural gas. The water security and climate change are increasing the vulnerability of energy sector and reducing the feasibility of energy trade. The inapt attention to climate change and water security is a threat to energy security, environmental security and likely to cause regional conflicts.

The results revealed significance ranking (72) to the SDGs (C16) for energy trade, sustainable development, and environmental security. It is important to motion that all

energy policies in the region did not attribute Sustainable Development Goals, perhaps due to formulation of energy policies before the induction of SDGs (Figures 4.13 and 4.14). The experts highly recommended the affordability (C10) as an economic criterion in energy policy. They tiered the significance ranking (83) to affordability. The existing ranking of affordability is meeting or close to expected ranking in all policies in the region. However, all South Asian nations had adopted the SDGs. Pakistan had particularly adopted SDGs as Pakistan Development Goals (PDGs) in policy visions. The scantiness of SDGs in energy policies can derail the global pathway to energy security and sustainable development.

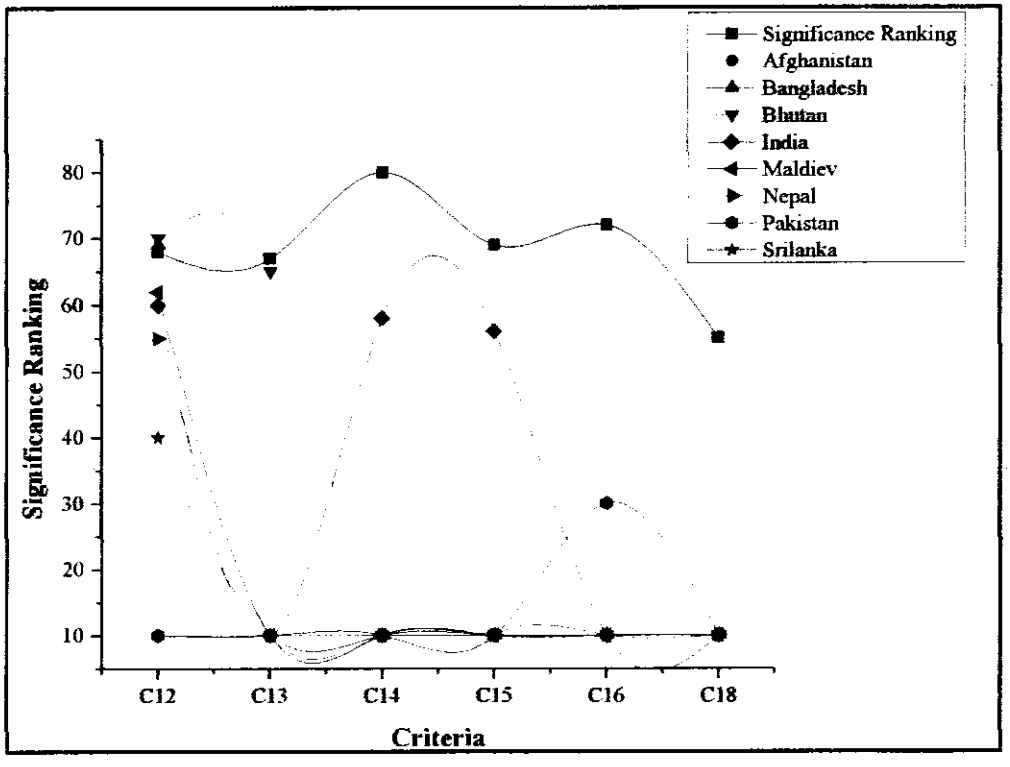

Figure 4.13 Ranking of environmental criteria in energy policies in the region

The regional environmental security is at risk and looking for an urgency to mediate the concerns. The SAARC and South Asia Cooperative Environment Programme (SACEP) are attempting to protect, manage and preserve the diverse and fragile regional ecosystems. They also address the threat induced by climate change and natural disasters. Although, SAARC Development goals (C17) did not consider energy security but they are now invalid and replaced by SDGs. The experts ascribed the significance ranking (55) to the role of South Asia Cooperative Environment Programme (C18) due to its ineffectiveness. The results indicated that role of South Asia Cooperative Environment Programme is not part of all energy policies in the region (Figures 4.13 and 4.14). The slight attention to update the goals, unclear provisions of SAARC Actions Plans on Environmental Protection

and least role of South Asia Cooperative Environment Programme is likely to foster damage environment and ecosystem.

The results deposed very weak Pearson correlation between significance ranking and existing ranking of environmental criteria in energy policies in the South Asia. While National Energy Policy of India 2005 and renewable energy strategies in India demonstrated the moderate positive Pearson correlation between significance ranking and existing ranking of environmental criteria (Table 4.5 and 4.6).

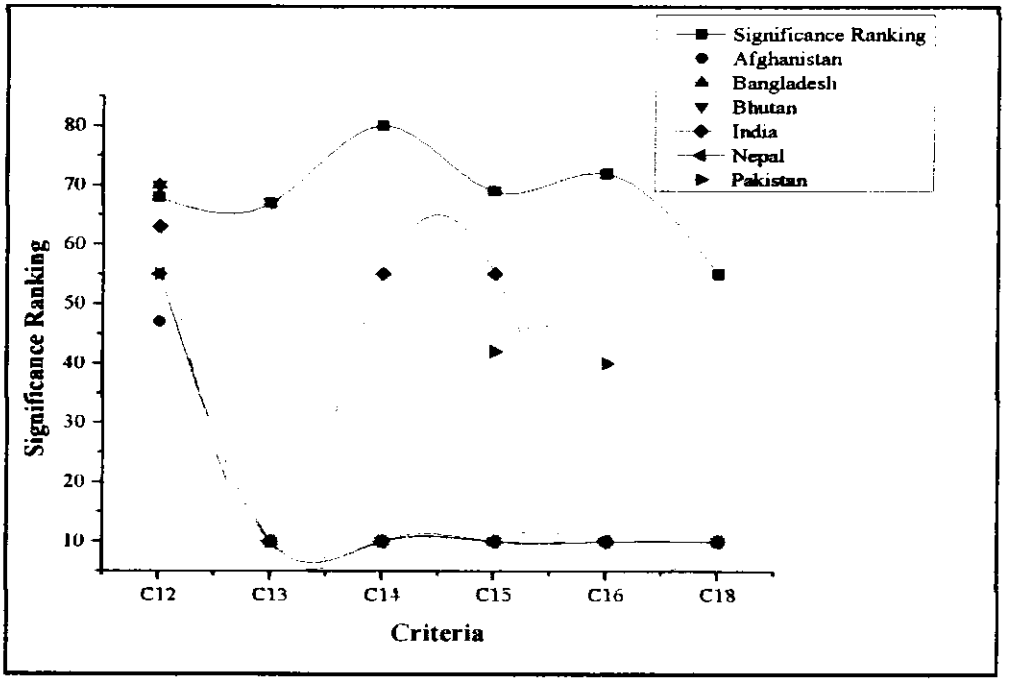

Figure 4.14 Ranking of environmental criteria in ARE policies in the region

The diminutive incorporation of environmental criteria in regional energy policies presents apprehension to environmental security and sustainable development. It would not only stress natural resources, leading to conflicts, reduces the capacity to settle disputes but also threatened national security. Furthermore, it is affecting the basic requirement for sustainable development, environment-friendly technologies, compliance of emission limits, waste management and long term public satisfaction. Meanwhile, it is reducing the capacity to adhere global agreements like Paris Agreement and Clean Development Mechanism as well as reducing the feasibility of energy trade is a technical barrier to trade.

4.1.2.4. The evaluation of social criteria

Social criteria cover access to energy as basic human right, social acceptability, job creation, social benefits and cooperation (Büyüközkan and Güleryüz, 2017). The experts rated commendable significance ranking (81) to access to energy as basic human right (C19). The experts believe that regional energy trade can stimulate to meet access

to energy as basic human right. Overall, all South Asian countries are committed to providing accessible, affordable and sustainable energy for all.

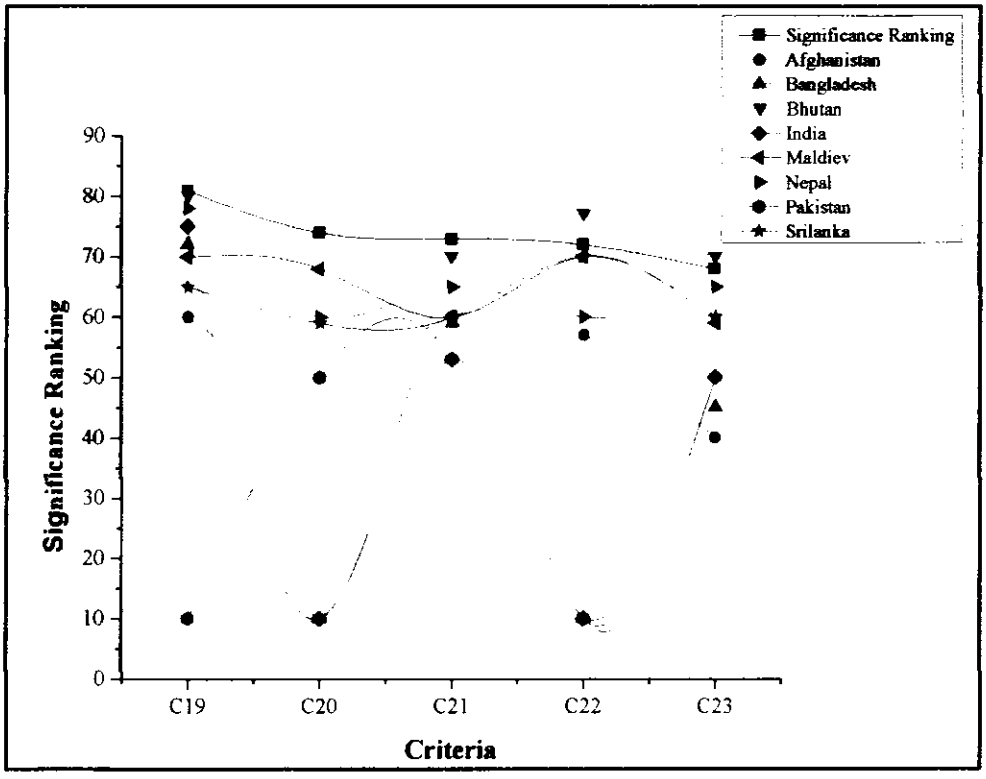

Figure 4.15 Ranking of social criteria in energy policies in the region

The experts visualize the worth of social acceptance (C20) with significance ranking of 74. The results indicated that energy policies of Bangladesh, Bhutan, and India were intended to least focus on social acceptance. The social acceptance usually relies on public, reiterates historical narrative, practices, and socio-political context. The embodiment of social benefits can foster the cross-border procurement of energy due to comprehensive stakeholder involvement. The experts reveal significance ranking (72) to social benefits (C22). The comprehension of social benefits was observed to less significant in Bangladesh, India, and Pakistan energy policies (Figures 4.15 and 4.16). Moreover, energy policies in the region grasp the social benefits at only national context but notion of social benefit at regional level can explicit the energy trade, settle disputes and environmental protection. Unfortunately, South Asia had numerous disputes due to historical narratives and socio-political context which are threatening energy trade feasibility and environmental security. Batel and Devine- Wright, (2017) recommends to reproduce way of thinking, eradicate social inequity, create larger and interconnected energy systems for social and environmental sustainability at local and regional levels.

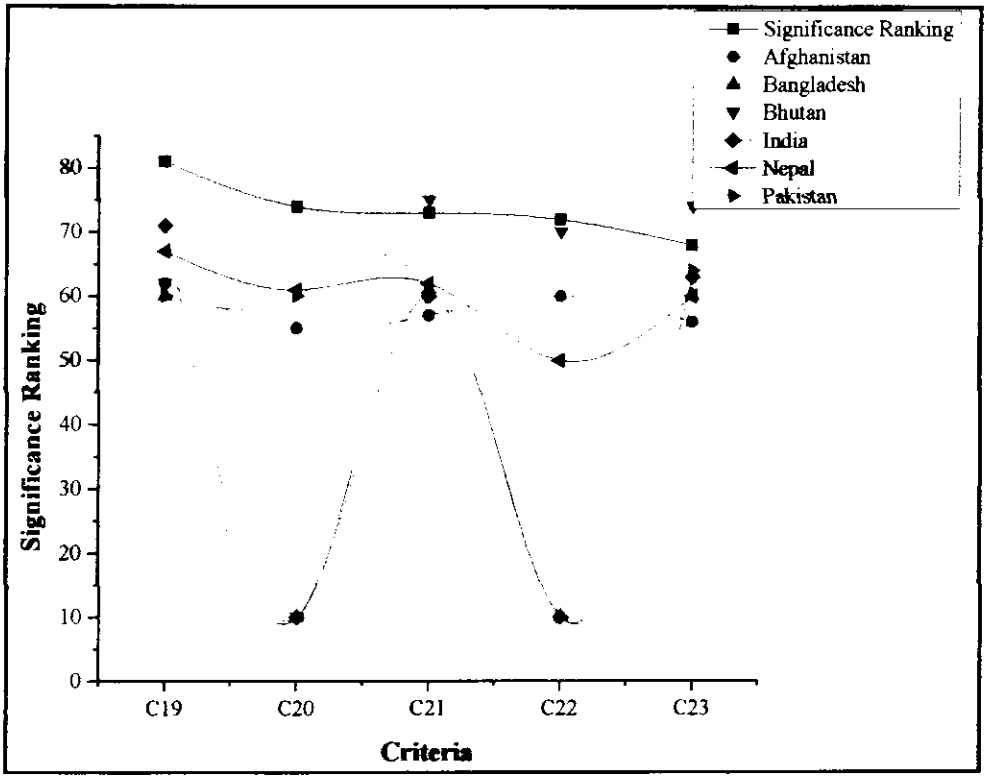

Figure 4.16 Ranking of social criteria in ARE policies in the region

The job creation is among main energy policy goals. The experts allotted the significance ranking (73) to job creation (C21). It is important to mention that all energy policies in the region had contemplated the employment opportunities at a national level (Figures 4.15 and 4.16). There is need to assess the employment potential in SAARC energy grid and SAARC Market for Electricity. It would be helpful to enhance the social acceptance and cooperation. The experts reckon regional cooperation an imperative for regional energy trade, development, and environmental security. They dispensed the significance ranking (72) to cooperation (C23). The results had expressed that energy policies in the region integrated the cooperation expect National Energy Policy 2004 of Bangladesh, National Energy Policy of India 2005 and National Power Policy 2013 of Pakistan. These countries consolidated the cooperation as part of their foreign policy. While, all alternative and renewable energy policies in the region soak up the local, regional and global cooperation for successful deployment of energy (Figures 4.15 and 4.16).

The results represent strong positive Pearson correlation or moderate between significance ranking and existing ranking of social criteria (Table 4.5) weak positive Pearson correlation in Renewable Energy Policy of Bangladesh 2008 and ARE policy of Pakistan (Table 4.6). The energy policies of South Asian states comparatively better capacity of social aspects than other criteria.

4.1.2.5 The evaluation of political aspects

The experts underpin political will, support, and commitment as a substantial criterion for energy trade, development, and environmental security. They imparted highest significance ranking (92) to political will (C24). The results had clarified that all South Asian countries politically committed for energy trade, development and environmental security. Despite diverse challenges, the South Asian states are demonstrating their commitment to either energy policies or part of foreign policy and eventually signed different energy projects (Figures 17 and 18).

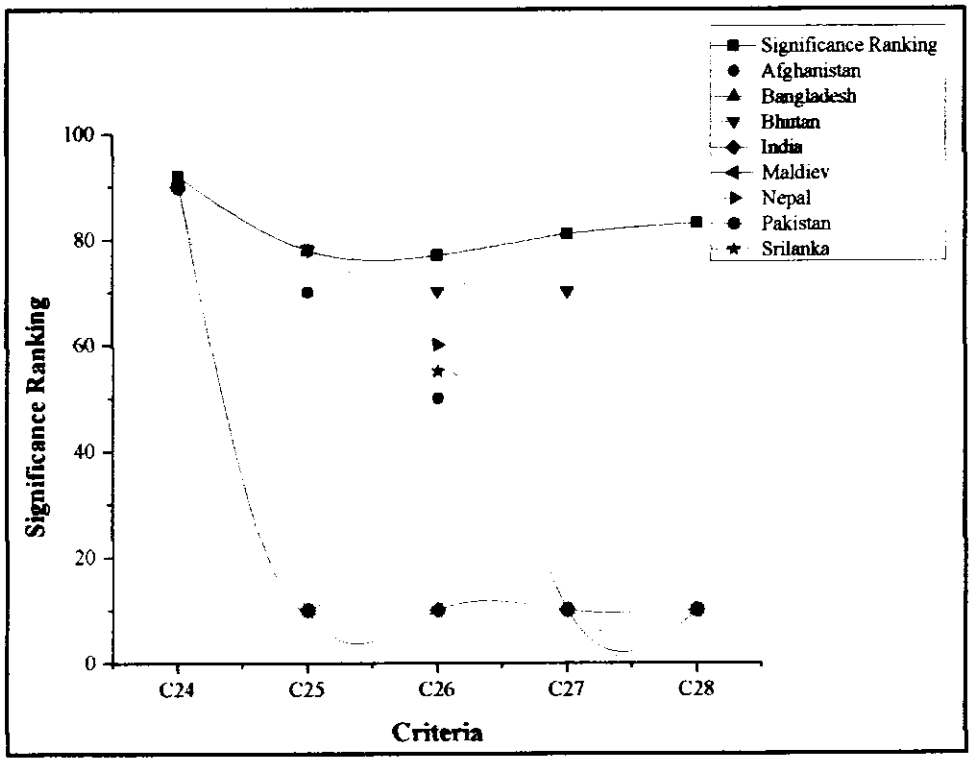

Figure 4.17 Ranking of political criteria in energy policies in the region

The experts attributed the significance ranking (78) to identification constraints (C25). According to results, Afghanistan Energy Sector Strategy 2008, Bhutan Sustainable Hydropower Development Policy 2008, Afghanistan Rural Renewable Energy Policy and Bhutan Alternative Renewable Policy 2013 had unfolded the constraints in energy generation and procurement to or from neighboring countries (Figures 17 and 18). While all other energy policies in the region clearly lagged the identification of constraints. The energy trade and environmental security is not possible without identification of constraints due to lower social acceptance, poor economic, technical and environmental sustainability. The results had shown that experts accredited the significance ranking (77) to negotiation and diplomacy (C26). While, all regional countries have precept the negotiation and

diplomacy for regional energy trade (Figures 17 and 18). The South Asia is known for various complex disputes. Therefore, the negotiation and diplomacy are an imperative for balancing energy, environment and development nexus.

The entities involved in energy trade expect right of ownership in terms of fiscal, social, political and environmental benefits. The experts assigned significance ranking (81) to right of ownership (C27). The results exhibited that only Royal Government of Bhutan anticipated the right of the owner in their energy policies (Bhutan Sustainable Hydropower Development Policy 2008 and Bhutan Alternative Renewable Policy 2013). While other energy policies in the region had no criteria for the right of ownership which limiting the trade feasibility (Figures 17 and 18). The experts confer high significance ranking (83) to secure supply (C28) but unfortunately, all energy policies in the region did not define the measures for safe and secure supply (Figures 17 and 18). The scantiness of this criterion not only reduces trade feasibility but also abate the social acceptance, economic viability, and environmental security.

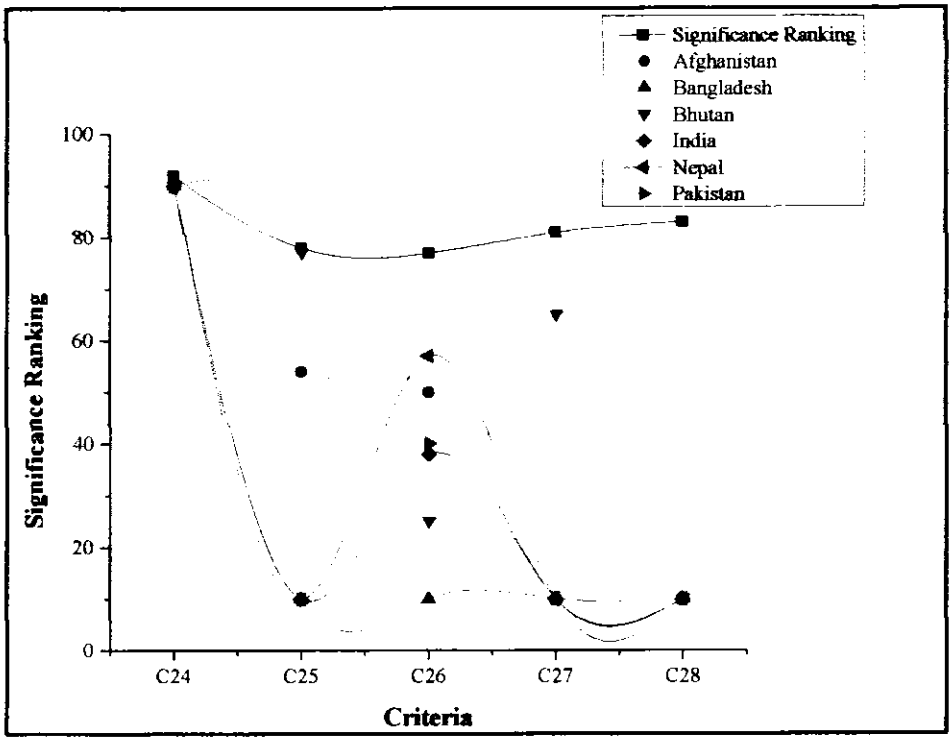

Figure 4.18 Ranking of political criteria in ARE policies in the region

The results exhibited positive and strong or very strong Pearson correlation between significance ranking and existing ranking of political criteria in most of the regional energy policies (Table 4.5 and 4.6). Political criteria shape the preferences of countries, policy choices, production choices and relations with various interest groups as well as interlink the primary energy supply, climate change, economic and environmental benefits.

Furthermore, political aspects are interconnected with geography, natural resource endowment, economic wealth, industry and global energy prices. South Asian region has unique and complex political circumstances. Meanwhile, staid political hiatus in regional energy policies have endured threats to energy trade, development, regional energy and environmental security.

4.1.2.6. Discussions

Poorly decided energy generation and procurement can invoke environmental damages, poor financial returns and stakeholder reactions (Büyüközkan and Karabulut, 2017). The technical, economic, environmental, social and political aspects are used in decision making, energy security, policies and sustainability. Energy endowments vary among South Asian countries and all neighboring countries did not cooperate in the region to secure it from each other (Singh, 2013). Although, many statistics of potentials of different energy resources are not available in some countries. According to SAARC Secretariat, (2010) and SAARC Energy Center, (2016), there are estimated 108981 million tons reserves of coal, followed by 5906 million barrels of oil, 95 trillion cubic feet (tcf) of natural gas, tremendous potential of 388775 MW hydropower, 223 million tons of biomass, massive potential of solar, and wind energy. An Infographic of country wise energy reserves in South Asia is shown in figure 4.19. Tripathi, (2012) considered energy as functional area for regional cooperation. Hence, the SAARC members had signed SAARC Framework Agreement on Energy Cooperation (Electricity) in November 2014 with a goal of SAARC Market for Electricity (SAME) and sustainable procurement of energy at affordable cost. The core objectives of this agreement are to enable cross-border trade of electricity among member states on a voluntary basis through mutual agreements and negotiate buying and selling entities in economic terms. Iskin *et al.* (2012) alluded identification of potential and availability of energy resources as an essence of planning and policy. Energy has become a scarce global strategic resource and power generation is geographically distributed. Su *et al.* (2017) and Ahmed *et al.* (2017a) pointed out that many countries are generating costly and environment unfriendly energy from fossil fuel due to scarcity and poor capacity to utilize the renewable energy resources. Ahmed *et al.*, 2017a also enumerated that an integrated energy market can enhance cross-border electricity trade (import or export) from countries abundant with energy resources to countries with less renewable energy resources as well as encourage foreign investment, technology transfer, reduce the reliance on fossil fuel and protect the environment.

Kahraman *et al.* (2009) closely related the reliability to equipment design, quality, fuel type, maintenance and operation of energy within intended and predetermined conditions. Securing reliable and environmentally sound supply is among geopolitical challenges of the current era and seeking strategic bilateral and regional cooperation (BMWi, 2010). The maturity of technology and energy projects is an effective criterion in decision making and investment perspective. The research studies had identified inclusive effects of maturity on other parameters such as reliability, efficiency, cost effectiveness, mutual understanding between investors and policy makers, the speed of implementation, and technology penetration in the energy mix at national, regional and international level (Amer and Daim, 2011; Büyüközkan and Güleryüz, 2017). Wang *et al.* (2017b) presented a systematic view of the trilemma of safety, security and sustainable development of energy systems is getting importance due to growing attention to energy and environmental issues.

Economic aspects cover investment cost, operation and maintenance cost, trade cost, supply cost, economic benefits of trade, payback period, affordability and tax in regional context. Sengül *et al.* (2015) refers competitive investment to the total expenditures required to make energy projects operational. It includes labor cost, purchase of mechanic equipment's, engineering services, infrastructure, construction work, technological installations supply, and trade cost. Similarly, SAARC Framework Agreement on Energy Cooperation mandated the planning of cross-border interconnection (Article 7), build, operate and maintain (Article 8), transmission service agreement (TSA) (Article 9), system operation and settlement (Article 11) being a part of the competitive investment.

The environmental and energy insecurity may result from dependence on imported fossil fuel to meet the energy demand of growing population (Mahmood *et al.*, 2014). According to the World Bank, the energy networks among different countries and inter-regional flows are helpful in reducing carbon, greenhouse gas emissions and combat climate change. The growing energy demand, outstripping domestic supply and supply gaps in India, Pakistan, Bangladesh, Afghanistan and Sri Lanka are rationalizing the energy trade. Meanwhile, Tajikistan, Kyrgyzstan, Nepal, Bhutan, Myanmar, and Turkmenistan and Iran can export energy due to excessive energy and endowment of resources (The World Bank, 2008). Mahmood *et al.* (2014) visualized regional energy trade in South Asia as an economically viable option, improve regional cooperation and prosperity.

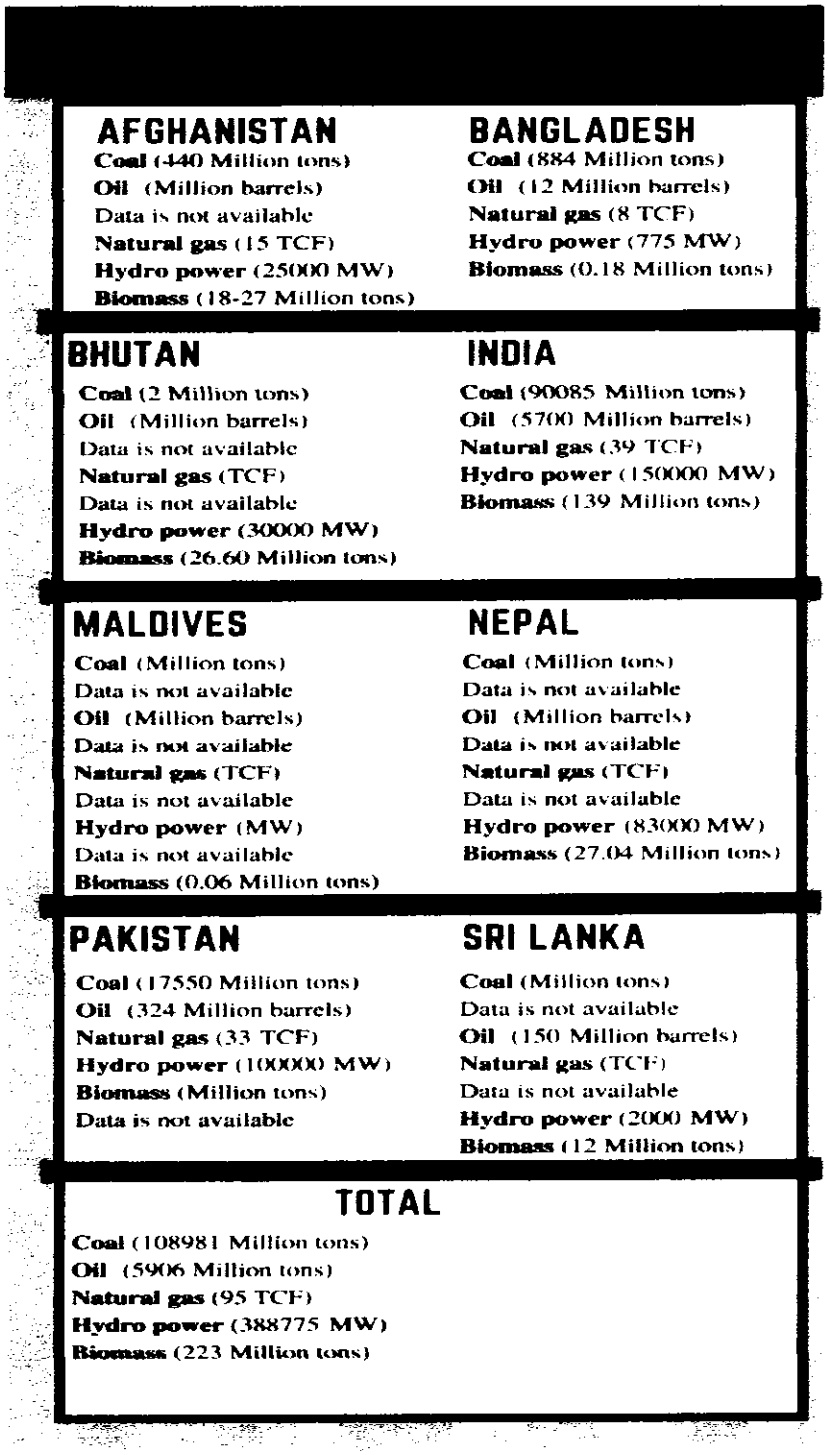

Figure 4.19 Infographic of energy reserves in South Asia Source (SAARC Secretariat, 2010; SAARC Energy Center, 2016)

Behera and Dash, (2017) hassled trade of energy can pledge the economic development, raise the income, alleviate the poverty, reduce the dependence on fossil fuels and carbon emissions. Transmission access (Article 12) of SAARC Framework Agreement on Energy Cooperation covers cross-border trade and non-discriminatory access to respective transmission grids. Meanwhile, facilitating buying and selling entities (Article

13) edict the member states in cross-border energy trade and create a rational market. The project payback period adduces the time span (number of years) required to return the total investment (Ramírez *et al.*, 2017). The energy trade may have to deal with two types of taxes including tax on energy trade and a carbon tax. The tax on energy trade could be a potential source of revenue generation. Coady *et al.* (2017) suggested reduction in emissions and promotion the renewable as well as protect the environment by introduction of carbon tax. SAARC Framework Agreement on Energy Cooperation decree duties and taxes (Article 4), the essence of trade duty, fees and levies exemption on cross-border energy trade.

This study appended the climate change, water security, Sustainable Development Goals (SDGs), South Asia Co-operative Environment Programme (SACEP) to adeptly comprehend the relationship of regional energy trade with environmental security and development. Wang *et al.* (2009) consider power generation from fossil fuels (oil, gas, and coal) as a source of carbon dioxide, NOx, and other gas emissions, which eventuated into temperature rise, climate change, threatened social structure and environment. Sovacool, (2017) argued that interconnected regional energy grids could potentially reduce the greenhouse emissions and reliant on fossil-fueled sources of energy. The increasing energy demand and expansion of energy systems require land. Welsch *et al.* (2014) determined changes in the landscape, rainfall and the availability of arable land as well as stresses ecosystem due to land use in power projects. The land is required for every stage of energy trade including generation, transmission, terminals and grids. Energy-water-climate change nexus has attained peculiar attention after COP21. Water and energy are supposed to be independent and interlinked valuable resources (Shahzad *et al.*, 2017). Water is a ubiquitous source for hydropower generation and cooling during thermal power production. Similarly, water utilization including collection, treatment, and distribution to end user requires energy. The mutual vulnerability of energy and water is being amplified by growing demand and climate change (Howells and Rogner, 2014). Seter, (2016) presented the link among water security, climate change, conflicts, political concerns, and environmental security as well as intensifying the governance capacity, regional trade, migration and national security. Therefore, the energy, water and climate change integration is substantial for sustainable energy procurement. The Sustainable Development Goals (SDGs) present a unique approach to global commitment, strengthen governance, integrate sectoral policies and foster global sustainable development

(Biermann *et al.*, 2017). The Goal 7 is to energy security, stresses to ensure affordable, reliable, sustainable and modern energy for all. The burgeoning energy demand and industrial growth are an important requirement to this goal. Alam *et al.* (2017a) proposed that the South Asian regions are energy deficit. Hence, power generation, distribution and secure supply cross the border could help in achievement of the Goal 7. The South Asian countries have reiterated the obligation of strong and intensify regional cooperation through successive summits at SAARC platform since 1987. The electric power consumption and generation of SAARC countries shows unidirectional causality which runs to environmental pollution and damage. Akhmat *et al.* (2014) reported that Bangladesh, Nepal and Sri Lanka are facing largest share to influence on precipitation due to CO_2 from power sector, while India and Pakistan have average influence on precipitation.

Binder *et al.* (2017) rationalized the social criteria for successful regional procurement of energy through involvement social actor in visions, foresight, institutionalization and development of energy material and flow. Mühlemeier *et al.* (2016) believed that social criteria can ensure the faultless functioning of technical aspects, sustainable energy production and procurement from the environmental, economic and political point of view through public support and involvement. Bauer *et al.* (2017) considered access to affordable energy as a basic human right as well as fundamental driver to human needs, development and sustainability. Batel and Devine- Wright, (2017) highlights the responses and representation of people through social acceptance towards the energy projects for the deployment of energy, ranging from construction of infrastructure, generation to distribution. Social acceptance and benefits is undeniable aspect for regional energy trade due to several geopolitical disputes in South Asia. A significant number of new employment opportunities from the deployment of projects in energy sector represents the success of energy policies. Dvořák *et al.* (2017) determined that the 1,114,210 people were directly or indirectly employed in energy sector of European Union in 2010 but two year later the number was increased to 1,218,230 (10%) in 2012 due to approval of European Energy strategy (Energy 2020), regional cooperation and interconnection. The SAARC energy grid and SAARC Market for Electricity had a significant potential to create new employment opportunities particularly in renewable energy sector. Paramati *et al.* (2017) has summarized energy, economic growth, and environmental concerns nexus as well as its complication with paradigm of development in both developing and developed countries. The cooperation between entities (local and

regional) may play significant role in the deployment of energy projects. Meanwhile, it will improve the institutional capacities of governments, technological assistance, exchange finance and economic development. These factors have an ability to a substantial reduction in emissions which eventually protect the environment. The article 5 and article 14 of SAARC Framework Agreement on Energy Cooperation emphasized on cooperation through data updating, sharing of information and knowledge sharing as well as joint research respectively.

The long-term development, procurement of energy and sustainability have a challenge of long-term commitment and cooperation but identification of political aspects can aspire collaboration over a long-time perspective (Mikkola *et al.*, 2017).Some studies have established political will, identification of constraints, right of ownership, secure supply, negotiation and diplomacy as a political criteria for regional energy trade (Hiteva and Sovacool, 2017; Alam *et al.*, 2017a). Sovacool, 2017 reflected the strong political will and commitment at national and regional levels to determine the pathways of energy transition. The successful energy transitions in The Nordic region is outcome of strong political will and policies. The identification of constraints increases the energy trade feasibility and implication of multi-lateral environmental agreements. These constraints comprise of geopolitical, social, economic, variable prices, reliability constraints, security, variable resource availability, interconnection, institutional and regulatory (Khan *et al.*, 2017). The article 15 of SAARC Framework Agreement on Energy Cooperation mandated to structure and function institutional mechanism for regulatory issues related to energy trade. The assessment of social, political, historical consideration, geopolitical narratives, role of intergovernmental, international and transitional regulatory regime is required for being agreed upon complex reforms to harness regional energy trade, climate change mitigation, development and environmental security (Young, 2017). Van de Graaf and van Asselt, (2017) interpreted that negotiation and diplomacy through intergovernmental organizations could help to resolve disputes regarding energy trade and environmental security, formulate and implement the agreements by providing, technical assistance and information. The article 16 of SAARC Framework Agreement on Energy Cooperation behests member states to negotiate on the disputes arising from interpretation and implementation of this agreement. If the member states are unable to settle the dispute, they can refer it to SAARC Arbitration Council. The right of ownership is among most controversial issues in case of regional energy transitions (Ipek, 2017). Hickey, (2017)

identified an immediate impinge of state decisions and potential effect on the entire region in globalized world. It can also affect the threat to energy use, water use, physical security, lifestyle and environmental security. The regional energy security and trade depends on secure energy corridor from resources- rich states to resource-deficit state (Hassan *et al.*, 2017). The rational behavior of various global economic players is looking to be a real threat to a safe and secure procurement of from one region to another region (Sahir and Qureshi, 2007). The secure supply is consequential concerns for regional trade in South Asia due to geopolitical tensions between India and Pakistan as well as Afghanistan and Pakistan from both India and Pakistan perspective. Although, article 10 of SAARC Framework Agreement on Energy Cooperation enact the protection of grid system and supply. This article directed the member states to develop and coordinate joint protection system, secure cross-border interconnection, and grid.

4.2 Environmental security: Water, and development in national and regional context

Water is irreplaceable, unique and scarce resource for sustaining life, environmental security and economic development (Bekchanov, 2014). According to United Nations, trans boundary water resources (surface or ground water) distribution are located on geographical boundaries of two or more states are feeding the majority of population worldwide. There are 276 international river systems, covering 45% of land surface, 23 basins among them are shared by 4 to 12 countries. It has been estimated that 145 countries share international river basin, their 75% population located within international basin system and 21 countries receives more than 50% fresh water supply from upstream. Furthermore, 1,814,600 bilateral and multilateral agreements are managing international basin systems (De Stefano *et al.*, 2012; Rieu, 2014; UN, 2015). However, the excessive demand, population growth, industrial development, agricultural expansion, urbanization, climate change and uneven distribution of water resources is leading most part of world towards variation in water quality and water scarcity (IPCC, 2007). The water scarce areas are habitat of about one-fifth of the global population as well as more than two-thirds population will live in areas with physical or economic water scarcity by 2025 (UN Water, 2007). Water scarcity has distinct socio-economic impacts including divesting effects on income, livelihood, domestic requirement and capital growth of various sectors (energy, agriculture, industry, livestock and water supply). Water scarcity is also impairing

ecosystems by affecting photosynthesis, vegetation activity, biological species evolution, and forest growth which ultimately reduce carbon sink and mitigation to climate change (Freire-Gonzalez *et al.*, 2017; Shao *et al.*, 2017).

The results had rationalized water security in resource in Pakistan and South Asia. Water being a most conflicted natural resource is threatening environmental security, peace and development. The average flow of 101.9 MAF was recorded in six major rivers (Indus, Jhelum, Chenab, Sutlej and Kabul) during Kharif season in 2002-07 (Ahmad, 2005; GoP, 2002; GoP, 2008b). Meanwhile, Indus river basin is considered as one of most vulnerable to climate change basins in the world (Sharma *et al.*, 2010). Water even does not reach the sea during certain periods of year (Molle *et al.*, 2010). The water scarcity in the Indus basin and its tributaries has adverse socioeconomic impacts, conflicts between provinces as well threaten environmental and national security of Pakistan. The government of Pakistan is conk out to provide access to safe water for all. Unfortunately, the government has formulated comprehensive national water policy too late in 2018 since partition, perhaps fostering water scarcity. Currently, the government of Pakistan is managing water resources through an accord entitled "Indus River System Authority (IRSA) Accord (Apportionment of the Water of the Indus River System between the Provinces of Pakistan) of 1991" among the provinces and the National Water Policy. Meanwhile, the National Water Policy of 2018 was initiated by Ministry of Water Resources and implemented for visualizing future rapprochement of water resources management.

The South Asian countries had formulated their water policies including National Water Policy of Bangladesh (1999), Bhutan Water Policy (2007), National Water policy of India (2012), Water Resource Management Policy of Nepal (2009), National Water Policy of Pakistan (2018) and National policy on Protection, Conservation of Water Resources, their Catchments and Reservations in Sri Lanka (2014). However, Afghanistan and Maldives did not formulate their water policies. The water from trans boundary rivers is governed by various stakeholders and managed at local, national and regional level to meet the demand (Rasul, 2014). However, increasing demand for competing uses and climate change is putting stress on fresh water rehouses which results in lack of access to safe drinking water (About 20% of population) in the region (Babel and Wahid, 2008). The upstream action often having downstream effects in the region e.g. Indian action are affectng Pakistan and floods in Nepal are affecting India. Similarly, Chinese actions on Brahmaputra River are affecting Bangladesh, India and Nepal (Tiwari, 2000). The failure

in recognize the value of Hindu Kush-Himalayan rivers results in inadequate measures to manage regional watershed, headwaters, natural resources, conflicts and ecosystem, enduring a serious threat to environmental security, development and regional security (Rasul, 2010; Tiwari and Joshi, 2012). Therefore, appropriate planning and diplomacy after multi-attribute analysis in geopolitical context can render water resource management. The decision-making using technical, social, economic, environmental, political and legal criteria hamper development as well as management of water resources in an equitable manner without trade-off sustainability of environment and ecosystem (Safavi *et al.,* 2016).

4.2.1. The evaluation of technical criteria

The technical criteria usually extend to water availability, reliability, allocation, navigation, monitoring, storage and hydropower development (Woodhouse and Muller, 2017; Ibrahim, 2017). The evaluation of water availability is comprehending as a criterion in water policy and planning. The experts ascribed exceptional significance ranking (89) in a national context and (86) in regional context to water availability (C1).

The results demonstrated that IRSA accord undermined water availability but National Water Policies of India and Pakistan were tamed with per capita availability only. However, Bhutan Water Policy (2007), Water Resource Management Policy of Nepal (2009), and National Policy on Protection, Conservation of Water Resources, their Catchments and Reservations in Sri Lanka (2014) exclusively pampered the water availability from all resources including glaciers, rain, rivers, lakes and ground water. Meanwhile, all regional water treaties did not consider the water availability, which, perhaps affect the implementation of treaties (Figures 4.20-22 and Annexure 2). The inadequate evaluation of water availability might impede development, equitable water access, allocation and distribution as well as damage ecosystem, eventuated in social unrest, environmental and water insecurity.

The experts allotted significance ranking 72 and 66 to reliability (C2) in national and regional context respectively. The existing ranking of reliability varies in IRSA accord (30) and National Water Policy of Pakistan (70). The National Water Policy has taken into account integrated water management, fiscal arrangements, dams and demand. Alike National Water Policy, all regional water treaties and individual policies has contemplated the reliability except Water Resource Management Policy of Nepal (Figures 4.20-22 and Annexure 2).

The international water law (The Helsinki Rules 1966 (Article 4, Chapter 2); Convention on the Law of the Non-navigational Uses of the International Watercourses 1997, Article 5, Part II), international environmental law and international human rights law privilege the equitable water apportionment as a cardinal principle to assure use, benefits, human well-being, and environmental security in all riparian states (ILA, 1967; UN, 2014; McIntyre, 2017). The experts rated equitable apportionment (C3) significance in national (75) and regional (74) context. Besides, the significance ranking of flow variability (C4) arbitrated in national context (65) and more important in regional context (79). The water policies usually did not mandate apportionment, it is the part of accords or treaties between provinces and states. Therefore, all water policies in the region did not pondered the equitable water apportionment (Figures 4.20-22 and Annexure 2). Appelgren, (2007) had determined that water treaties have two mechanism for apportionment worldwide including fixed apportionment or joint mechanism. The fixed apportionment entitles a fixed amount of water to riparian states. While joint mechanism undertakes flow variability, multiple social, economic, political and environmental factors. The first type of mechanism is facing conflicts due to weak interpretation, increasing water demand, climate change, environmental factors, massive expansion in industry and agriculture. However, second type of mechanism is recommended by the Helsinki Rules 1966 (Article 5, 7 and 29) as well as Convention on the Law of the Non-navigational Uses of the International Watercourses 1997 (Article 8, Part II) and productive in recent decades (ILA, 1967; UN, 2014). The IRSA accord is based on based on flow variability and joint mechanism. The results had shown that the Treaty of Mahakali and Treaty on Sharing of Ganges Water are designed on joint mechanism, flow variability and environmental factors according international law. But the Indus Water Treaty did not decree the flow variability and commenced on fixed apportionment (Figure 4.21). Furthermore, there is consistent water conflict between India and Pakistan particularly in dry season, damaging ecosystem threatening environmental security in low riparian due to poor justification of the treaty. As the treaty was designed before the Helsinki Rules 1966 and Convention on the Law of the Non-navigational Uses of the International Watercourses 1997. The environmental conditions of low riparian might be affected due to variation in quantity, duration and frequency of dry season.

The article 12 of the Helsinki Rules 1966 mandated the riparian states to navigate, monitor and meter the trans boundary water to ensure equitable use. The article 7 of

international law confines the basin states to not use the reasonable share of each other (ILA, 1967). Moreover, the article 21 (Part IV) of Convention on the Law of the Non-navigational Uses of the International Watercourses 1997 is applicable to monitor, prevent, reduce and control the water pollution (UN, 2014). The experts attributed the significance ranking in national (87) and regional (82) context to monitoring and metering (C5). It is notable to mention that the monitoring metering was addressed in IRSA accord (only metering of river flow) and National Water Policy of Pakistan (water pollution and metering of river flow) (Figure 4.20). According to results, the regional water treaties behest the monitoring and metering of river flow only and omitted the monitoring of water pollution (Figure 4.21). Any adverse activity in upper riparian likely to damage the environment in low riparian. The trans boundary water pollution endures the environmental security of low riparian. However, water policies of all South Asian countries mediated monitoring and metering of rivers water flow and pollution (Figure 4.22).

The experts assigned an outstanding significance ranking to water storage and hydropower development (C6) in national context (93) and regional context (80). The results presented that the IRSA accord cogitated the only storage and ruminated low existing ranking (50). Although, the National Water Policy of Pakistan comprehensively addressed both storage and hydropower development (Figure 4.20 and Annexure 2.1). But lack of new large dams and low storage capacity is increasing water scarcity, stress and environmental insecurity in lower riparian provinces of Pakistan as well as coddle the inter-provincial conflict. However, the water policies in the region assimilate the National Water Policy of Pakistan except National Water Policy of Bangladesh having comparatively less attention to hydropower (Figure 4.21). The Treaty of Mahakali did not render storage of water but briefly discuss energy transfer between both countries. However, Treaty on Sharing of Ganges Water and the Indus Water Treaty mused the mechanism for water storage and hydropower development (Figure 4.22). Although, article 7 (not use co-riparian water), article 8 (construction on international basin) of international law along with part 2 (not cause harm low riparian) and part 4 of Convention on the Law of the Non-navigational Uses of the International Watercourses provide the mechanism for development (dams and hydropower), information exchange, notification of adverse effects and negotiation. These laws discourage upper riparian to undertake development unless informed to lower riparian (ILA, 1967; UN, 2014). Unluckily, South Asia is conceded for eminent water conflicts between upper and lower riparian (Hassan *et al.,* 2017). Water dispute on Ganges-

Brahmaputra-Meghna (Bangladesh, India and Nepal), the Indus River (India and Pakistan) and the Kabul River (Afghanistan and Pakistan) threatening development, peace, water and environmental security (Uprety and Salman, 2011; Hassan *et al.*, 2017).

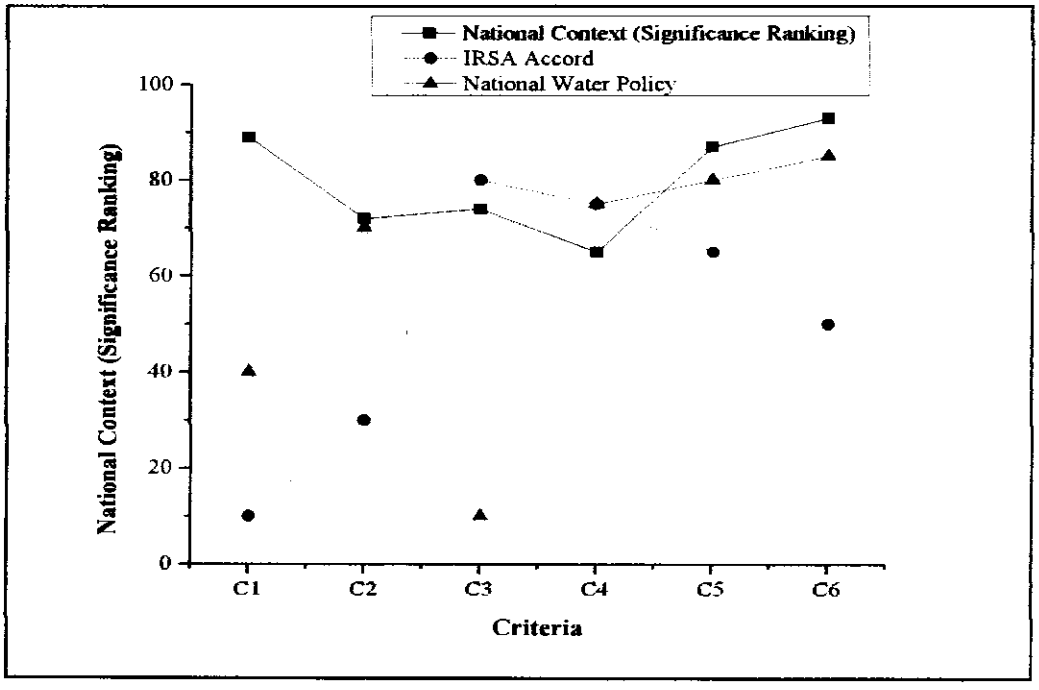

Figure 4.20 Ranking of technical criteria in water policy and accord in Pakistan

Interestingly, all regional conflicts are on water storage, rights and hydropower development. The main reasons are late exchange of information, no prior intimation, violation of technical design, increasing demand, inappropriate interpretation in dry season, water insecurity, demarcation of boundaries without headwater at independence time, low storage capacity, unplanned extensive hydropower project on shared basins and climate change. Akthar, (2010) identified most prominent disputed projects include Wullar Barrage (Talbul Navigation Project), Kishanganga Hydroelectric Power Project (Neelum) and Uri-II Hydroelectric Power Project on Jhelum River, Baghihar Hydroelectric Power Project, Dul Hasti dam, Rattle Hydroelectric Power Project, Bursa, Kiru, Pakdul and Kwar dam on Chenab and Chutak, Nimo Bazgo and Dumkar Hydroelectric Power Project on Indus. The Indian actions are violating article 3 (Right on Western Rivers), article 4 (maintenance of water channels), Criteria in Annexure E (paragraph 8) and Annexure D (Design, height, reduction in run-off and gated spillways) of Indus Water Treaty. The lack of cooperation on these projects eventuated in loss of billion rupees as wells drastic reduction in Western Rivers flow. Further consequences are water stress, insecurity, ecosystem and environmental damage in low riparian. The environmental insecurity might intimidate agriculture, economic activities, development and livelihood of people.

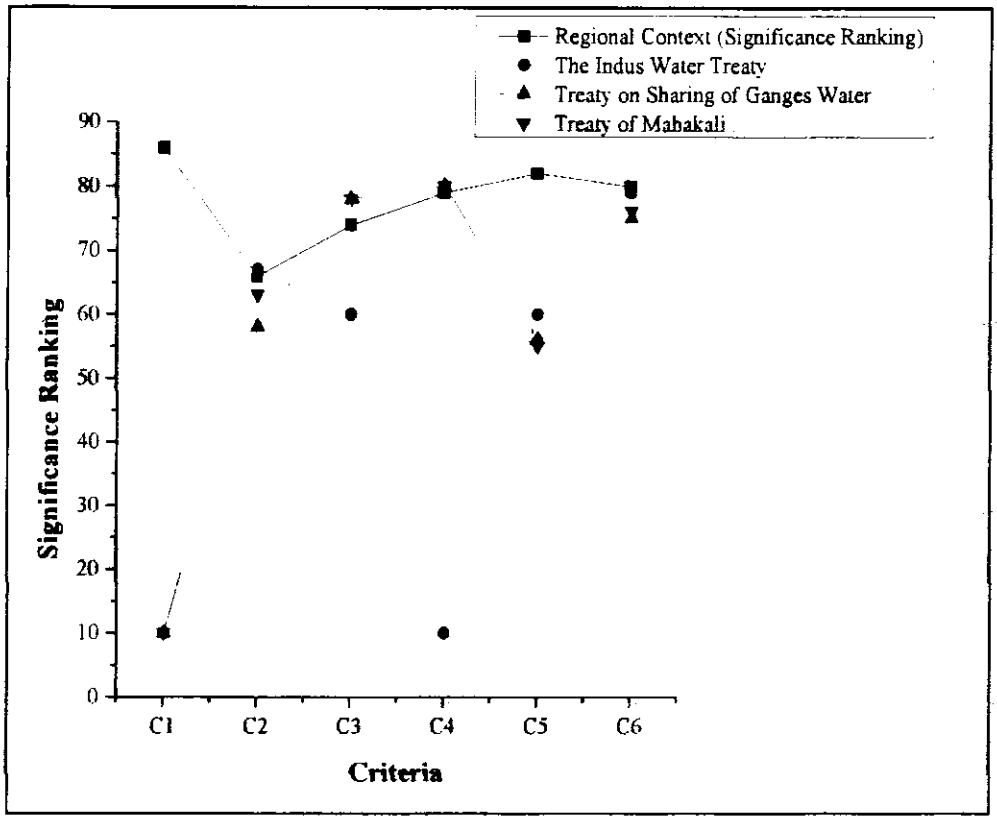

Figure 4.21 Ranking of technical criteria in regional water treaties

The correlation between significance ranking and existing ranking of selected technical criteria of water in national context was found moderate negative and weaker positive in IRSA accord and National Water Policy respectively (Table 4.7). The regional water treaties impart moderate negative correlation between significance ranking and existing ranking of selected technical criteria (Table 4.8). The results represented very weak positive correlation in National Water policy of India (2012) and National Water Policy of Pakistan (2018), weaker correlation National Water Policy of Bangladesh (1999), Bhutan Water Policy (2007) and Conservation of Water Resources, their Catchments and Reservations in Sri Lanka (2014) and strong positive correlation Water Resource Management Policy of Nepal (2009) (Table 4.9).

Environmental security, ecosystem and socioeconomic dynamics are threatened beyond the borders in the South Asia. It is an essence to scrutinize the technical aspects and rethink them for environmental security, sustainability, poverty alleviation and development in the region

Table 4.7 The correlation between significance ranking and existing g ranking of selected criteria of water policy and accord in Pakistan

Criteria	IRSA accord	National Water Policy
Technical	-0.42	0.17
Economic	-0.08	0.15
Environmental	0	0.7*
Social	0.11	0.03
Political	0.25	0.4

(*** p < 0.01, ** p < 0.05, *p < 0.1) (Very weak= 0.00-0.19, Weak= 0.20-0.39, Moderate= 0.40-0.59, Strong= 0.60-0.79, Very strong= 0.80-1.0)

Table 4.8 The correlation between significance ranking and existing ranking of selected criteria in regional water treaties

Criteria	The Indus Water Treaty	Treaty on Sharing of Ganges Water	Treaty of Mahakali
Technical	-0.38	-0.4	-0.42
Economic	0.45	0.01	-0.08
Environmental	-0.5	-0.8**	-0.6
Social	0.4	0.5	0.42
Political	-0.05	-0.07	0.51*

(*** p < 0.01, ** p < 0.05, *p < 0.1) (Very weak= 0.00-0.19, Weak= 0.20-0.39, Moderate= 0.40-0.59, Strong= 0.60-0.79, Very strong= 0.80-1.0)

Table 4.9 The correlation between significance ranking and existing ranking of selected criteria in water policies in region

Criteria	BGD	BTN	IND	NPL	PAK	SLK
Technical	-0.21	0.2	-0.08	0.62*	0.06	0.32
Economic	-0.28	-0.43	-0.13	-0.3	-0.03	-0.28
Environmental	-0.24	0.2	0.8**	-0.11	0.68*	0.08
Social	-0.06	0.07	0.18	0.03	-0.08	-0.03
Political	-0.01	-0.1	-0.4	-0.3	0.4	-0.1

(*** p < 0.01, ** p < 0.05, *p < 0.1) (Very weak= 0.00-0.19, Weak= 0.20-0.39, Moderate= 0.40-0.59, Strong= 0.60-0.79, Very strong= 0.80-1.0)

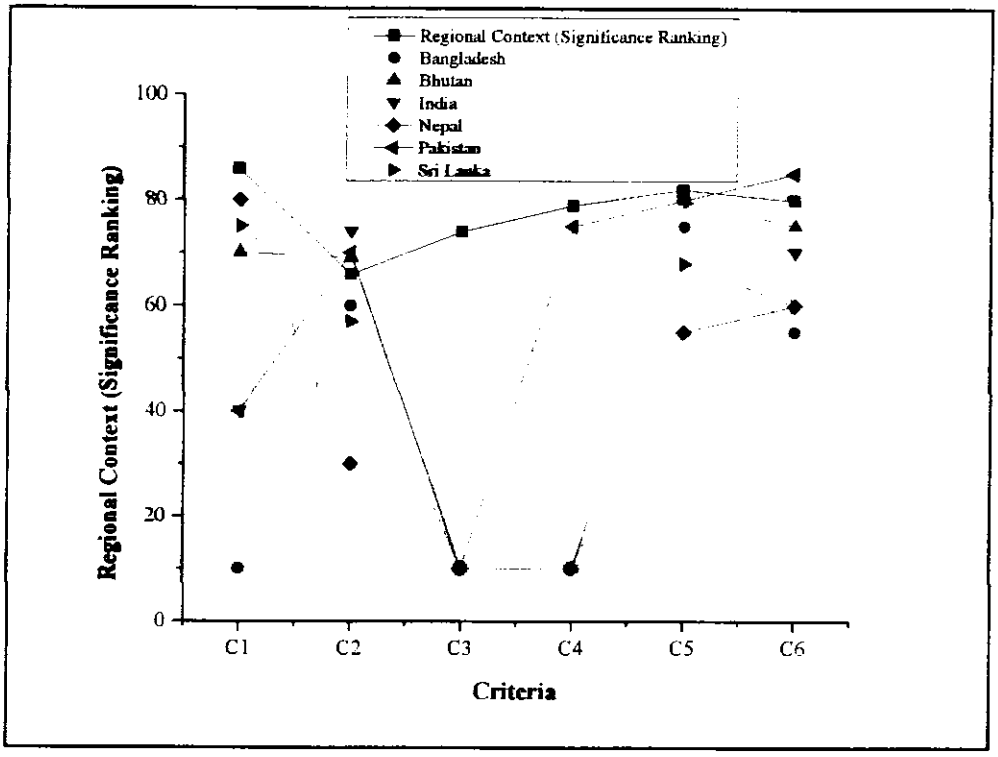

Figure 4. 22 Ranking of technical criteria in water policies in South Asia

4.2.2. The evaluation of economic criteria

The natural resource policy which comprehends operational economy and equity are liable to appeal community, ensure appropriate allocation, justify community preferences and benefits. The economic narratives encompass of balanced mix of uses, income, low cost, equitable distribution, compensation, and incentives (Kaine *et al.*, 2017). The experts conferred significance ranking in national context (82) and regional context (78) to demand and use in different sectors (municipal, agriculture, environment, industry, and energy) (C7). The results had evinced that IRSA accord did not apprehend the water demand and use in different sectors except the primary focus on water arability in major cropping season (Rabi and Kharif) during apportionment. The accord merely consider industry, domestic and commercial use as well as ignore water for environment and ecosystem services. The one-dimensional approach in this accord is affecting provincial water rights and pampering conflicts due variable demand. The National Water Policy of Pakistan identified the all major consumer (municipal, agriculture, environment, industry and energy) (Figure 4.23). But the policy did not rationalize the actual demand and requirement for each sector. According to results, the Treaty of Mahakali and Treaty on Sharing of Ganges Water discussed water demand and use for municipal, agriculture,

environment, industry, and energy. The Indus Water Treaty entertained the water for municipal, agriculture, industry and energy use except environment and ecosystem services (Figure 4.24). Alike, National Water Policy of Pakistan, other water policies in the region also just recognized the municipal, agriculture, environment, industry and energy sector as potential consumers (Figure 4.25). The vague picture of actual demand and use in South Asian states is aggrandizing over exploitation of water resources along with exalted the threat to economy, development water and environmental security.

The experts accredited the significance ranking 70 and 77 in national and regional context respectively to income (C8). The results unfurled that the IRSA accord did not esteem income generation against the use of water. This criterion would not only justify efficient use of water but also reconcile dispute settlement. The National Water Policy of Pakistan incorporated water income through the concept of more crop per drop in agriculture, hydropower development and dams (Figure 4.23). However, the regional treaties did not consolidate the income generation aspect of water resources (Figure 4.24). The water policies in the region are moderately equipped with income from water resources through demand management, cost recovery, and polluter pay principle except Bangladesh and Sri Lanka whose pay less attention to this criterion (Figure 4.25). It was noted that all regional water policies did not undertake the concept of water resources accounting and water footprint. It may affect the workability of water resource policy, economic and environmental sustainability.

The South Asian countries comprises of large low-income population. It is not possible to provide access to clean and safe water without incentives and compensations. The experts enumerated the significance ranking to compensation and incentives (C9) in national context (74) and regional context (66). The existing ranking had evinced that the IRSA accord and National Water Policy of Pakistan had taken in account compensation and incentives through both water quantity and fiscal mechanism (Figure 4.23). The results manifested that Treaty of Mahakali and Treaty on Sharing of Ganges Water expressed the mechanism of compensation and incentives in terms hydropower trade and financial mechanism. Whereas, the Indus Water Treaty exhibited the compensation in transition period only (Figure 4.24). It did not manifest the compensation or incentive mechanism in case of injustice or violation of water rights of low riparian except the United Nations or the World Bank involvement. The absence of mechanism plugged fear, conflicts, environmental damage and insecurity in low riparian. The existing ranking of all water

policies in the region envisioned compensation and incentives to manage cost and sustainability except the less attention in Water Resource Management Policy of Nepal (Figure 4.25).

The experts granted significance ranking 75 and 73 to water loss (C10) in national and regional context respectively. Unfortunately, water loss was found scant in IRSA accord, National Water Policy of Pakistan, regional water treaties and policies except Bhutan National Water Policy (Figures 4.23-25 and Annexure 2) which paid a little attention to water loss. The water loss endorsing floods during monsoon while endure water and environmental security in dry season due to over-abstraction, less availability, ecosystem damage and conflicts.

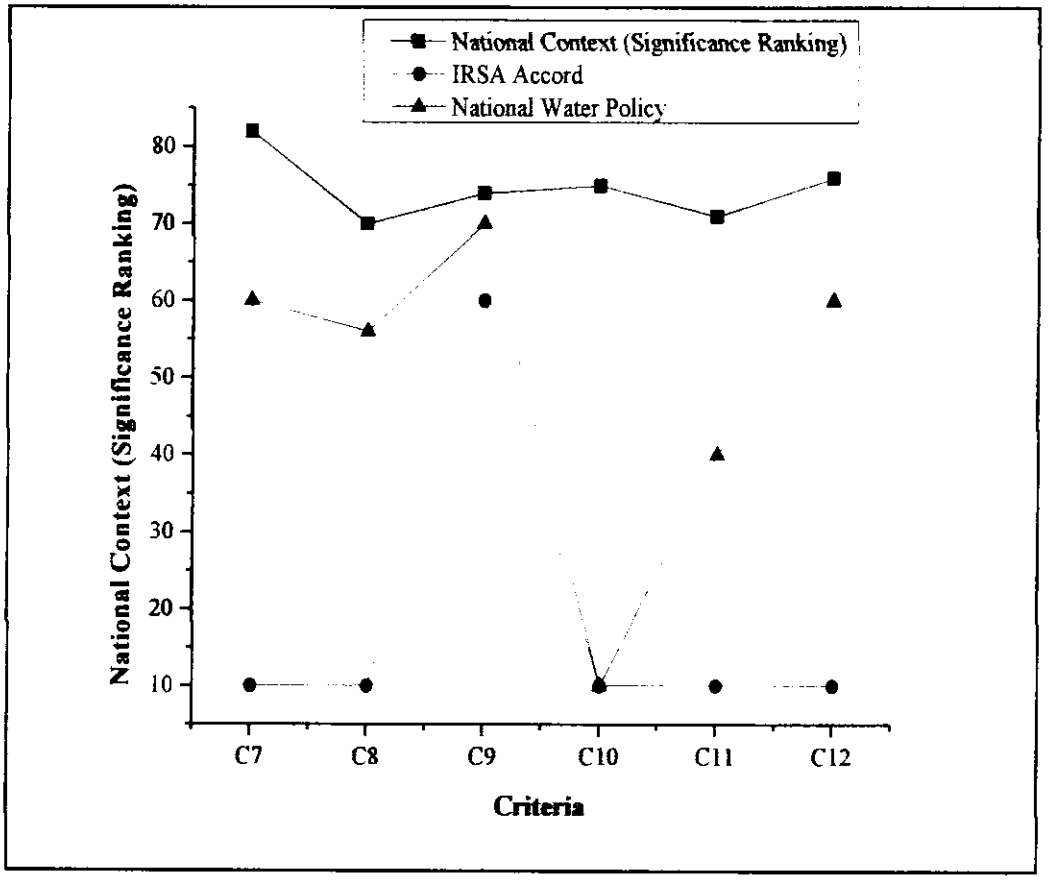

Figure 4.23 Ranking of economic criteria in water policy and accord in Pakistan

The experts ascribed significance ranking to administrative cost (C11) (71 and 63) as well as operation and maintenance cost (C12) (76 and 68) in national and regional context. The results divulged that IRSA accord did not regarded both administrative cost as well as operation and maintenance cost. The National Water Policy of Pakistan contemplated partially both costs and their recovery by the concept of polluter pay principle and maintenance of resources (Figure 4.23). However, all regional water treaties did not

mediate administrative cost, operation and maintenance cost (Figure 4.24). The existing ranking of all water policies in the region demonstrated the consideration of administrative cost, operation and maintenance cost (Figure 4.25). The polluter pay principle and billing from domestic as well as agriculture sector mainly reflected the focus of most policies for cost recovery. Water pricing is appealing policy makers as a cost recovery instrument, water and environmental security. It propounds fiscal incentive, support for future water services, efficient use of water, and socioeconomic value of water (Expósito and Berbel, 2017). It had been noticed that only national water policies of Bangladesh, Bhutan and Pakistan had addressed the water pricing in terms hydropower development and use of surface water but policies of India, Nepal and Sri Lanka did not mandate water pricing, eventuated in over abstraction, inefficient use of water and environmental insecurity. Additionally, the concept of water pricing for abstraction of ground water is still awaited in the region.

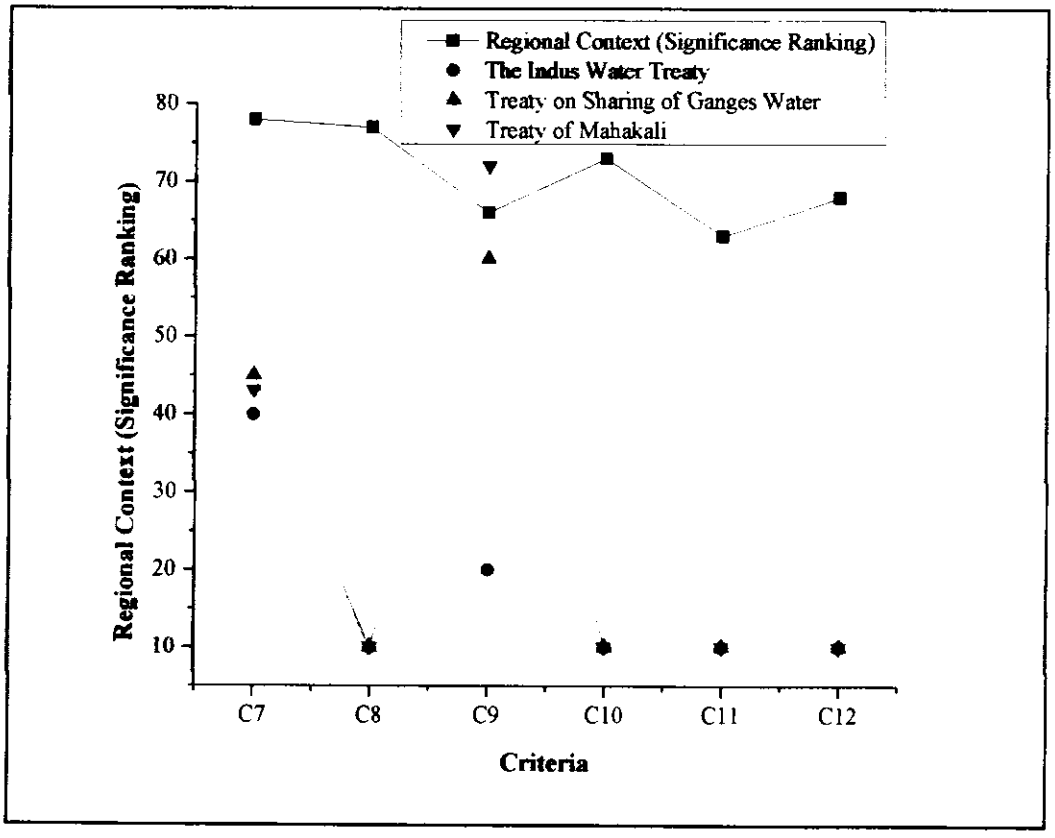

Figure 4.24 Ranking of economic criteria in regional water treaties

The Pearson correlation between significance ranking and existing ranking of economic criteria was noted moderate in the Indus Water Treaty but very weak in the Treaty of Mahakali and Treaty on Sharing of Ganges Water (negative) (Table 4.8). The Bhutan Water Policy indicated negative moderate correlation followed by negative weak Pearson

correlation in Water Resource Management Policy of Nepal, National Water Policy of Bangladesh and National policy on Protection, Conservation of Water Resources, their Catchments and Reservations in Sri Lanka. The National Water Policy of India and National Water Policy (Final draft) of Pakistan exhibited negative very weak Pearson correlation between existing ranking and significance ranking of economic criteria (Table 4.8-4.9).

The economic criteria recognize fiscal value as well as real value of water resources. The economic and financial instruments of water resource policy meliorate the environmental security through restrained water abstraction, pollution and use. The economic perspective of water resources policies and management is glimpsing improvement in both national and regional context due to substantial gaps.

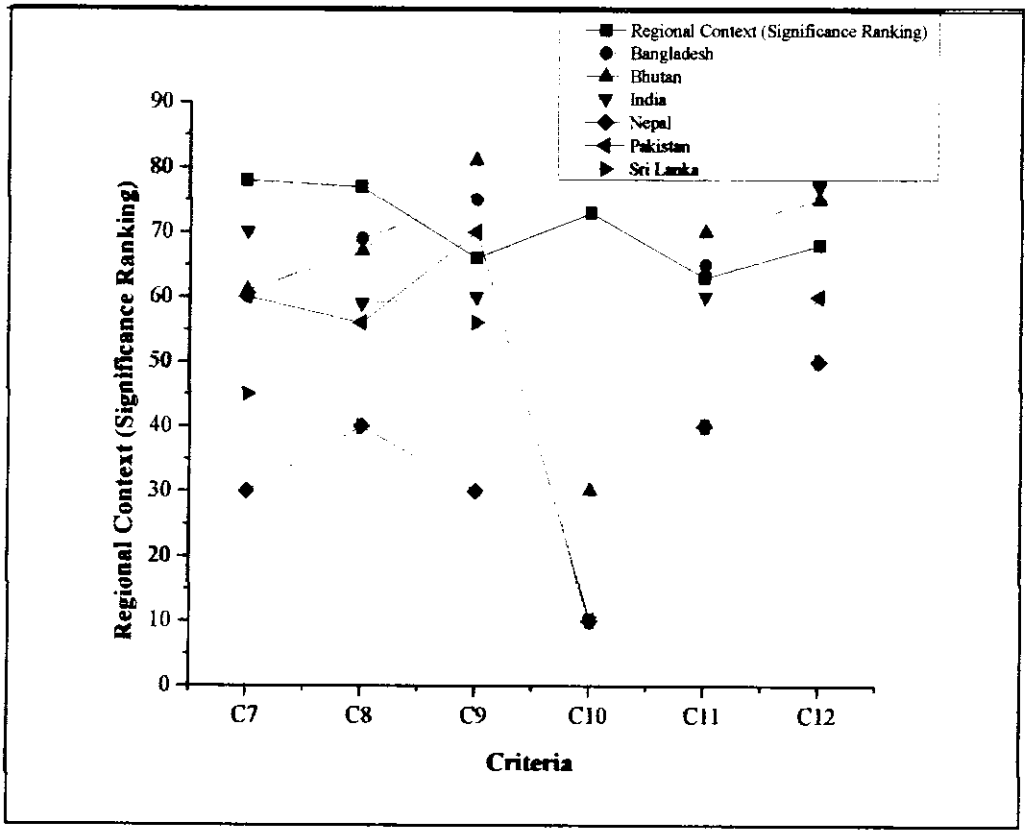

Figure 4.25 Ranking of economic criteria in water policies in the region

4.2.3. The evaluation of environmental criteria

The increasing demand is putting pressure on natural resources, precedes to unsustainable use and damage environment. The experts assigned significance ranking 86 and 78 in national regional context respectively to water resource vulnerability (C13). The

results revealed that the IRSA accord and regional water treaties did not decree water resource vulnerability. Unlike treaties, all water policies in the region cogitated vulnerability of water resources (Figures 4.26-28 and Annexure 2). The less remuneration of water resource vulnerability water treaties might affect decision-making, supply, equity and water resources management and menaced environmental security.

The experts also pointed out the climate change induced vulnerability of water as an eminent concern, and stressed to integrate water resource policy with climate change (C14). The results disclosed that the IRSA accord, The Indus Water Treaty, Treaty of Mahakali, Treaty on Sharing of Ganges Water, National Water Policy of Bangladesh, and Water Resource Policy of Nepal did not contemplate the climate change under their provision (Figures 4.26-28) which intensify the impact of climate change, water scarcity, environmental concerns and vulnerability of region to climate change. The other water resource policies (Bhutan, India, Pakistan and Sri Lanka) had visualized the threat of climate change to water resources (Figure 4.28) and struggling to adapt and mitigate the impact of climate on water resources.

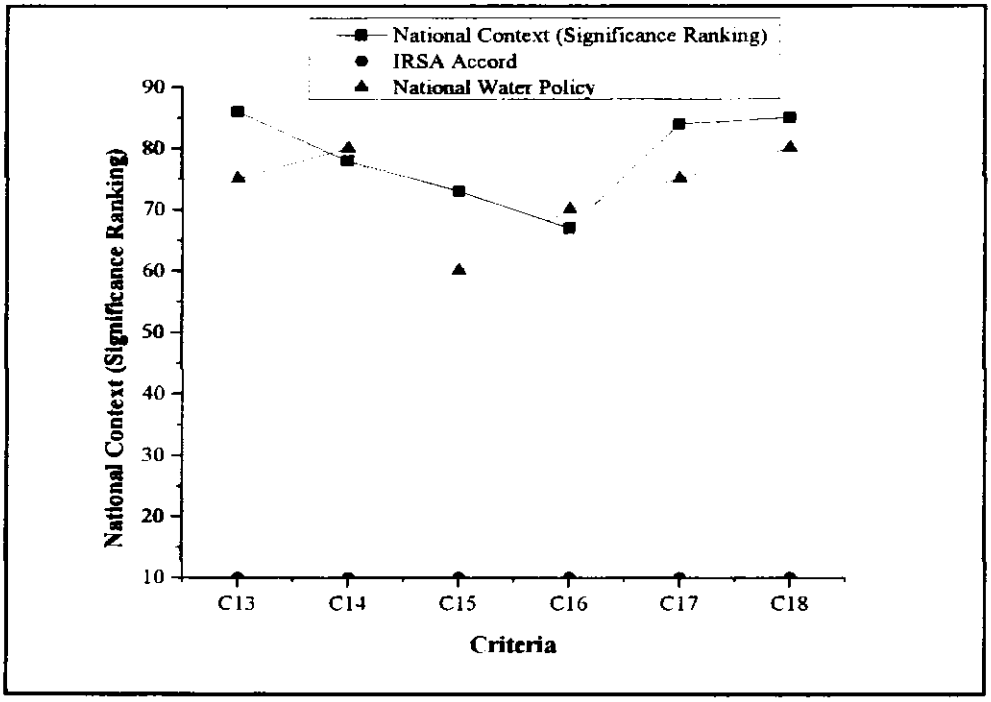

Figure 4.26 Ranking of environmental criteria in water policy and accord in Pakistan

The part 4 (protection and preservation of ecosystem) under article 20 (protection and preservation), article 22 (introduction of new species) and article 23 (protection of marine environment) of Convention on the Law of the Non-navigational Uses of the International Watercourses commenced for conservation of ecosystem (UN, 2014). The

effective water policy covering ecosystem conservation is key to environmental security and sustainable development (Singh, 2017). The experts recognized relationship between ecosystem and water policy. They attributed significance ranking to effects on ecosystem (C15) in national context (73) and regional context (72). The results exhibited the IRSA accord, all regional treaties, water resources policies of Nepal and Sri Lanka did not recognize the services and effects on ecosystems (Figures 4.26-28). This approach fosters the exploitation, devalues the ecosystem and its services as well as threatened environmental security. However, the existing ranking demonstrated that other water policies in the conceded the significance of ecosystems and their services (Figure 4.28), which will eventually play positive role in environmental sustainability.

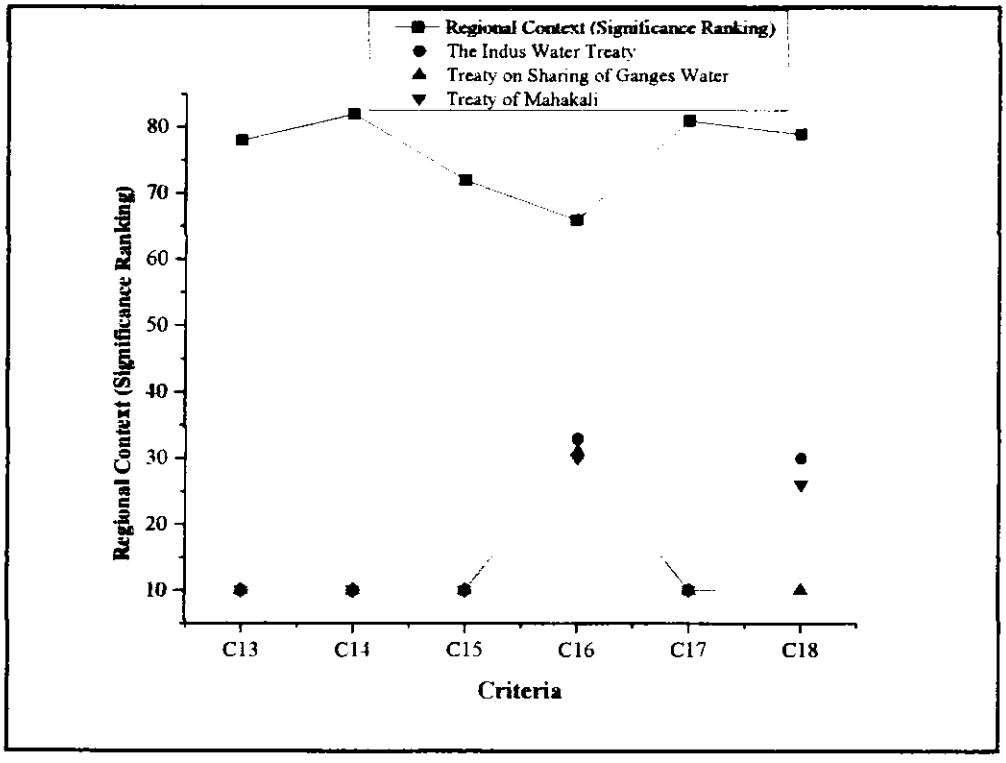

Figure 4.27 Ranking of environmental criteria in regional water treaties

The experts apprehend the SDGs (C16) as a key pillar in water policies and planning to attain sustainable development, water and environmental security. They ranked significance to SDGs in national context (66) and regional context (67). The existing ranking represented that IRSA accord did not consider SDGs, regional water treaties and water policies of Bangladesh, Nepal and Sri Lanka ponder partially SDGs while other water policies (Bhutan, India and Pakistan) mediated SDGs in terms of accessibility, affordability and integrated water resource management (Figures 4.26-28 and Annexure 2). The experts granted exceptional significance to water resource depletion and scarcity (C17) in both

national and regional context. The existing ranking reflected that IRSA accord and regional water treaties did discuss the water scarcity and depletion (Figures 4.26 and 4.27), hence, pregnant with regional water conflicts, tension and environmental insecurity. However, all water policies in the region except water resource policy of Nepal considered the water scarcity and depletion as challenge to water and environmental security (Figure 4.28).

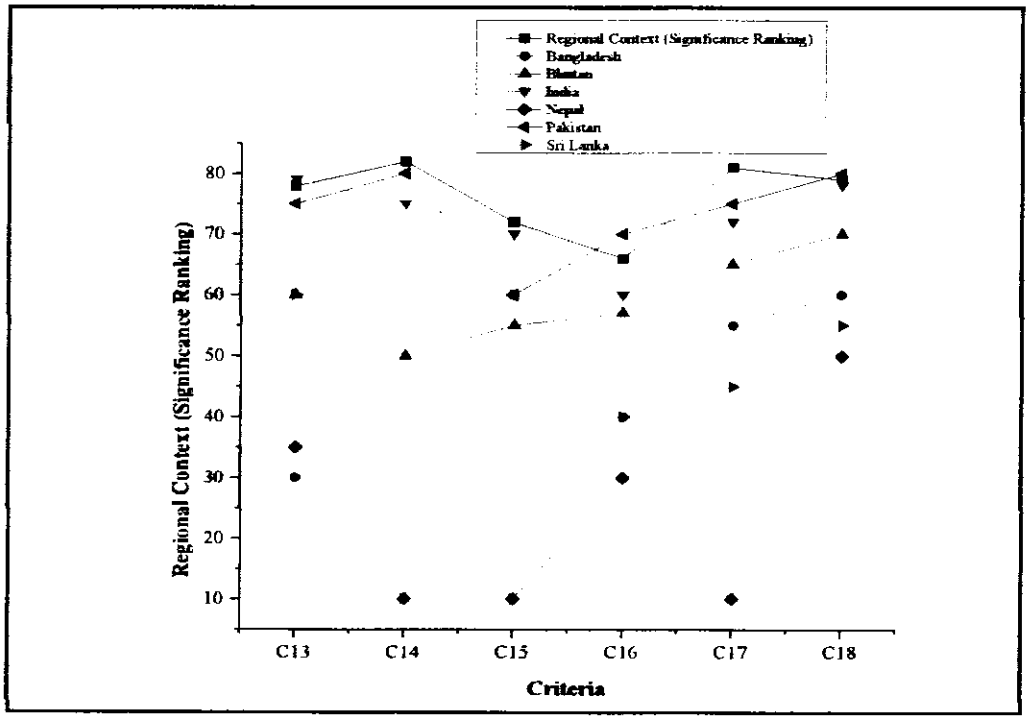

Figure 4.28 Ranking of environmental criteria in water policies in the region

The article 9 and 10 (monitoring and prevention of pollution) of international water law and article 21 (prevention, reduction and control of pollution) of Convention on the Law of the Non-navigational Uses of the International Watercourses clearly stated that basin states shall put efforts to prevent, monitor and control the pollution (ILA, 1967; UN, 2014) The water shortage, low availability, uneven distribution of water resources, environmental insecurity and fragile water ecology hampers the need of water conservation. The experts revealed the significance ranking to water conservation (C18) in national (85) and regional (79) context. The results expressed that IRSA accord and regional water treaties exhibited merely consider the water conservation (Figures 4.26 and 4.27). The modest attention to water conservation likely to increase use and trans boundary pollution in addition with damage to the environment of low riparian states. The South Asian countries had pondered conservation in their water policies (Figure 4.28). They are intended to conserve water through increase in storage capacity, efficient use, water cycling, pollution prevention, water and waste water treatment.

The results indicated the strong positive Pearson correlation in National Water Policy of Pakistan between significance ranking and existing ranking of environmental criteria (Table 4.7). The Indus Water Treaty had represented negative moderate Pearson correlation while Treaty on Sharing of Ganges Water and Treaty of Mahakali had deposed negative strong Pearson correlation between significance ranking and existing ranking of environmental criteria (Table 4.8). The national water policies of India and Pakistan had rendered strong correlation. The correlation was observed weak in water policies of Bangladesh (negative) and Bhutan as well as very weak in policies of Nepal and Sri Lanka (Table 4.9).

The environment, ecosystem services, biodiversity, health of water bodies and public health might be crumbled due to water scarcity and insecurity. Therefore, environmental aspects must be reckoned into water policy for environmental security and sustainable development. However, the relationship between environmental aspects and water security in policies ought to value the environment, visualize scantiness and redefine the priorities in both national and regional context.

4.2.4. The evaluation of social criteria

The social dimensions of water policy cover social acceptance, equity, benefits, employment, accessible and affordable supply (Calvo-Mendieta *et al.*, 2017). The experts dispensed significance ranking to social acceptance and benefits (C19) in national (74) and regional (70) context. The results had expressed that IRSA accord and regional water treaties did not muse social acceptance and benefits (Figure 4.29 and 4.30). However, all water policies in the region entertained social acceptance and benefits (Figure 4.31) which might enhance their credibility.

The infrastructure development, dams, hydropower, water treatment, water distribution and supply creates plenty of job opportunities. The experts also consider water source management a penitential field for employment opportunities, emphasized to deem this criterion in water policy, as it will intensify the value of water resources. They rated to esteem employment opportunities (C20) in national and regional water policies and planning. The results pointed out that water accord, regional treaties and all water policies in the region did not employment opportunities (Figures 4.29-31 and Annexure 2). This indicated the less attention to vital social criterion which might devalue the water resources,

decrease ownership, metamorphize sustainable development and threatened environmental security.

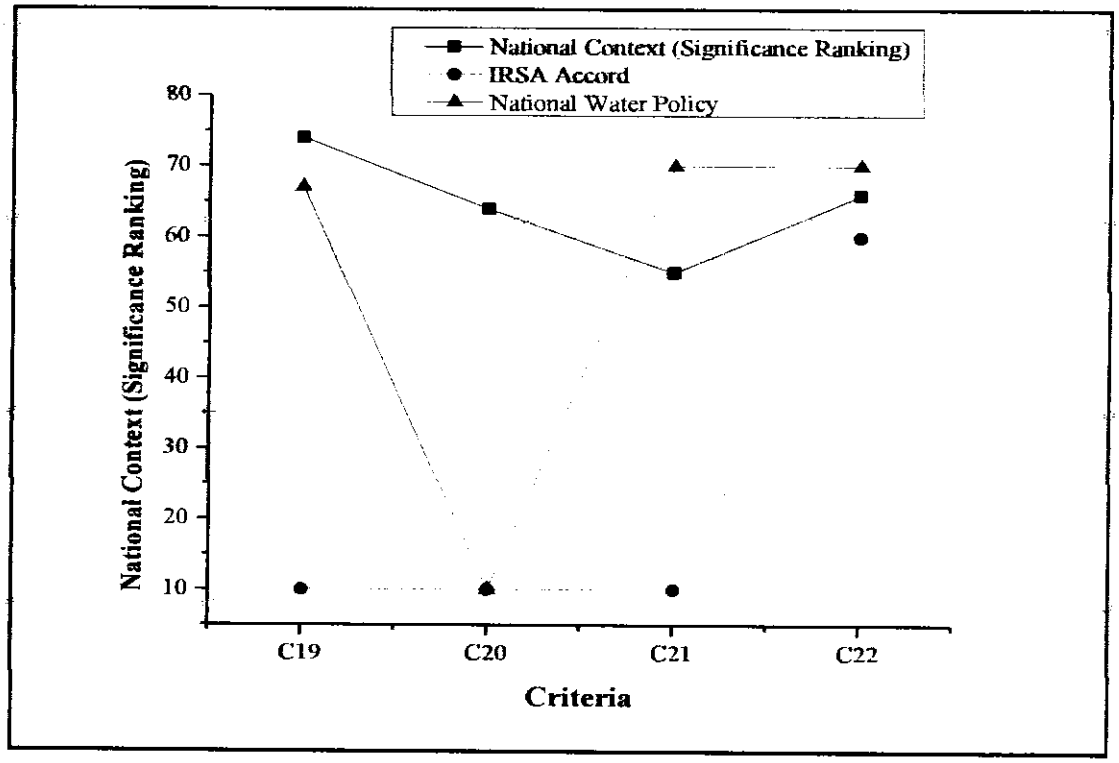

Figure 4.29 Ranking of social criteria in water policy and accord in Pakistan

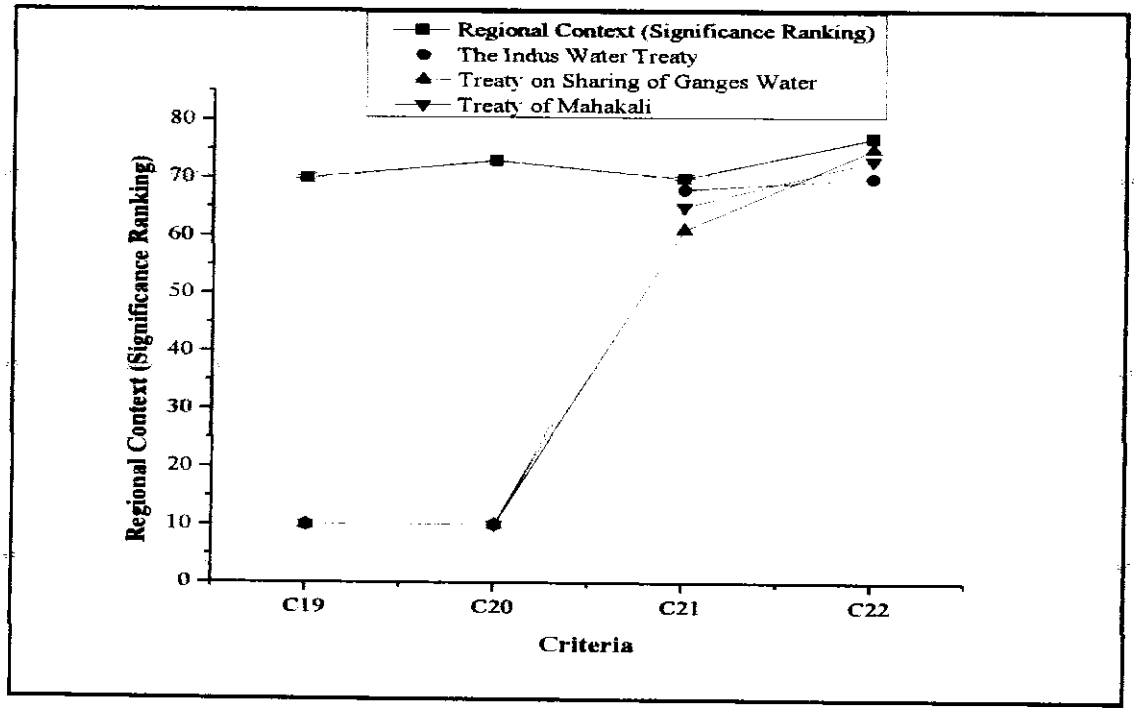

Figure 4.30 Ranking of social criteria in regional water treaties

The experts accredited significance ranking to technical human resource capacity (C21) in national (65) and regional (70) context. It is evident from the results that National Water Policy of Pakistan, regional water treaties and water policies in had considered the lack of technical human resource capacity (Figures 4.29-31). They primarily focused on the institutional capacity building. There is need to focus on capacity building of all stakeholders for sustainable use of water. The incorporation of social and religious value lead to more effective water resource management and environmental sustainability. The experts urged to moot the sustainable water supply in water resource policies. They administered significance ranking of 66 in national and 77 in regional context to sustainable water supply (C22). The existing ranking of IRSA accord, regional water treaties and policies had expressed the consideration of sustainable water supply and challenges to secure it (Figures 4.29-31). Contemporary, all South Asia countries are fail to secure sustainable water supply at grassroots level which are posing adverse effects on public health, ecosystem and environment.

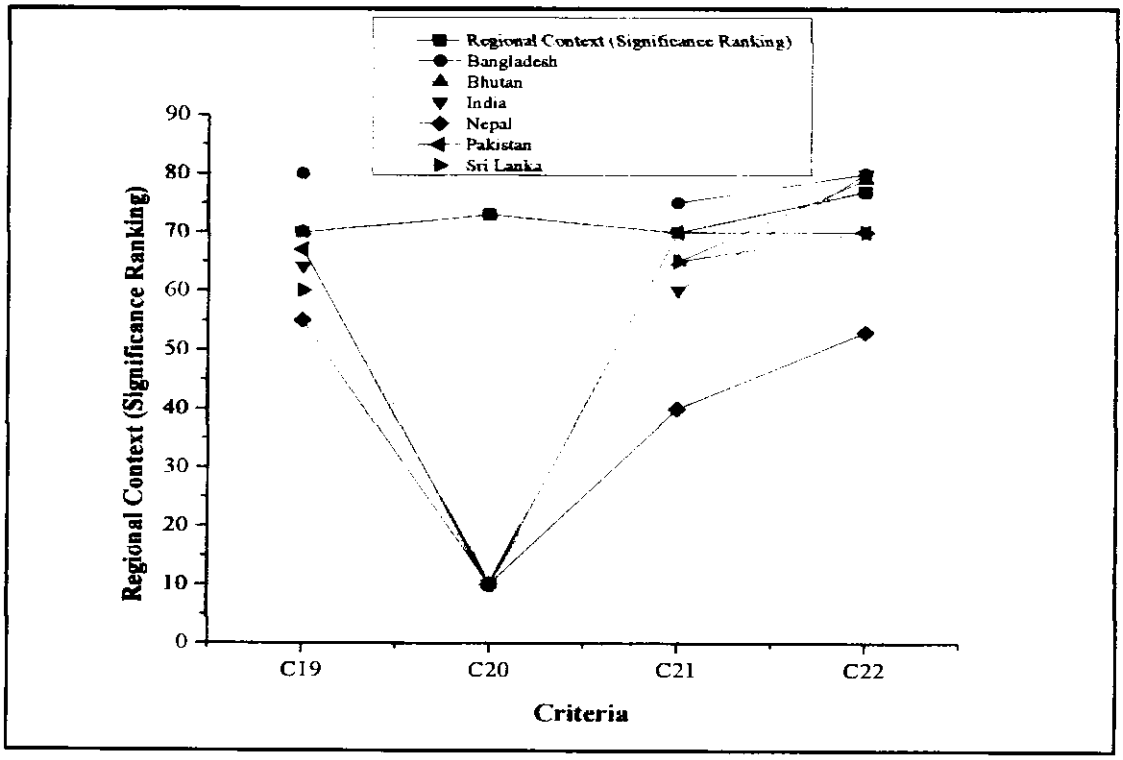

Figure 4.31 Ranking of social criteria in water policies in the region

The results had indicated positive very weaker Pearson correlation between significance ranking and existing ranking of social criteria in national context (Table 4.7). The regional water treaties demonstrated moderate positive Pearson correlation between significance ranking and existing ranking of social criteria (Table 4.8). The regional water

policies expressed very weaker Pearson correlation between significance ranking and existing ranking of social criteria (Table 4.9). The social criteria are important drivers to environmental and water conservation as well as legitimatization of water resource policy at grassroots level. There is need to rationalize the social criteria with public expectations and attributes of environmental sustainability in both national and regional context.

4.2.5. The evaluation of political criteria

The political aspects in water policies consist of will, preferences, fairness, rights, cooperation, data exchange, and dispute settlement mechanism. The experts awarded outstanding significance (more than 80) to political will (C23) in both national and regional context. The results demonstrated the documentation of political will in all accords, treaties and policies (Figures 4.32-34 and Annexure 2). But, the experts pointed the dearth of political will and commitment in the actions and efforts of all regional governments. They argued that there is no significant increase in the population securing access to clean water and control of pollution in last decade in the South Asian region.

The international water law (The Helsinki Rules 1966 (Article 4, Chapter 2)) and Convention on the Law of the Non-navigational Uses of the International Watercourses 1997 (Article 5, Part II), refers the equitable water apportionment and share as a central principle to assure well-being and environmental security among water basin states (ILA, 1967; UN, 2014; McIntyre, 2017). The experts ranked the significance of 79 and 82 to fairness and equity (C24) in national and regional context respectively. The results confirmed the consideration equity and fairness in IRSA accord, regional water treaties, and water policies in the region (Figure 4.32-34). However, the experts demonstrated that water conflicts on water rights and individual share in both national (inter-provinces) and regional (inter-states) context raising questions on the equity and fairness documented in accord, treaties and policies.

They designated significance ranking to preferences (C25) in national (74) and regional (75) context. The results revealed that IRSA accord and the Indus Water Treaty prefer economic and political dimensions. The Treaty of Mahakali and Treaty on Sharing of Ganges Water prefer economic, political and environmental dimensions. However, the water policies in the region prefer political, economic, technical, environmental and social aspects (Figures 4.32-34). The climate change, variation in precipitation and temperature cycles are inducing unpredictable spatial and temporal changes. The users are altering water

resources which intensify the impacts of climate change and mutates the availability, quality, quantity for other users and create conflicts. The article 29 (establishment of joint agency/commission) and chapter 6 (procedure for prevention of disputes) of The Helsinki Rules 1966 and article 8 (joint mechanism), and part 4 (planned) of Convention on the Law of the Non-navigational Uses of the International Watercourses, provides guidelines for cooperation between riparian states (ILA, 1967; UN, 2014). The experts allotted significance ranking to cooperation (26) in national (74) and regional context (75). The results revealed that IRSA accord, regional water treaties and water policies demonstrated the cooperation between users (Figures 4.32-34). The conflict between provinces of Pakistan (Sindh and Punjab) and some states of India on water had historical roots from British Rule on India. As discussed above, their lack of cooperation on trans boundary rivers in South Asia and causing conflicts. The main factors behind conflicts particularly between India and Pakistan are lack trust and political interests. The cooperation between Bangladesh, India and Nepal is comparatively better than India and Pakistan. The lack of cooperation is threatening regional and environmental security. There is need to consider water as basic human right and commodity beyond politics for long-term cooperation and environmental sustainability.

The article 29 (establishment of joint agency/commission) of The Helsinki Rules 1966 and article 8 (joint mechanism), 24 (management of water resources) and 25 (regulations of water resources) of Convention on the Law of the Non-navigational Uses of the International Watercourses, mandated the establishment of commission for enforcement of treaties (ILA, 1967; UN, 2014). The experts accredited significance ranking (70) to enforcement capacity (C27) in both national and regional context. They assigned significance to commission (C28) in national (67) and regional (74) context. It is notable to mention that all basins states had established commissions at both national and regional levels (Figures 4.32-34). The regional commissions are functional but geopolitical rifts, lack of technical human resources and financial constraints in the region are affecting their effectiveness and dispute settlement capacity. The delay in conflicts settlement is nurturing the national and environmental insecurity. The South Asian countries had also established commissions, ministries and relevant department for water resource management. Further, environmental protection departments under ministries of environment or climate change are monitoring the water pollution and impacts of climate change. However, the institutions

are not producing effective results due poor to governance, inadequate procedure, lack of human, technical and financial resources.

The international water law (The Helsinki Rules 1966 (Article 8)) and Convention on the Law of the Non-navigational Uses of the International Watercourses, (Article 9 and 11-14) addressed the exchange of data and response to notification by co-riparian states (ILA, 1967; UN, 2014). The experts also consider exchange of data as mean of trust, confidence and conflict control. They conferred the significance ranking of 68 and 64 to data sharing (C29) in national and regional context respectively. The results reflected that the IRSA accord, regional water treaties and water policies in region comprehended the exchange of data (Figure 4.32-34). As mentioned above late sharing of information between India and Pakistan on various projects augmented the conflict. Furthermore, late information sharing affects the prior planning to manage environment and ecosystems in case extreme weather events.

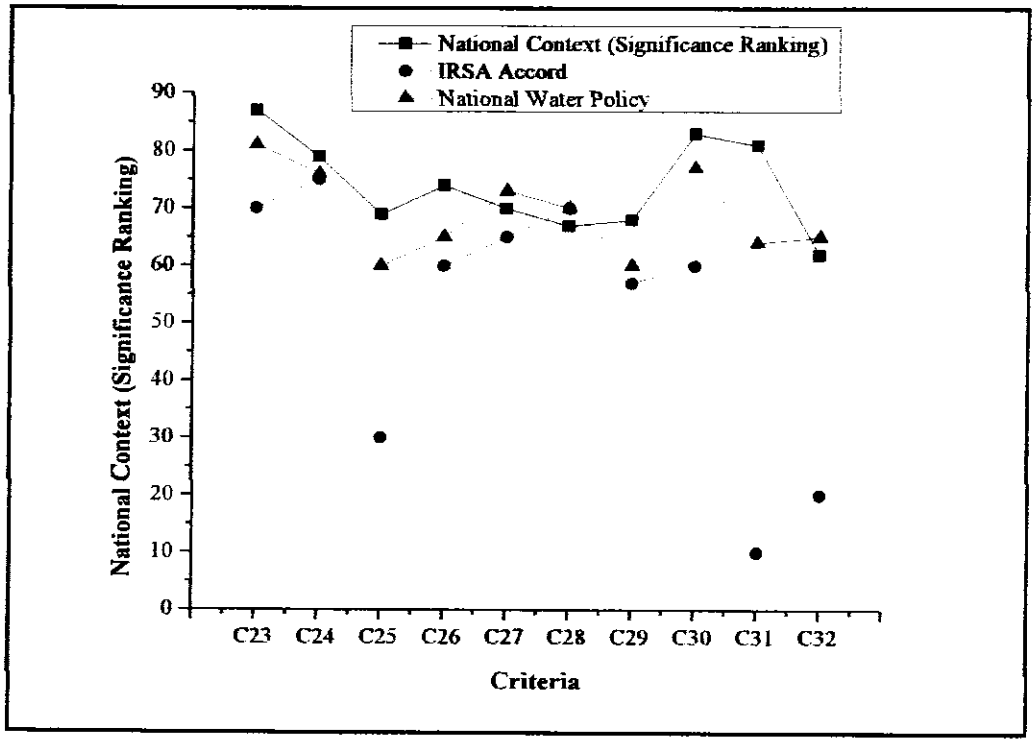

Figure 4.32 Ranking of political criteria in water policy and accord in Pakistan

The Helsinki Rules 1966 (article 4 (apportionment), article 5 (criteria for determination of equitable share (did not cover use for environment)) and article 7 (not use the water of riparian)) and Convention on the Law of the Non-navigational Uses of the International Watercourses, (article 5 (equitable use of water) article 6 (factors in deciding equitable share) and 32 (no discrimination in water use)) covers allocation of water rights (ILA, 1967; UN, 2014). The experts conceived water rights a crucial element for water

resources management and policy. They assigned a prodigious significance ranking to water rights (C30) in both national regional context. The results had expressed the consideration of water rights in IRSA accord, regional treaties and policies (Figures 4.32-34). The states own the water rights in South Asia, the royal or federal government allocate the water apportionment to provinces and users. As discussed above in water appointment and flow variability in technical, there is need to revisit water apportionment criteria in the IRSA accord, and the Indus Water Treaty.

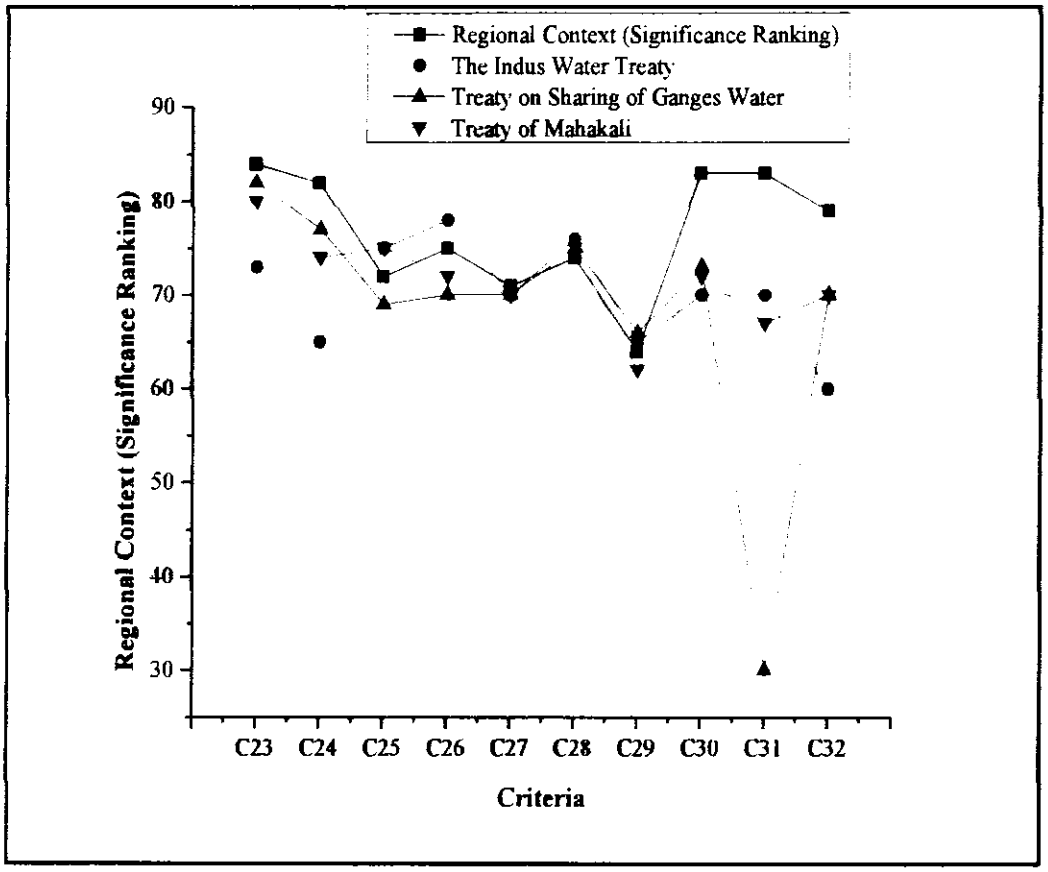

Figure 4.33 Ranking of political criteria in regional water treaties

The article 11 (negotiation and diplomacy in case of violation), and chapter VI; procedures for prevention and dispute settlement (article 26 (prevention of dispute), article 27 (involvement of United Nations), article 32 (involvement of third party), article 34 (involvement of International Court of Justice)) of the Helsinki Rules 1966 and article 3 (engagement in agreement) and article 33 (settlement of dispute) of Convention on the Law of the Non-navigational Uses of the International Watercourses provides comprehensive mechanism to settle disputes on international water resources (ILA, 1967; UN, 2014). The experts believe to settle regional water conflicts through negotiation and diplomacy. The granted an exceptional significance to negotiation and diplomacy (C31).

The existing ranking had shown that regional water treatises and water policies in the region except IRSA accord had recognized the diplomacy and negotiation as a potential tool to settle dispute (Figures 4.32-34). However, the geopolitical politics and tension between India and Pakistan had slowed down the process of negotiations and diplomacy.

The Helsinki Rules 1966 deals only surface water and did not include water for environmental and ecosystem. While the UN convention provides mechanism for both surface and ground water management. The experts suggested to prefers international water laws in agreements, accords or treaties than water policies. They attributed the significance ranking (79) to international law (C32). The results explored that the Indus Water Treaties was based on old rules of water sharing due to its formulation and implementation before the both international laws. However, this treaty was found more closes to The Helsinki Rules 1966. The Treat of Mahakali and Treaty on Sharing of Ganges Water were adhering the guidelines of the UN convention and established more cooperation. The water policies in the region are also following the directions of the UN convention on issues like water apportionment, rights and dispute settlement.

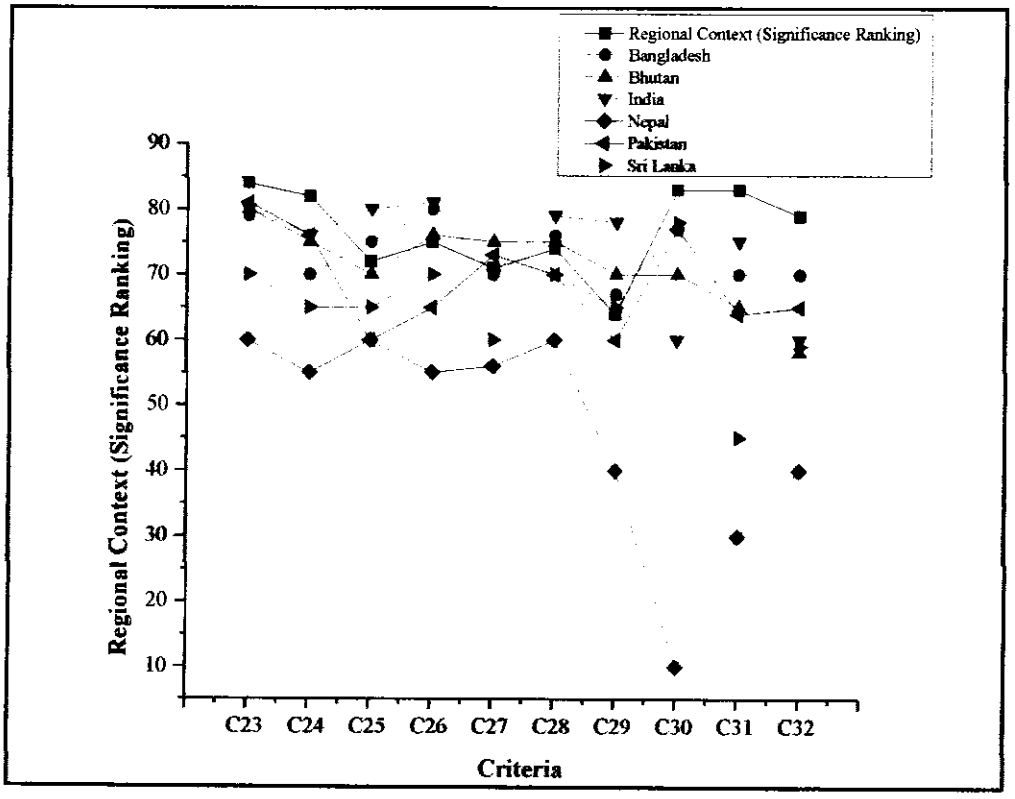

Figure 4.34 The ranking of political criteria in water policies in the region

The results had exhibited sundry Pearson correlation between significance ranking and existing ranking in IRSA accord (0.25), The Indus Water Treaty (-0.05), Treaty of Mahakali (-0.07), Treaty on sharing of Ganges Water (0.51), National Water Policy of

Bangladesh (-0.01), Bhutan Water Resource Policy (0.1), National Water Policy of India (-0.4), Water Resources Management Policy of Nepal (-0.3), National Water Policy of Pakistan (0.4), and National Policy on Protection, Conservation of Water Resources, their Catchments and Reservations in Sri Lanka (0.1) (Table 4.7-9). The political criteria in national and regional context is illustrated in figures 13-15.

The political aspects balance economic, social and environmental aspects in water resource management and planning. The political aspects govern priorities, preferences, fairness, equity, cooperation, stakeholder's engagement, implementation of treaties, policies and procedures. The current scenario of water resource management in South Asia needs to revisit political dimensions, shift the management paradigm to sustainability and conformity with technical, economic, social and environmental aspects.

4.2.6. Discussions

The technical criteria in planning implicitly promotes efficiency, equitable allocation, environmental security and integrated water resource management (Woodhouse and Muller, 2017). According to Kotir *et al.* (2017), water availability and its assessment is indispensable for biodiversity, trophic interaction of terrestrial food web, hydropower development, water use, supply, distribution, allocation access and ecosystem sustainability. The Hindu Kush-Himalayan rivers and their tributaries are providing ecosystem services as well fresh water in South Asia (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka) (Rasul, 2010; Tiwari and Joshi, 2012). The Ganges, Indus and Brahmaputra rivers are supporting agriculture, industry, environment, fisheries and hydropower development in the region. The Indus River Basin Irrigation System (IRBIS) irrigates about 14.3 million hectors of farmland (76% cultivated area) meets 170 BCM withdrawal per annum and provides 80% of food grains in Pakistan (GoP, 2010b). The Ganges-Yamuna river system provides 100 BCM water per year for irrigation, fresh water to half population of Bangladesh and India (60% of Indian irrigated area) as well as entire population of Nepal (National Ganga River Basin Authority, 2011). The Brahmaputra and its tributaries upholds 1.4 BCM of water per year to Bangladesh, Bhutan and India along with 5 BCM water per year to Northern Afghanistan (NAS, 2012). Bajracharya and Shrestha, (2011) reported 54000 glaciers, covering about 60000 km^2 area (30% of global glaciated mountains) in Hindu Kush-Himalaya, 27000 km^2 area of stored ice, 248 MAF regional water reservoir capacity and three distinct rainfall systems

(Southwestern monsoon, northwestern monsoon and western weather system in Pakistan). Hanif, (2014) pointed out 772 MAF water withdrawal per year and 90% of water supplies are consumed for domestic, agriculture, industry and other purposes. The region requires 1166 MAF water to grow major 8 crops in 204.8 million ha cropped area. An infographic of water profile of South Asia is shown in figure 35. The reliability is defined in three dimensions (policy option, optimizing water system and contingent valuation) for judicious decisions, appropriate technical aspect (efficient technology or service), financial aspects to maximize socioeconomic benefits and protect environment (Griffin and Mjelde, 2000; Bozorg-Haddad *et al.,* (2017). Griffin and Mjelde, (2000) assessed reliability in policy options adjusted the long-run water supply, manage the short supply of water during water shortfall, administer long-term demand and reduce the demand during shortfall. The optimization of water systems urge to dispense energy, water supply, price and excessive demand. The contingent valuation foresees latent water shortfall, encounter the frequency, duration and strength of shortfall. Safavi *et al.,* (2016) refers reliability as a pivotal to sustainability and credible water policy and planning. The rivers flow downhill across the provinces and states, offering an opportunity to sustain development and environment. Ruhl, (2017) defines apportionment refers as a quantity of water that must flow downhill across lines and must be equitable based on flow variability in a decree at national or regional level. Furthermore, the water allocation ought to consider ecosystems and their services in low riparian areas (Ruhl, 2017). The major rivers emanate from Himalayas are nurturing edibles and livelihood in water-stressed south Asia across the borders (Hassan *et al.,* 2017). Hanasz, (2017) extended monitoring and metering to navigation of water flow and monitoring of water pollution. It is important to monitor the water resources for positive interaction and cooperation among riparian communities. The water is scarce resource and branding every drop of water worthful as well as oblige the water resources management in a sustainable way (Pisaniello and Tingey-Holyoak, 2017).

The research studies refer to store water in the form of dams for reliability, shared fairly, equitable use in industry, agriculture, environment, domestic, commercial and hydropower development (Longo and Cummings, 2013; Pisaniello and Tingey-Holyoak, 2017). Spalding-Fecher *et al.* (2017) recognized hydropower as low carbon, cheaper energy resource, and hamper the climate change mitigation commitments towards international community as well as agreements like Paris Agreement. The exploration of hydropower for multiple purpose (industrial, residential and commercial) imbibes comprehensive water

resource management and policy. It clinches an opportunity to energy security, reliability, efficiency, accessibility, environmental protection and economic development (Danish *et al.*, 2017). Meanwhile, dams and hydropower development ensures various conflicts between states and socio-economic impacts due to valorization of land, water and environment (Hess and Fenrich, 2017). Consequently, it is a remarkable criterion in water policy and planning because of renewable energy source, substitute to fossil fuel and valuable economics (Nieminen *et al.*, 2017). The expression of economic criteria in policy ensure environmental conservation, resilience, cultural benefits and economic sustainability (Kaine *et al.*, 2017). The water availability, its demand and use is attracting attention of global leaders and decision makers due to rising global risk of water crises in Africa and South Asia over the next decade (Grafton, 2017). The global water extraction become tripled from 1960-2010 due to increasing demand. If same pattern of withdrawal continues, further 50% upsurge (4000 km^3 to 6000 km^3) is projected by 2100 (Wada and Bierkens, 2014). Pfister *et al.* (2017) considered importance of water demand and uses in water resource policy and planning due to substantial damage to environment, public health, economy in case of scarcity. Furthermore, water is global resource and virtually require demand and supply balance in various sectors (agriculture, industry, commercial, domestic and environment) for water and environmental security (Hoekstra, 2016). Weiss, (2017) recognized income per capita and expanded productivity as prominent features of twentieth-century economic transformation. Meanwhile, accentuates on sustainable management of scarce natural resources have been increased to conserve environment. The recognition of measurable economic values and valuable ecosystem services revisit the sustainable management of natural resources. The efficient use of natural resources is measured in terms of income generation. Njiraini *et al.* (2017) acknowledged water an economic good, contemporary use of every drop of water should contribute to economy. The incentives and compensations on improved water management practices aspires the long-term compatibility of water policy with choice of internal power dynamics, local water resource managers and community (Kovacs *et al.*, 2016). Vogl *et al.* (2017) divulged incentives and compensations harmonize the implementation of policy, support of institutional goals, cost, benefits, stewardship and equitable distribution of water among various sectors and stakeholders. The water resource policies which are offering compensation and incentives to all actors (individuals, municipalities, and corporation) secure stewardship and more benefits (Vogl *et al.*, 2017). Water sustains human livelihood,

ecosystem, agriculture, economy and social development at regional and global level. Besides, a huge quantity of water lost due to evapotranspiration, inefficient use and flow directly into sea (low storage capacity). Jia *et al.* (2017) highlighted billion dollars loss, economic damage, water scarcity and environmental insecurity. The administrative, operation and maintenance cost requires financing for long-term viability and sustainability of water resources. Slavíková *et al.* (2017) included investment for new dams, cost of infrastructure, abstraction of ground water, supply cost, waste water disposal and treatment in administrative cost. Traditionally, cost recovery is limited to supply and sanitation services.

According to OECD, cost can be recuperated at lowest rate by incorporating economic, social, environmental, climatic and geographic conditions. Many countries had introduced water pricing, polluter pay principle and taxes for cost recovery. It is an essence to integrate relevant costs, financing and recovery with public policy like water resources policy and planning (OECD, 2010). The change in water availability likely to affect human health, scarcity, development and environment (Karabulut *et al.*, 2017). The article 6 (factors in deciding equitable share) of Convention on the Law of the Non-navigational Uses of the International Watercourses oblige water for environment and ecosystem to sustain life (UN, 2014). Water resources vulnerability refers to functional complexities of water resources systems in socioeconomic and environmental context, confronted by flaws and weaknesses (Huang and Cai, 2009). Cai *et al.* (2017) measures vulnerability in terms of potential threats and sensitivity of the water resources. Greve *et al.* (2017) reported that many regions (Asia, Eastern Europe, and Sub-Sharan Africa) and large river basins (Yangtze, Niger and Indus) are impended by vulnerability and uncertainty, complicated decision-making, challenging improvements, degrading basins and environment. Cai *et al.* (2017) also stressed to speculate water resource vulnerability in the policy for sustainable functioning of water resources and environment. Asian water resources are sustained by more than 46,000 glaciers of Hindu-Kush Himalaya (HKH) (Qiu, 2010). According to Yao *et al.* (2012), the HKH region has experienced temperature rise more than global average which has conferred divesting impacts on environment particularly negative mass balance, glacial melting and water scarcity. The climate change has inflicted natural disasters (extreme rainfall and drought), trans boundary water issues, conflicts, economic loss, glacier melting, reduction in available water, demographic impacts, social, environmental and water insecurity in South Asia (Wilson *et al.*, 2017; Gerlitz *et al.*, 2017).

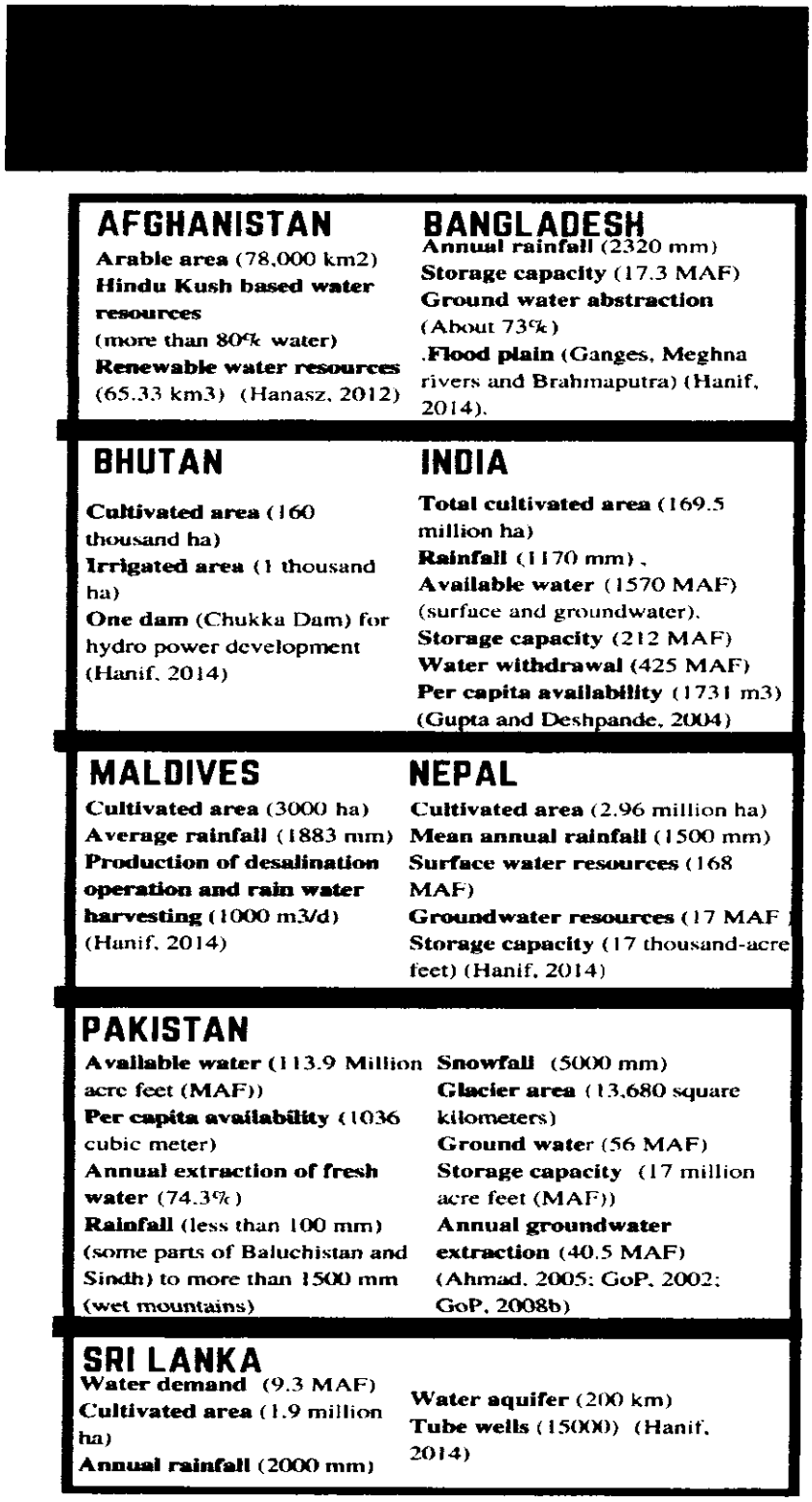

Figure 4.35 Infographic of water profile of South Asia

The vulnerability and environmental insecurity has been triggered in Eastern Brahmaputra (Bangladesh and India), Koshi (Nepal) and Indus (Pakistan) rivers due to climate change (Gerlitz *et al.*, 2017). Rasul, (2014) assessed high risk to low riparian (more than 1.3 billion people) due to their reliance on river network for fresh water, agriculture,

industry, hydropower and environmental sustainability. The cross-sectoral integration of climate change and water resources policy can confront the impacts of climate change on water resources (Francés *et al.,* 2017). The environment and ecosystems are imperiled due to current aggravated situation of water bodies. The water of many rivers including Colorado, Murry-Darling, Yellow, Rio Grande and the Indus hardly reach the sea (Singh, 2017). Many animals and plant species are becoming endangered and facing decline in population. According to World Wildlife Fund for Nature, 30% fish stocks and 50% fresh water of wetland have been decreased in last century (WWF, 2015). Meanwhile, the increasing salt content in water bodies also damaging ecosystems (UN, 2014). The Untied Nations set the Sustainable Development Goals (SDGs) as a global agenda (17 goals, 169 targets and 230 indicators) for sustainable development by 2030. The SDGs aims to set achievable targets to kindle actions for well-being of humanity and planet (UN, 2015). They are representing collective, systematic approach to interlink and integrate economic, social and environmental aspects to ensure sustainable development (Barbier and Burgess, 2017). The goal 6 (clean water and sanitation) particularly focus on sustainable management of water, provision of clean water, and sanitation for all (UN, 2015). The South Asian countries had adopted the SDGs, meanwhile the government of Pakistan has declared SDGs as Pakistan Development Goals (PDGs). The SDGs provides imperative directions to conceptualize sustainable development in policies and decision-making (Reyers *et al.,* 2017). Liu *et al.* (2017) recognized water scarcity and depletion as a duress to socio-economic development as well as threat to livelihood and environment worldwide. It has affected the water availability, use, environmental flow, biodiversity and ecosystem. The water scarcity and depletion of water resources in addition with climate change, thereby enhanced competition among various sectors over natural resources, kindle tension and conflict between upper and lower riparian as well as threatened trade, economy and environmental security (Feitelson and Tubi, 2017). It has attracted the environmentalists, social scientists, economists and hydrologists as an important criterion for water policies at local, national, regional and global level (Liu *et al.,* 2017). Aprile and Fiorillo, (2017) ponder water conservation as a requisite to sustainable environment and development because of increasing water scarcity, pollution and climate change. Simha *et al.* (2017) suggested water conservation through management of demand and source side issues, reuse and pollution prevention which protects natural environment. It has established an essence to harmonize the water conservation, human interaction and environment with water

resources policy to support water resources and socio-economic development (Wang *et al.*, 2017d).

Calvo-Mendieta *et al.* (2017) declared water as a communal property (an economic, social and environmental heritage), belongs to society, basic human right, maintain lifestyle of society, contribute to national economy without appearing in national fiscal account and sustain the environment. The social criteria ascertained the holistic management of water resources and integration of water policies with national environmental and economic policy (Harmancioglu, 2017). The European Union Water Framework Directive (WFD) considers social acceptance and benefits a crucial element in water resource policy and management. It advocates direct public participation in decision-making for social acceptance and benefits. Ruiz-Villaverde and García-Rubio, (2017) dispensed many benefits of social acceptance including acceptance, equitable distribution of water resources, improvement in public awareness, better utilization of knowledge, reduced litigation, cover delays, inefficiencies, transparent decision-making and ownership of each stakeholders. The sustainable development in line with green economy facilitates the skill development and create employment opportunities through sustainable management of natural resources (Bek *et al.*, 2017). The skilled and competent employees understand the values of natural resources, use efficiently and protect the environment. Gibbs and O'Neil, (2016) identified the potential of environment-friendly strategies to promote green economic growth and green jobs. The water resources conservation and management has a potential of many employment opportunities (Fill *et al.*, 2017). It is complex to handle water resources due to involvement of technical and human interconnections. The effective management of water resources depends on how complexity is handled technically (Taylor and Sonnenfeld, 2017). Cheema and Javed, (2017) evaluated the need of technical human resource to conserve environment and water resources. The basic elements include to focus on value of resources, align policies, develop knowledge, skill and environment-friendly practices to manage water resources (Jabbour & de Sousa, 2016). However, Wei *et al.* (2017) recommends to comprehend social and religious values to develop human resource capacity for water resource management due to strong motive in behavior change. Many countries in the world are facing the challenge to provide supply in sufficient quantity and quality of water. The interruption in supply is likely to continue in unpredictable way due to increasing demand, extreme weather events, scarcity, mismanagement of resources and climate change (Bakker, 2014; Pahl-Wostl, 2015). The governments and municipalities are

striving to secure and manage water supply through millions of unsustainable groundwater pumps, more than 45,000 major dams, diversions, lakes and rivers (Postel, 2010). This over-abstraction is intimidating water resources and environment which resulting in ecological crises (Taylor and Sonnenfeld, 2017). Furthermore, goal 6 of SDGs accentuates governments to ensure clean water for all. Therefore, government are responsible to take regulatory initiatives and secure sustainable water supply.

The policy discourse of water resource management consoles technical and political aspects to ensure demand and supply (Rap, 2007; Rap and Wester, 2017). They support financial mechanism, stakeholder involvement and environmental sustainability (Kendy *et al.*, 2017). Badran, (2017) assimilates water crises with the crises of water management due to inappropriate policies and lack of political will in developing countries. Loucks, (2017) stressed on developing countries to show and generate the political will in policies and action to overcome water crises because many people in these countries are living without adequate supply of water. The fairness and equity are cardinal attributes of water treaties and policies. The fairness is the combination of principles of justice and equity (Yihdego and Rieu-Clarke, 2017). The equity confines body of rules to deal allocation, rights, share and benefits of water resources. They are emanated from international water laws, international environmental laws, and international human rights to manage water resources (McIntyre, 2017). The water policies reflect numerous preferences like indigenous values (Australia), water variability, water market and social justice in western notions (Nikolakis *et al.*, 2013; Schulz *et al.*, 2017). However, Schulz *et al.* (2017) refers to set preferences based on economic, social, environmental and political considerations to achieve environmental sustainability. Glenk and Fischer, (2010) highlights climate change mitigation, flood management, dam building, pollution prevention, water charges, stakeholder engagement and fish conservation as dominant preferences. The experts support the Schulz *et al.* (2017) conceptual framework and believe its comprehensive approach covers other two frameworks along with environmental sustainability and security. According to Petersen-Perlman *et al.* (2017), a flexible and innovative approach can manage water resources to assure cooperation between users in both local and regional context. Tropp *et al.* (2017) pertains enforcement capacity as the ability to legitimate compliance mechanism, monitor public officials, institutions, service providers and water resources against set standards, impose sanctions in case of non-compliance, and assure practicable corrective actions when required. The enforcement mechanism exhorts to

effective institutions, appropriate monitoring, effective enforcement and a clear allocation framework. The international water laws refer joint commissions, dispute settlement mechanism, involvement of third party (UN, and The World Bank) and International Court of Justice as enforcement mechanism. The ministries, commissions, agencies and departments relevant to water resources handle the issues at national level (Petersen-Perlman *et al.*, 2017). The provisions of flow variability and data sharing decreases the uncertainty and enhances the flexibility, trust and effectiveness of water treaties and accords (Milman *et al.*, 2013). De Stefano *et al.* (2017) refers data sharing and public participation as fundamental characteristics of water treaties that have corroborated effectiveness of many treaties as well as reduce conflicts. The access to clean water is a basic human right and an instrument to rationalize other human rights (UN, 2010). The water rights (ownership) and productivity are closely linked in water resource management (Suárez-Varela *et al.*, 2017). Ge *et al.* (2017) argued that fair and efficient use of water depends on the allocation of water rights at principal, national and regional level.

Diplomacy on water resources provides a mechanism to manage conflicts, negotiate the matters or treaties for allocation and management of international basins at national and regional level (Earle and Neal, 2017). Patrick *et al.* (2014) placed cross-cutting dynamic nature of water conflicts and tensions at the heart of national security, thus proximity linked to environmental security, economic development, geopolitical concerns, poverty alleviation and social issues. Water diplomacy is a dynamic process, not a one-time practice, capable of developing national or regional cooperation, and institutionalized conflict management through skill development, negotiation, involvement of professionals and stakeholders for sustainable and peaceful solutions to water rights, allocation and management (IUCN, 2014; Earle, and Neal, 2017). According to Petersen-Perlman *et al.* (2017), poorly defined water laws, customary laws and agreements have low enforcement capacity and dispute settlement mechanism. The international dispute settlement mechanism requires legal means and defined jurisdictions. The Helsinki Rules 1966 and Convention on the Law of the Non-navigational Uses of the International Watercourses provides guidelines for international water agreements and treaties for use of international basins.

4.3. Environmental security: Climate change and development

The Sustainable Development Goals (SDGs) urge the states to take urgent action to combat climate change (Goal 13) and make resilient and sustainable cities (Goal 11) (The United Nations, 2015). Similarly, the United Nations Framework Convention on Climate Change (UNFCCC) has established a global action framework on climate change to halt the increase in average global temperature below 2 °C above pre-industrial level in the form Paris Agreement (UNFCCC, 2015). Both the SDGs and Paris agreement provide a roadmap for formulation and implementation of climate policies and plans, shared targets, common responsibility, climate justice and effective actions to mitigate climate change (y de Loma-Osorio, 2017). Although, South Asian countries had established and implement climate change policies and plans (Table 4.10), Dhaka Declaration on Climate Change 2008, and Thimphu Statement on Climate Change 2010 but still they are not as palpable to cope the challenge of climate change. This study had focused to analyze the climate change policies and plans in technical, economic, environmental, social and political context to assess the gaps and threat to environmental security.

Table 4.10 Infographic of climate change related policies plans and institutional framework in South Asia

	National Capacity Needs Self-assessment for Environmental Management (NCSA). National Adaptation Programme of Actions for Climate Change (NAPA) 2009	National Environmental Protection Agency (NEPA). Ministry of Agriculture, Irrigation and Livestock (MAIL). Afghanistan National Disaster Management Authority. Ministry of Water and Energy. Department of Meteorology
	National Environmental Policy 1992 National Adaptation Programme of Actions (NAPA) 2005 Vision 2021 Bangladesh Climate Change Strategy and Action Plan 2009	Ministry of Environment and Forest National Disaster Management Council Meteorological Department
	Bhutan 2020-A vision to peace Bhutan National Adaptation Programme of Actions (NAPA) 2006 National Environment Strategy 2015	The National Environment Commission Ministry of Industry and Trade Bhutan Water Cooperation Partnership Department of Agriculture Department of Energy Department of Hydro-met services
	National Environmental Policy 2006	Ministry of Environment, Forest and Climate Change

[redacted]	National Adaptation Programme of Actions (NAPA) 2008 National Action Plan for Climate Change and Health 2016	Prime Minister's Council on Climate Change Department of Meteorology Ministry of Water Resources Ministry of Power Ministry of Agriculture and Farmers Welfare Ministry of Health
[redacted]	National Adaptation Programme of Actions (NAPA) 2007 National Sustainable Development Strategy 2009 Maldives Climate Change Policy Framework 2015 Vision 2020 Environmental Protection and Preservation Acts Third Environmental Action Plan	Ministry of Environment, Energy and Water Ministry of Economic Development and Trade
[redacted]	National Adaptation Programme of Actions (NAPA) 2010 Climate Change Policy 2011 Nepal Environmental Policy and Action Plan 1993	Ministry of Environment Climate Management Division Water and Energy Commission Ministry of Energy Ministry of Water Resources
[redacted]	National Environmental Policy 2005 Climate Change Policy 2012 Framework for the Implementation of Climate Change Policy 2014-30 The Pakistan Climate Change Act 2017 Pakistan Vision 2025	Ministry of Climate Change Provincial Environmental Protection Agencies Ministry of Water Resources Ministry of Energy Planning Commission of Pakistan Ministry of Planning, Development and Reforms Ministry of National Food Security and Research Pakistan Meteorological Department
[redacted]	National Environmental Policy 2003 The National Climate Change Adaptation Strategy for Sri Lanka 2011-16 The National Climate Change Policy of Sri Lanka 2012 National Adaptation Programme of Actions (NAPA) 2015	Climate Change Secretariat Ministry of Mahaweli Development and Environment Ministry of Power and Energy Ministry of Agriculture

4.3.1. The evaluation of technical criteria

The technical aspects comprise of vulnerability assessment, adaptive capacity, use of low carbon technology (industry, infrastructure and transport), de-carbonization of energy sector and climate change uncertainty. The experts reveal vulnerability assessment (C1) an essence to mitigate and adapt climate change as well identify threats to environment. The results revealed that the National Climate Change Policy of Pakistan and

Climate Change Framework for Implementation of Climate Change Policy had identified the agriculture, livestock, arid areas, hyper arid area, biodiversity, ecosystems, coastal areas, forestry, livelihood, public health, mountain areas, wetlands, rangelands, water and energy sectors more vulnerable to climate change. Similarly, all National Adaptation Programme of Actions and policies in the region had dispensed the vulnerability assessment (Figure 4.36) and identified vulnerable sectors in their country (Table 4.13). The comparison of available data on climate change vulnerability to various sectors in National Adaptation Programmes of Actions (GoIRA, 2009; GOB, 2005; GOB, 2009; RGOB, 2006; GOI, 2008; GoM, 2007; GoM, 2005; GoN, 2010, GoN, 2011; GoP, 2015; GOSL, 2015) is presented in table 4.13. It is notable to mention that biodiversity, ecosystems, agriculture, forests, soil, water and energy are among vulnerable sectors in all countries, which are apprehending threat to environmental security.

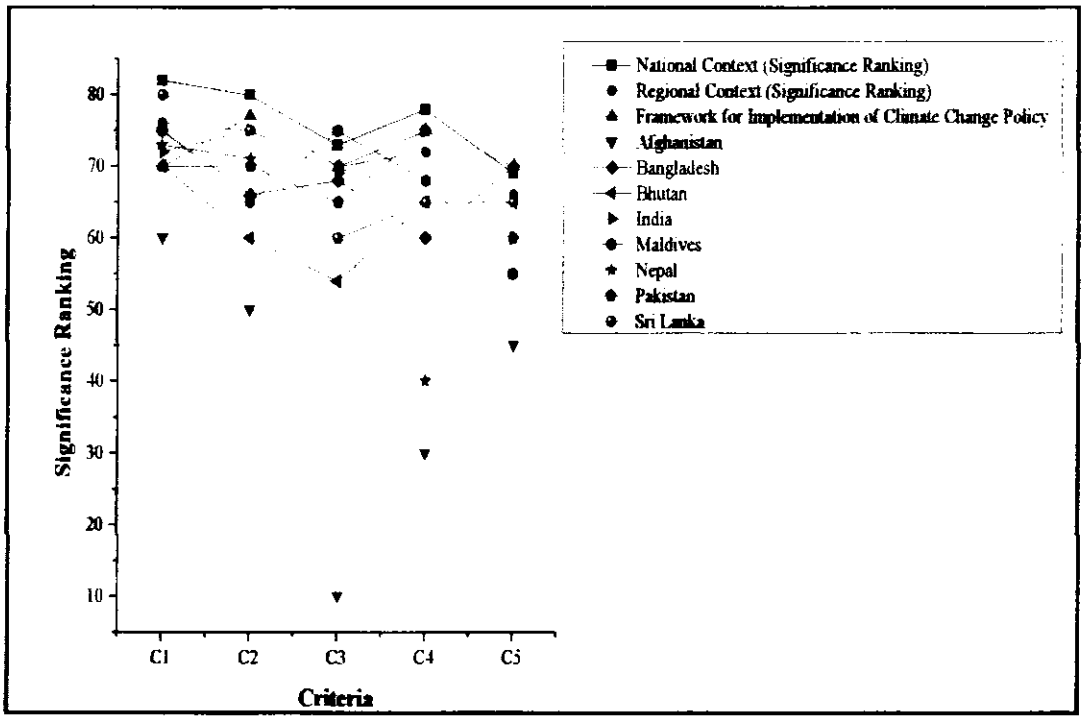

Figure 4.36 Ranking of technical criteria in climate change policies and plans in national and regional context

The experts granted the significance of 80 and 75 to mitigation, adaptation and adaptive capacity (C2) in national and regional context. The results had expressed the identification of mitigation and adaptation measures for vulnerable sectors in all policies, frameworks and national adaptation plans in region (Figure 4.36 and Annexure 3). However, all South Asian countries are struggling to adapt climate change due to lack of

data, low institutional capacity and financial concerns. The insufficient adaptive capacity is harnessing adverse impacts of climate change and environmental insecurity.

The experts supported the use of low carbon technology (C3) and decarbonization of energy sector (C4) for climate change mitigation. The results exhibited that climate change policies and plans in the region except Afghanistan had undertaken the promotion and use of low carbon technology and energy generation (Figure 4.36 and Annexure 3). Meanwhile, all countries tinted lack of domestic manufacturing, skills, financial resources, research and development as potential barriers to use low carbon technology and meet the targets of Paris agreement. Perhaps, these barriers have slackened the shifting of energy-intense system to low carbon development and mitigation to climate change.

Table 4.11 The correlation between significance ranking and existing ranking of selected criteria of climate change in national context

Criteria	National Climate Change Policy	Framework for Implementation of Climate Change Policy
Technical	0.81*	0.46
Economic	0.67	0.67
Environmental	0.50	0.52
Social	0.71	0.55
Political/Institutional	0.16	0.68

(*** p < 0.01, ** p < 0.05, *p < 0.1) (Very weak= 0.00-0.19, Weak= 0.20-0.39, Moderate= 0.40-0.59, Strong= 0.60-0.79, Very strong= 0.80-1.0)

Table 4.12 The correlation between significance ranking and existing ranking of selected criteria in climate change policies and plans in South Asia

Criteria	AFG	BGD	BTN	IND	MDV	NPL	PAK	SLK
Technical	0.44	0.12	0.25	0.85*	0.61	0.53	0.74	0.78
Economic	0.24	0.93***	0.43	0.53	0.65	0.62	0.71*	0.56
Environmental	0.36	0.35	0.67**	0.84***	0.64*	-0.20	0.58	0.54
Social	0.11	0.07	0.4	0.36	0.15	-0.01	0.50	0.38
Political	0.75	0.60	0.75*	0.56	0.5	0.83*	0.52	0.68

(*** p < 0.01, ** p < 0.05, *p < 0.1) (Very weak= 0.00-0.19, Weak= 0.20-0.39, Moderate= 0.40-0.59, Strong= 0.60-0.79, Very strong= 0.80-1.0)

The experts suggested to invoke the climate change uncertainty (C5) into their policies. The existing ranking of climate change policies and plans demonstrated that regional states had moderately consider the climate uncertainty (Figure 4.36). Although, member states assert uncertainty in their adaptation plans but their initiatives and response to cope these uncertainties were found to be insufficient e.g. most of countries in South Asia are being consistently hit by flood from decades but still are unable to reduce the damages. Therefore, more evaluation of uncertainties and futuristic approach is obligatory to adapt climate change and protect environment. The results represented positive Pearson Correlation between significance ranking and existing ranking of technical criteria in National Climate Change Policy (very strong) and Framework for Implementation of Climate Change Policy (moderate) (Table 4.11). Alike the national context, the climate change policies and plans had expressed positive Pearson Correlation between significance ranking and existing ranking of technical criteria in regional context (Table 4.12).

The climate change has invoked threat to environmental and national security across the world but the technical aspects confronts indispensable role in mitigation and adaptation. Therefore, profound attention in policies and plans is required to embark the mitigation and adaptation.

4.3.2. The evaluation of economic aspects

The cost of climate change, impact on gross domestic product (GDP), cost of low carbon technology, consumption of resources, carbon tax, incentives and subsidies are major economic aspects climate change. The experts also referred to mediate the cost of climate change (C6) and impact on GDP (C7) in both national regional context. The results had evinced that the National Change Policy and framework in Pakistan deem both criteria to a lesser extent. The framework referred the loss of more than 9.6 billion US dollars in the flood of 2010 only (GoP, 2015b). Bangladesh Climate Change Strategy and Action Plan 2009, Maldives Climate Change Policy Framework 2015 and their plans cogitated the cost of climate change. The government of Bangladesh has endured the loss of more than 10.88 billion US dollars during 1974-2007 by only flood and invested more than 10 billion US dollars in climate resilient infrastructure (GOB, 2009). The climate change has induced the cost of more than 1 billion US dollars to tourism sector and 300 million dollars combined cost during Tsunami in Maldives (GoM, 2007). However, other countries in the region undermine the cost of climate change (Figure 3). Furthermore, the climate changes policies

and plans has identified the impact of climate change on GDP except Afghanistan, India and Pakistan (less attention) (Figure 4.37 and Annexure 3).

The experts referred to behold willingness to pay (C8) in climate change policy but pointed out pathetic response in current socio-economic condition of South Asia. The results confirmed that South Asian countries merely or partially reflected the willingness to pay in their climate change policies (Figure 4.37). The experts visualized to ponder cost of low carbon technology (C9). The results had shown that the South Asian countries did not estimate the cost of low-carbon technologies and esteem low significance (Figure 4.37). However, all regional states had affirmed the lack of financial resources and looking for financial assistance from Clean Development Mechanism (CDM), Global Environment Facility (GEF), Green Climate Fund (GCF) and support under Paris agreement. However, the lack of financial resources will affect the efforts to mitigate climate change and threat the environmental security.

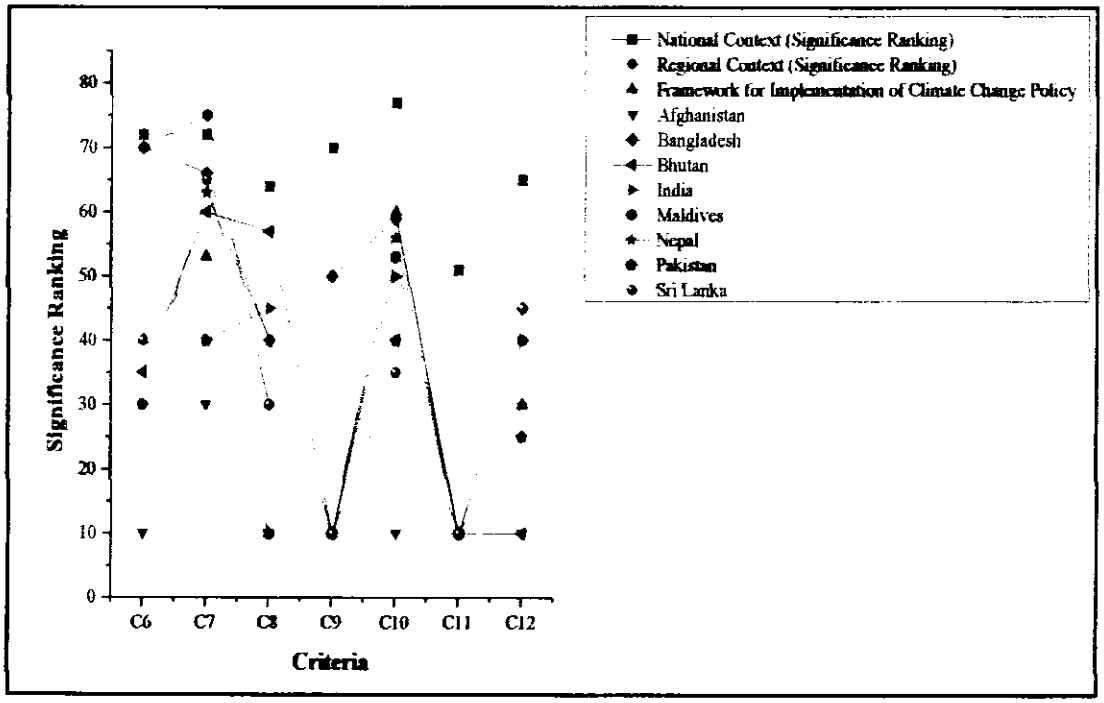

Figure 4.37 Ranking of economic criteria in climate change policies and plans in national and regional context

The experts granted significance ranking (77) to consumption pattern (C10) in both national and regional context. The results manifested that the climate change policies and plans in the region except Afghanistan had conceived the modestly (Bhutan, Pakistan and Sri Lanka) or moderately (Bangladesh, India, Maldives and Nepal) consumption pattern (Figure 4.37). The experts supported the second argument and rated low significance to

carbon tax (C11) as compared to incentives and subsidies (C12). Besides, they argued that almost 50% people in South Asia are living below poverty line and less aware about climate change, therefore, they will resist to pay carbon tax, and affected by energy prices. Meanwhile, governments are unable to rationalize redistribution of income due to fragile governance, ineffective policies and regulations. However, they suggested the phasing out of GHG emissions by introducing transition time, incentives and subsidies. The results had revealed the dearth of carbon tax but modest consideration of incentives and subsidies in climate change policies and plans in South Asia (Figure 4.37). The immaterial contemplation of both criteria will affect the implementation of policies and plans.

The results conferred diverse positive Pearson correlation between significance ranking and existing ranking of economic criteria of climate change policies and plans in both national and regional context (Table 4.11 and 4.12). Overall, the economic criteria are partially considered in climate change policies and in both national and regional context which will potentially threat their effectiveness, sustainability and environmental security.

4.3.3. The evaluation of environmental criteria

The climate change has intensify the global environmental changes including GHG emissions, rainfall, scarcity of natural resources (energy, water and food), biodiversity, habitat and ecosystems loss (Smith, 2017). The experts signaled the GHG emission as a potential threat to environmental security and connoted to insinuate GHG emissions, their abetment and global warming (C13). The results conferred the climate change policies and plans in region except Afghanistan dictated GHG emissions, temperature rise (Table 4.13), and their abatement measures (Figure 4.38 and Annexure 3). However, their effectiveness and implementation is confronting various problems including governance issues, human, technical and financial limitations.

The experts had granted high significance ranking to effects of climate change on ecosystems (C14). The results had demonstrated that the effect of climate change on ecosystem had been thoroughly addressed in all climate change policies and plans in the region (Figure 4.38). However, the implementation of mitigation and adaptation measures to hold the impact of climate change on biodiversity and ecosystems are still awaited, consistent decrease, extinction of many species and habitat loss deposed climate-induced environmental insecurity.

The experts had assigned an outstanding significance ranking to water security (C15) and energy security (C16) in climate change policies and planning in both nation and regional context. They proposed to integrate the energy, water and climate change nexus. The results exhibited the consideration of water security in climate change policies and plans in region. However, the energy security was found to be mince in climate change policies and plans in South Asia (Figure 4.38 and Annexure 3). The experts also criticized the governments in region on straggling efforts to water and energy security as presented in climate change policies and plans.

The experts valued to discuss the SDGs (C17) in climate change policies and plans. The results unfurled that all climate change policies and plans in the region except National Action Plan for Climate Change and Health 2016 of India (encompass SDGs) were implemented before SDGs. But they had esteem the urgent measures to combat climate change (Figure 4.38) because it was also part of Millennium Development Goals (MDGs). They had also focused interlinked sectors in their objectives including agriculture, energy, water, livelihood, infrastructure, biodiversity and ecosystems.

The experts dispensed high significance ranking to adjure the Paris agreement (C18) in climate change policies and plans. However, the results indicated the climate changes policies and plans in the region had partially mediated the Paris agreement except Afghanistan (did not consider) in terms global support to combat climate change (Figure 4.38), perhaps, the climate changes policies and plans in region were formulated and implemented before the Paris agreement. Furthermore, the assessment of "nationally determined contributions (NDCs)" to climate change mitigation is still awaited. This will affect the harmonization of their efforts to global mitigation of climate change.

The South Asia Cooperative Environment Programme (SACEP) is an inter-governmental organization working in collaboration with South Asian Association of Regional Cooperation (SAARC) to promote and assist the protection and management of environment in South Asia (SACEP, 2017). The SAARC has introduced SAARC Environment Action Pan 1997, Dhaka Declaration and Action Plan on Climate Change 2008, Delhi Statement on Cooperation in Environment 2010, Thimphu Statement on Climate on Climate Change 2010, SAARC Convention on Cooperation on Environment 2010 and SAARC Agreement on Rapid Response to Natural Disasters 2011 to protect environment, abate climate change and regional cooperation on environment (SAARC, 2017). The experts supported the regional environmental protection and cooperation

through SACEP and SAARC (C19). Meanwhile, they pointed out the inadequacy, low technical capacity and regional geopolitical narratives as barriers. The results revealed that the climate change policies and plans in region had imparted low significance to SACEP and SAARC initiatives (Figure 4.38). It was observed that Dhaka Declaration and Action Plan 2008 and Thimphu Statement on Climate Change are too much brief and inadequate to cope the horrendous challenge of climate change. They are unable to develop diplomatic pressure to revisit and transform them to comprehensive agreement.

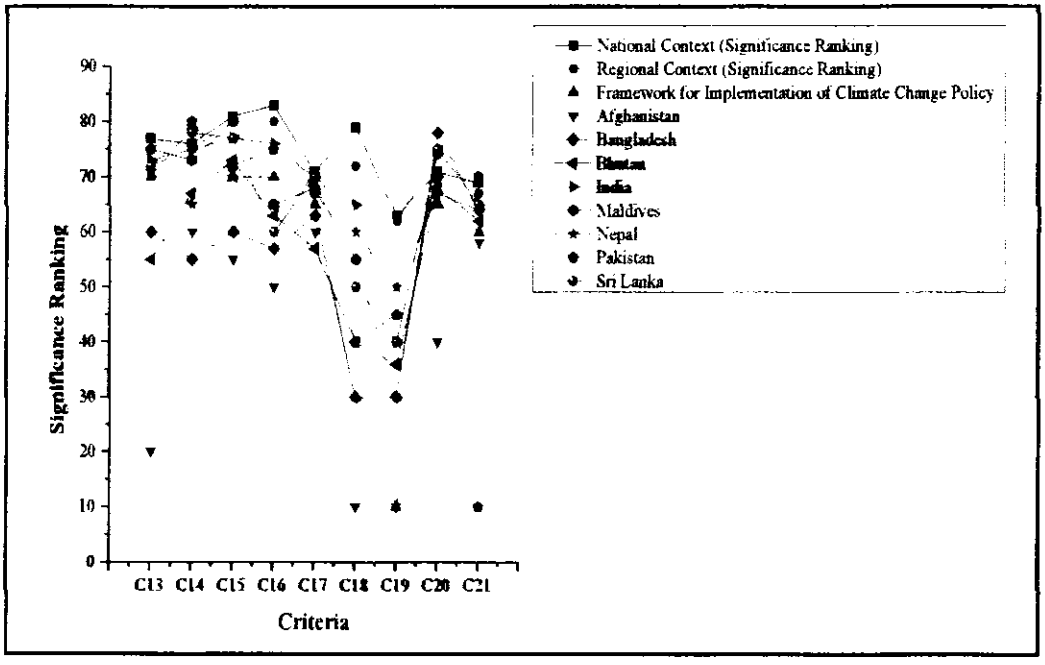

Figure 4.38 Ranking of environmental criteria in climate change policies and plans in national and regional context

The experts also evoked the extreme weather events (C20) and change in precipitation (C21) as core criteria to reduce the consequences of climate change. The results had manifested the consideration of extreme weather events in climate change policies and plans in the region. However, the effects on precipitation were in climate change policies and plans except the National Climate Change Policy of Pakistan (Figure 4.38). The detail of effects of climate change on precipitation in South Asia is furnished in table 4.13.

The results bestow the moderate positive Pearson correlation between significance ranking and existing ranking of environmental criteria in national context (Table 4.12). Similarly, the positive Pearson correlation (weaker to very strong) between significance ranking and existing ranking of environmental criteria was exhibited in regional context except Nepal (negative correlation) (Table 4.13). The modest attention to some

environmental criteria and inappropriate implementation of environmental risks related mitigation and adaptation measures in climate change policies and plans seems to favor the climate change to escalate environmental degradation as well as threatens human and environmental security.

4.3.4. The evaluation of social criteria

The multifaceted and complex nature of climate change involves different actors and interacting systems. The social criteria such as public participation, social acceptance, impacts on income, livelihood and poverty, migration, settlement, food security, public health and effect of employment incorporate multi fold trust and stakeholder concerns in climate change policy. The experts recommended to consider the social acceptance and participation (C22). The results had evinced that the climate change policy and framework in Pakistan had mediated social acceptance and participation. Alike, other climate change policies and plans in the region had also addressed the social acceptance and participation (Figure 4.39 and Annexure 3)

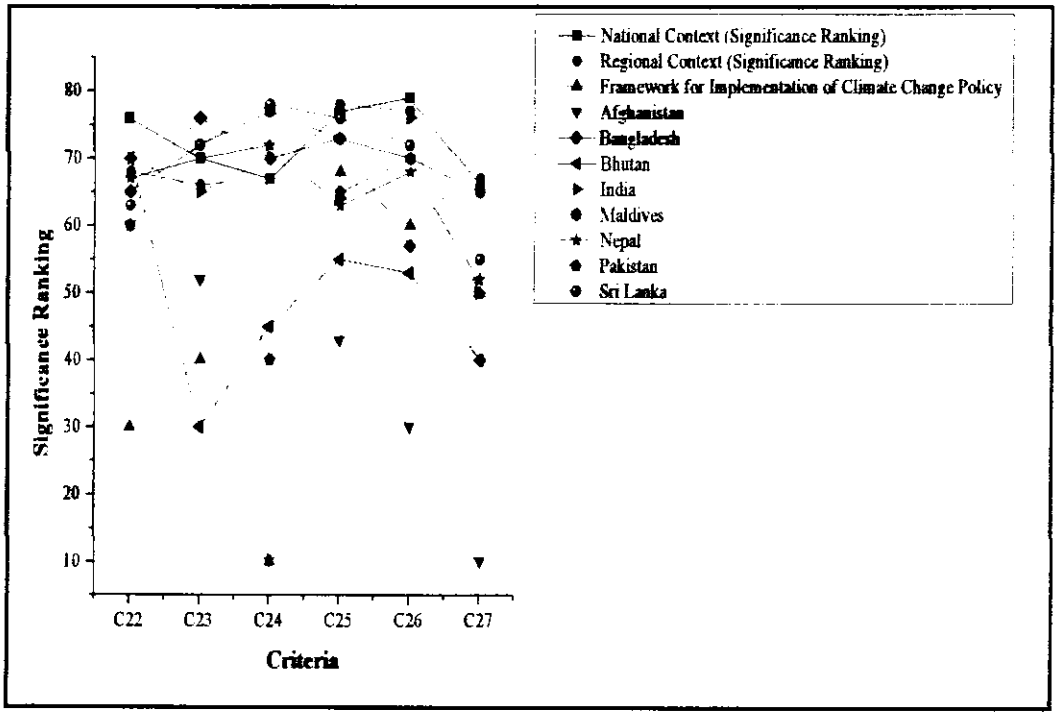

Figure 4.39 Ranking of social criteria in climate change policies and plans in national and regional context

The experts granted significance to livelihood, income and poverty (C23), migration and settlement (C24) and effect on employment (C25). The results demonstrated that climate change policy and framework of Pakistan had partially dealt the livelihood,

income, poverty, and effect on employment. However, they had paid modest attention to climate-induced migration and settlement. While, other climate policies and plans in region had reflected the income, livelihood and poverty. But, climate policies and plans in region except Afghanistan had entertained the livelihood, income and poverty, migration, settlement, and effect on employment (Figure 4.39). However, exact data of evaluation of impacts on livelihood, income, poverty, migration, settlement, and employment is available in South Asian countries.

The experts administered high significance to food security (C25) in climate change context of South Asia. The results expressed that South Asian countries are aware of threat climate to agriculture and food security (Figure 4.39). However, they have to implement the proposed mitigation and adaptation for agriculture and food security as soon as possible. The experts rated high significance to public health (C26) in climate change policies. The results had indicated that public health and the climate change related concerns to public health were pondered in climate change policies and plans particularly Indian National Action Plan for Climate Change and Health 2016 (Figure 4.39 and Table 4.13). However, the implementation of proposed mitigation and adaptation is urgently required to handle public health. The results had shown that the effects of climate change on employment (C27) had been given least priority in both national and regional context

The results divulged diverse positive Pearson except climate change policy and plans of Nepal (negative) correlation between significance ranking and existing ranking of social criteria in context of South Asia (Table 4.12 and 4.13). The social dimension of climate change policies and plans in the region driving the lunge to contemplate social structure demographic groups, vulnerable locations, displacement, health, food security and well-being to avoid the climate-induced conflicts for long-term socioeconomic and environmental sustainability.

4.3.5. The evaluation of political criteria

The eminent threat of climate change has reshaped the political, public and policy narratives as discourse of environmental security (Smith, 2017). The experts allocated an outstanding significance to political will (C28) and revealed it as an imperative climate change adaptation. The results evinced the demonstration of political will in the policies and plans in their region (Figure 4.40) but experts portrait the contradictory scenario for implementation of plans and secure committed obligations. They had criticized footling

practical measures except the India, Maldives, and Nepal. These are eroding political will toward environmental concerns, climate change and environmental security.

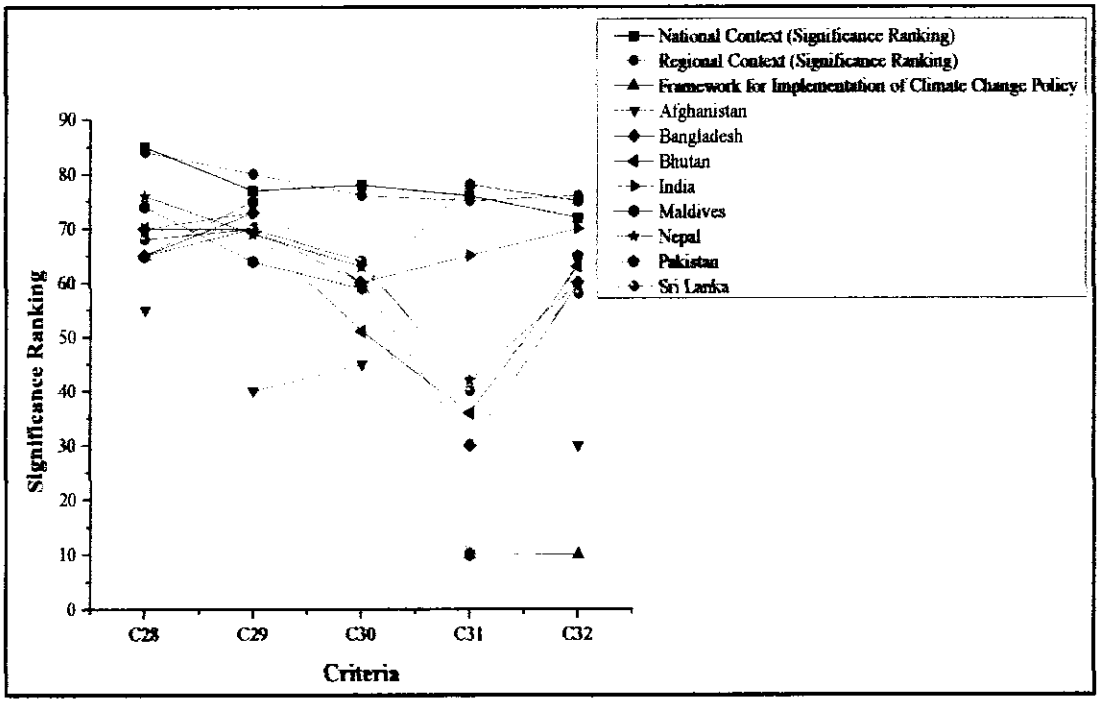

Figure 4.40 Ranking of political criteria in climate change policies and plans in national and regional context

The experts allotted an exceptional significance to cooperation (C29) for success of climate change policies and plans in both national and regional context. The climate change policies and plans had considered cooperation on climate as nidus criterion for adaptation of climate change policy (Figure 4.40 and Annexure 3). The results revealed that the governments are promoting cooperation on climate change to some extent at national level, but no significant proceeding was observed after Thimphu Statement on Climate on Climate Change 2010, SAARC Convention on Cooperation on Environment 2010 and SAARC Agreement on Rapid Response to Natural Disasters 2011. The lack of cooperation climate change at regional level has threatened the environmental security and development.

In addition, the Paris agreement (article 6, 8 (c) and 11) proposed to develop institutional capacity (C30) in developing countries, technical and financial support by developed countries. The results evident the existence of institutional framework for climate change in all countries except Afghanistan (weak institutional framework) (Figure 4.40). However, the technical capacity was found low because many employees were from irrelevant academic background and experience, having limited knowledge climate

modeling, socioeconomic vulnerability assessment, climate variability and uncertainty, adaptation measure, fundamentals of climate change policy, sustainable natural resource management and international agreement. This limited capacity will potentially threat the implementation of policies, adaptation, national and environmental security.

The experts assimilated the climate change as matter of national security (C31). The climate change policy and plans in Afghanistan and Pakistan snubbed the relationship between climate change and national security. However, other climate change policies and plans in the region had partly excogitated the relationship between climate and national security (Figure 4.40). The less implication of this criterion might endanger national sovereignty and environmental security in the region.

The experts suggested to utilize the negotiation and diplomacy (C32) for strengthen clime change policies, plans and cooperation between national and regional entities. The results had shown that the climate change plans mediated the negation and diplomacy in climate change plans (Figure 4.40). However, there is need to initiate diplomacy and define mechanism for negotiation at both national and regional to combat climate change in long haul. The results expressed variable positive Pearson correlation between significance ranking and existing ranking of political criteria in context of South Asia (Table 4.11 and 4.12). The notion of political aspects develop concord among actors on adaptation measure, increases the effectiveness of policies, cooperation and protect the environment.

4.3.6. Discussions

According to Hallegatte, (2009), climate change resilient, investments and development requires to consider technical aspects of climate change in policies and plans. The research studies refer vulnerability du to climate change as function of exposure (nature and extent) to a system and sensitivity (degree of effect which might be positive or negative) caused by climatic variations (IPCC, 2001b; Gerlitz *et al.,* 2017). Gerlitz *et al.* (2017) had identified that energy systems, agriculture, industry, coastal area, glaciers, forests, soil, water, ecosystems, tourism, development and infrastructure are vulnerable to climate change due to rising temperature, glacier melting and climate-induced disasters. An infographic of climate change scenario and vulnerability in South Asia is demonstrated in table 4.13. Hence, it has emerged the significance of vulnerability assessment of a system, nations and communities which render to adaptive capacity of people and systems, funding as well as implementation priority (Singh *et al.,* 2017). Furthermore, clause 3 of Thimphu

Statement on Climate Change and article 2 of Paris agreement accented on member states to assess the climate change vulnerability (SAARC, 2010; UNFCCC, 2015). The divesting impacts of climate change, complex interactions with human, ecological and physical systems necessitate adaptive capacity, mitigation and adaptation of climate change. According to Spencer *et al.* (2017), reduction in emissions, lifestyle changes, mitigation and adaptation of climate change will commute the future planning. Adaptive capacity is known as capability of a system to cope climate change, variability and extreme weather events. It inhibits potential damage to opportunities and overcome the consequences (IPCC, 2001a). Biesbroek, and Wals, (2017) determined the successful implementation of climate change mitigation and adaptation plans by adaptive capacity of individuals, communities, institutions and states. Furthermore, the article 2 (b) (increase in ability to adapt), article 6 (mitigation and adaptation mechanism), article 7 (mitigation, adaptation and adaptive capacity) of Paris agreement provides comprehensive guidelines for mitigation, adaptation and development of adaptive capacity (UNFCCC, 2015).

The dense population, intensive resource utilization and industrialization has posited vehement environmental pressure, increased greenhouse gas emissions, global warming, climate change and environmental insecurity due to urban sprawl and carbon-energy intensive development. The energy intensive development and industries are major contributor of GHG emissions (Wang *et al.,* 2017a). Energy-intensive industries are facing defy of innovations, technical concerns, meeting global marketing trends, high mitigation cost, and provisions of Paris agreement. Åhman *et al.* (2017) identified the low carbon development, decarbonization of energy sector and industries can meet the target of Paris agreement, energy efficiency and effectively contribute to climate change mitigation. Therefore, the studies recommend low carbon development and decarbonization of energy sector in climate change policies and framework implicitly support the high reduction in GHG emissions and mitigation efforts (Åhman *et al.,* 2017; Wang *et al.,* 2017a). The article 4(19) and article 10 of Paris agreement broadly sermon the use of low carbon technology, low carbon development, decarbonization of energy sector and transfer of low carbon technology to developing countries and finical support (UNFCCC, 2015). Similarly, clause 5 of Thimphu Statement on Climate Change 2010 and Dhaka Declaration on Climate Change 2008 accentuated the South Asian Association Regional Cooperation (SAARC) members to promote low carbon technology (SAARC, 2010). The sustainable economic development urges to establish adaptive plans to response uncertain environmental and

socioeconomic changes (Hallegate *et al.*, 2016). The implementation of such plans is being challenged by climate change uncertainty, its diverse impacts and changing socio-economic conditions. The incorporation and understanding of numerous uncertainties during adaptive decision has transformed the climate change adaptation from static to dynamic approach (Lawrence, and Haasnoot, 2017). The economics of climate change is complex but cardinal in design of climate change policy (Balint *et al.*, 2017). The climate change is causing bulk of economic cost and damage. The economic cost of climate change includes the cost of damage and cost of mitigation. The cost of damage resulted from impact of extreme weather events on infrastructure, tourism, agriculture, glacier melting, energy, water, livelihood, health and environment.

The mitigation cost include cost on low carbon development, technology and emission reduction (Hsiang *et al.*, 2017). The global environmental changes particularly GHG emissions, climate change and its adaptation robustly affected and reliant on growth per capita income (Leimbach *et al.*, 2017). Hsiang *et al.* (2017) estimated the increase in annual loss by 0.6% GDP per 1 °C rise in temperature. They suggested climate change damage and economically rational management of climate as integral part of climate change policy. Meanwhile, article 8 of Paris agreement evoked the parties to recognize the loss due to climate change (UNFCCC, 2015). Anderson *et al.* (2017) anticipated participation and willingness to pay by states and as an emitter in climate change mitigation and adaptation efforts. The cost of greenhouse gas reductions and mitigation of climate change are local (Aldy *et al.*, 2017) and impel economically rational management (Hsiang *et al.*, 2017). Despite, implementation of climate change policies, the developing countries are struggling to control increasing GHG emissions due lack of low-carbon technologies.

Lee *et al.* (2017) highlighted involvement of high cost of low-carbon technologies but developing countries are unable to afford the cost without support due to limited financial resources. For this purpose, the developed nations will voluntary assist the developing countries under article 9 of Paris agreement (UNFCCC, 2015). Similarly, the SAARC members decided to develop mutual fund under Dhaka Declaration on Climate Change 2008. The climate change has reshaped the density, abundance, distribution of animal and plants species, cropping pattern, agriculture, habitats (Birch *et al.*, 2017), water and energy consumption as well as economics of resource consumption, their values, and implication of human decisions.

Table 4.13 Infographic of climate change scenario and vulnerability in South Asia

	Greenhouse gas (GHG) emissions are increasing but exact calculations are not available	I.1-2.6 °C during 1976-2099 (Aich *et al.*, 2017) 2 °C increase in Hindukush region (Mukhpody and Khan, 2014)	8-10% increase is projected in Hindukush in next decades (Mukhpody and Khan, 2014)	Nil	Increase in frequency and intensity of floods, droughts and frost events in different part of country. The country has faced more severe and longest droughts during 1998-2006.	Glaciers are melting but exact calculations are not available.	Agriculture Biodiversity Energy Forestry and rangelands Health Livelihood Water resources
	16.7-18.2 billion tons of CO_2 equivalent since 2005	0.03-0.5 °C during last decades. 1°C increase is expected by 2030	5% increase by 2030	4-6mm/year during last decades 19cm by 2030	Most vulnerable country to cyclones and sixth vulnerable country to floods (UNDP, 2004). Natural disaster eroded 73,552 ha. Floods hit one quarter of country every year and 60% area once in each 4-5 yeas Six severe floods in last 25 years. More frequent cyclones and a severe cyclone in every 3 years. Floods and cyclones killed	Nil	Agriculture Disasters Environment Food security Health Industry Infrastructure Land and soil Livelihood Water Resources

					41,000 and 46 hundred thousand people during 1970-98.		Trade
	Forest cover on 72.5% of its total land area. Highest GHG emissions sequestration potential in the world	Temperature is increasing but exact calculations are not available	Increase in precipitation has been observed but exact details are not available	Not available	More frequent flash flooding, landslides and Glacial Lake Outburst Floods (GLOFs) are threatening hydropower generation (Backbone of economy). Five GLOF events in 1960, 1968, 1970, 1994 and 2015.	Glaciers are melting as wells resulting in glacial lakes. There are 2,674 glacial lakes, among them 562 are associated with glaciers. 24 lakes are dangerous for outburst.	Agriculture Biodiversity and forestry Health Livelihood Natural disasters and infrastructure Water resources and energy
	The GHG emissions are continuously increasing. Currently, 1.02 metric tons of CO_2 per Capita are emitted.	0.4 °C rise has been observed during last decades. However, cooling trend has been reported in North West India and	10-12% precipitation increase in West Coast, Andhra Pradesh and North West India. A 6-8% decrease in	1.06-1.75 mm/year	More frequent, severe and long floods, droughts and cyclones during last 130 years. Increase in severe storms at the rate of 0.11 events per year. Increase in epidemics and diseases.	Glaciers are melting but exact calculations are not available.	Agriculture Costal Area Disasters Ecosystems Energy Food security Forestry Health Livelihood

		some parts of South India.	rainfall in North Madhya Pradesh, North Eastern India, some parts of Gujrat and Kerala.				Water resources
	Not available	1.5 °C increase by 2100 0.2-1.1 °C increase in sea surface temperature	No significant change in precipitation	1.7 mm/year	Sea level is rising while 80% population is less 1 m Mean Sea Level. Increase in intense rainfall and cyclones. The tide height has been increased to 2.78-3.18m. Northern Maldives being exposed to more frequent and severe storms.	Data is not available	Agriculture Coastal zone management Critical Infrastructure Fisheries Food security Human Health Tourism Water
	0.25% contribution to global GHG emissions	0.06 °C increase during last decades 1.2 °C increase is projected by 2030	There is no clear trend about precipitation. However, decline in pre-monsoon is	Not available	Increase in frequency, intensity and duration of floods, droughts, storms, soil erosion and glacial lakes.	Glaciers are retaining at the rate of 10-60 m/year. The number of glaciers are	Agriculture and food security Climate-induced disasters

			observed in far and mid-Western Nepal. Meanwhile, there is 5-10 % increase in precipitation in Eastern Nepal during winter as well as 15-20% increase in summer month in whole country.			increased by 9% in Nepal. There is 20% decrease in glaciers area (Bajracharya *et al.*, 2007). There are 26 dangerous glacial lakes.	Forests and biodiversity Public health Urban settlement and infrastructure Water resources and energy
	310 million tons of CO_2 equivalent CO_2 (54%) Methane (36%) Nitrous oxide (9%)	0.099 °C rise/ decade Overall 0.47 °C increase from 1960 to 2010	Unpredictable trend. Decrease in rainfall during 1910-50. Increase in rainfall during 1951-62.	1.1 mm/year Karachi coast (1.1 mm/year) Pasni coast (1.1 mm/year) Makran coast (1-2mm/year)	Increase in frequency, intensity and duration of floods, droughts, storms, heat waves, severe cold wind and glacial lakes. Consecutive and massive floods during 2010-14. Recent severe drought in Thar.	Glaciers are melting in HKH. A new 1100 m^2 lake associated with Hinarchi glacier is a clear evidence. There is an upward rise of	Agriculture and livestock Arid and hyper arid area Biodiversity and ecosystems Coastal areas Disasters Forestry

	Carbon Monoxide (0.7%) VOCs (0.3%)		Again, decrease in rainfall during 1963-76. Increase in rainfall during 1977-97. Decrease in precipitation during 1997-date.		More heat waves and high temperature in early summer season.	1km in snowline during last 25 years. About 2500 glacial lakes, 52 of them are dangerous. The country has experienced GLOF like Booni Gole Glacier outburst, Attabad Lake and Passu lake outburst (Rasul *et al.*, 2011)	Human health Livelihood Mountain areas Rangelands and pastures Water resources and energy Wetlands
	0.15-0.20 metric tons/ capita increase in CO_2	0.017-0.026 °C increase per year during 1996-2001 0.5 °C increase is projected by 2010 to 2039.	No change in North-East monsoon. Mean annual precipitation has been decreased by 7 %.	1-3 mm/year	Increase in consecutive dry days and decrease in wet days. Expansion of dry zones. Increase in number of thunder days and 10-20 % increase in cyclones.	Not Available	Biodiversity and coastal resources Export Food security and water

[redacted]	2-3 °C increase is projected by 2070 to 2099.	Increase in frequency and intensity of droughts, floods and landslides.	Health and human settlement Industry and energy Infrastructure Tourism

Source: (GoIRA, 2009; GOB, 2005; GOB, 2009; RGOB, 2006; GOI, 2008; GoM, 2007; GoM, 2005; GoN, 2010, GoN, 2011; GoP, 2015; GOSL, 2015

Zaman *et al.* (2017) interlinked climate change with natural resources consumption, energy, GHG emissions and environmental pollution. It has changed the prices, gas rents, natural resource prices and exploitation of natural resources. McCollum *et al.* (2014) conferred prices of fossil fuels, energy demand, GHG emissions and natural resources consumption as key players of policy agenda and environmental sustainability. According to Baranzini *et al.* (2017), carbon taxes and prices promotes carbon-efficient technologies, adjust relative prices, internalize global warming, reduces abatement cost, ensure energy conservation and efficiency, increase cooperation, thematic criteria in climate change policy, harmonize regulations and environmental concerns. While, other argued that carbon taxes to reduce GHG emissions will put the burden on low-income groups as well as the increase the price of electricity unless the state rationalize redistribution of income, transfer payments, variation in tax or introduce incentives and subsidies (Fullerton *et al.*, 2017).

The greenhouse gas emissions (carbon dioxide, nitrous oxide, methane and water vapors) from both natural and anthropogenic sources are major drivers of greenhouse effect, global warming and climate change (Ahmed *et al.*, 2017c; Hassan *et al.*, 2012). The World Bank projected the 4 °C rise in mean world temperature above the pre-industrial epoch, dangerous heat extremes, sea level rise, water scarcity, drastic damage to ecosystems and environmental insecurity in near future (The World Bank, 2013). Therefore, SAARC member agreed to establish regional Clean Development Mechanism (CDM) in Dhaka Declaration on Climate Change 2008 (SAARC, 2008). Alike, articles 4 and 5 of Paris agreement adjudicate the parties to focus on assessment and mechanism for abatement of GHG emissions. Meanwhile, parties declared to hold mean global temperature rise below 2 °C above pre-industrial level (UNFCCC, 2015). Hatfield-Dodds *et al.* (2017) indicated the assessment and GHG emissions abatement as a primary objective of climate change policy and boost economic growth in addition with resource efficiency. Climate change has impelled the marine, freshwater and terrestrial species redistribution beyond geographical range limits. It has interrupted abruptly key interactions, biotic communities and ecosystem functioning. Pecl *et al.* (2017) reported that species in cooler region, oceans and warmer regions are moving to higher elevation (poleward), greater depth and tolerable temperature respectively. The clauses 10, 11 and 12 of Thimphu Statement on Climate Change and article 7 (2) of Paris agreement particularly focused on biodiversity and ecosystems under change in

climate context (SAARC, 2010; UNFCCC, 2105). Chiba *et al.* (2017) presented that climate change vulnerability to plant, animal, microorganism communities, and environmental interactions as well as ecosystem services and biodiversity are intimating environmental insecurity. The climate change has hastened grappling impact on water and environmental security including more frequent natural disasters, glaciers melting, damage to Hindukush-Himalaya (HKH) water tower, effect on headwater of major rivers of continent and trans boundary water concerns, and conflicts (Wilson *et al.*, 2017). Teotónio *et al.* (2017) had determined that the climate change has intimated threats to energy security encompassing of its possible effect on technical efficiency of thermal energy systems due to variation in cooling water temperature, sensitivity of renewables towards climatic parameters (variation in irradiance, wind speed and precipitation) and impact on availability of water resources for hydropower. Wilson *et al.* (2017) refers to consider the relationship of climate change and water security. Similarly, Guivarch and Monjon, (2017) shared the success the GHG emissions reduction after consideration of energy security in climate change policies. The Sustainable Development Goals (SDGs) provides a pathway to global sustainable development during 2015-2030. The research studies interlinked success of goal 13 (urgent measures to combat climate change) with the achievement of other goals including goal 2 (zero hunger by reducing risk to agriculture), goal 3 of good health and well-being (reducing the negative health effects of air contamination), goal 6 of availability and sustainable water management (reducing the risk to water resources), goal 7 of affordable and clean energy for all (ensure water supply for power generation, reducing the risk of climatic variation and structural changes) (Riahi and Krey, 2017), goal 11 (sustainable cities), goal 14 (conservation of marine resources) and goal 15 (conservation of terrestrial ecosystems). The Paris agreement demonstrated the common global ambition to combat climate change, its adaptation and more support to developing countries. The agreement aims to clasp average global temperature below 2 °C above pre-industrial level, intensify the capability of developing countries, suitable fiscal support, transfer of technology, robust transparent framework, and capacity building of developing as well as vulnerable countries to deal with climate change (UNFCCC, 2017). Peters *et al.* (2017) consider it a cumulative positive step to reduce global GHG emissions, address climate change and more relevant in implementation of climate change policy. The aggregate global temperature rise due to climate change is

likely to increase extreme weather events as well as socio-economic and environmental damage (Demski *et al.*, 2017). The human-induced climate change has metamorphosed the pattern of weather into a new pattern of more extreme weather events such as deadly heat waves, intense rainfall, droughts and devastation floods. These events are more frequent, intense and severe in recent decades than before ever across the world. Janković and Schultz, (2017) determined instability in environment along with change in food production, infrastructure, water management, energy, diseases, migration, settlement and economic hardship dynamics. Besides, the 1-3% annual increase in precipitation is projected per 1 °C temperature rise by IPCC depending upon geographical location of the region (IPCC, 2014; Nolan *et al.*, 2017). The extreme weather events and change in precipitation has gauged the attention of policymaker due severe consequences (Sisco *et al.*, 2017).

It is important to consider public and stakeholders concerns to foster trust and successful implementation of climate change policy (Visschers, 2017). The research studies stated social acceptance, participation and active engagement of stakeholder and local communities to provide valuable knowledge, willingness, integrity and enhance implementation of climate change mitigation actions (Smith and Sharp 2012; Brugnach *et al.*, 2017). The Thimphu Statement on Climate Change 2010 (clause 4 and 6) and Paris agreement (article 7(5) and article 12) emphasized the involvement of stakeholder and social acceptance (SAARC, 2010; UNFCCC, 2015). Ur-Rehman *et al.* (2017) expressed the effects of climate change on the livelihood of many people in developing countries. It has particularly affected the agrarian economy because they are dependent on agriculture and livestock for income generation. A decrease in milk production, crop failures, and effect on fisheries due to droughts and water scarcity has threatened sustainable access to natural resources, national economy, income and employment opportunities. The intense rainfall and severe cyclones can damage infrastructure and mature crops which ultimately affect the livelihood and income of people. Similarly, the impact of climate change on industry and hydropower has also threatened livelihood, income of people and employment (Teotónio *et al.*, 2017). The Thimphu Statement on Climate Change 2010 (clause 12) and Paris agreement (article 7(2)) has visualized the impacts of climate change on livelihood, income and poverty (SAARC, 2010; UNFCCC, 2015). In addition, the rapid socioeconomic changes due to climate change has resulted in labor migration to urban centers and overseas communities as

well as alters social pattern of rural communities (Kollmair & Hoermann, 2011). These migrations and settlement in urban centers has also changed environmental and socioeconomic paradigm in urban centers and threatened environmental security (Gerlitz *et al.,* 2017). The agricultural productivity, crop and food security has been adversely affected by climate change in many countries across the world. The natural disasters (flood, drought, heavy rainfall, storms and cyclones), pests, plants diseases, water scarcity, change in cropping season and patterns has reduced the productivity and profit as well as intimate threat to environmental and food security (Alam *et al.,* 2017b; Hassan *et al.,* 2016). It has affected the supply side of food security by inducing variation in food prices, food needs, water and land scarcity, machinery, planning, labor and financial resources (Golub *et al.*, 2013). Furthermore, climate change has affected the nutritional value of food, micronutrients and vitamins which will eventually cause malnutrition and decrease the immunity of body (Bullock *et al.,* 2017). The climate change has intensified the infectious diseases dynamics, spread, distribution, seasonality, intensity and transmission due to variation in temperature and precipitation (Butterworth *et al.,* 2017). The climate change has induced disproportionate burden of diseases among children including impact on developing fetus, low birth rate, cognitive and behavioral disorder, malnutrition, asthma, heart diseases, physical trauma, infectious diseases, and mental ill-health in developing countries (Perera, 2107). Hajat *et al.* (2104) projected around 257% increase in heat-related death (approximately 2000/ year) by 2050. Schütte *et al.* (2017) acknowledged the efforts of the World Health Organization (WHO) and The World Medical Association (WMA) to convince the countries for recognition of public health as a core criterion in climate change and adaptation plans.

The goals of Paris agreement are not possible to achieve without cooperation from aslant political spectrum. More focus on different political narratives such as political will, cooperation, international obligations, negotiation and diplomacy is likely to frame better adaptation measures and achieve the climate goals (Whitmarsh and Corner, 2017). Ampaire *et al.* (2017) identified that political constraints and conflicts of interests among stakeholders are manifesting ominous effects on implementation of adaptation strategies. However, the strong political will of governments is expected to balance climate change adaptation and development. Otherwise, the absence of political will can imperil mitigation and adaptive measures (Adelle and Russel, 2013). The

article 3 and 7(9) of Paris agreement postulated the parties to demonstrate the political will to combat climate change (UNFCCC, 2015). Carattini *et al.* (2017) identified the toughest conditions for mitigation and adaptations due to complexity of climate change and elicited the cooperation at local, national and regional level. The Paris agreement has opened a new arena of cooperation on climate change. The articles 3, 7(6) and 11 have particularly focused on cooperation between developed and developing nations on climate change in the form of capacity building, technical support, technology transfer and financial cooperation (UNFCCC, 2015). Meanwhile, clauses 2 and 9 of Thimphu Statement on Climate have also riveted the regional cooperation on climate change (SAARC, 2010). The key institutional framework and their roles should be stipulated by policy documents. The inappropriate institutional capacity reflects poor strategic planning and futile policies due to absence of research based findings (Ampaire *et al.*, 2017). The Thimphu Statement on Change (Clause 9) refers to develop institutional capacity (SAARC, 2010). The climate change is directly linked with national security and failure to manage climate can impair global economy as well as destabilize the security landscape. Kelly, (2017) interlinked the social, economic, political and environmental instability with growing conflicts due to stripping impacts of climate change. The climate change being an international governance challenge evolves political feasibility, lags between environmental impacts, mitigation measures, divergence in views polluters and vulnerable as well as conflicts between region depends on shared natural resources (Underdal, 2017). Meanwhile Oberthür and Groen, (2017) argued that Paris agreement was just beginning and it is insufficient by itself and necessitate to strengthen quickly. The negotiation and diplomacy can conduct the harmonization in views and practice for successful implementation of policies and plans (Moomaw *et al.*, 2017).

4.4. An overview of environmental security and development

The experts (94%) confirmed the link of environmental security and development. The response (100%) exacerbated the environmental factors as an essential component of an emerging discourse of international relations and about 89% attested its impact on foreign policy and global standing of country (Table 4.14). For instance, China has immediately replaced the United States (US) after the withdrawal of US President Donald Trump administration from Paris agreement. It has stabilized

the position of China as a global leader and key figure in future combat of climate change at global level. The experts pointed out the environmental insecurity as a threat to stability, sovereignty and notational security. Majority of respondents (93%) aggravated environmental insecurity and mismanagement of resources can destabilize the state. At the same time, 77% respondents provoked that environmental challenges such as climate change water and energy security are destabilizing the South Asia. Besides, 73% experts elicited that climate change is complicating the nexus of water and energy security.

Table 4.14 An overall expert response on environmental security and development

Aspect	Response (% age)				Std. Dev.	Sci square test		
	1	2	3	4		Chi-square Value	Df	P value
Environmental security and development	83	11	6	0	0.52	23.059[a]	2	0.001
Environmental factors and emerging discourse of International Relations	56	44	0	0	0.51	0.059[b]	1	0.8
Environmental factors and foreign policy	33	56	11	0	0.47	7.176[a]	2	0.02
Environmental insecurity, mismanagement of resources and de-stability	62	31	0	7	0.59	8.941[a]	2	0.01
Climate change water and energy security and stability	39	38	23	0	0.8	1.882[a]	2	0.3
Climate change, water and energy security nexus	23	50	27	0	0.75	3.294[a]	1	0.1
Integration of climate change,	0	27	73	0	0.7	2.882[b]	2	0.05

water and energy security nexus in policies								
Environmental concerns and human security	67	33	0	0	0.47	2.83[b]	1	0.04
Environmental diplomacy	77	23	0	0	0.39	7.11[b]	1	0.04
Regional institutional capacity to settle conflicts	22	0	72	6	0.52	11.41[a]	2	0.003
Role of global environmental institution	33	62	5	0	0.49	1.47[b]	1	0.2

(1. Strongly Agree, 2. Agree, 3. Disagree, 4. Strongly disagree) (a represents minimum expected cell frequency of 5.7, b represents minimum expected cell frequency of 8.5)

Furthermore 73% respondents were exasperated on lack of integration of climate change, water and energy security nexus in national policies and discourse of international relations at both national regional level. Majority of experts (84%) contemplated the water resource management of trans boundary water and water security as a leading cause of conflicts followed by climate change (10%) and energy insecurity (6%) (Table 4.14). The environmental security is directly linked with sustainable development and human security. All experts were agreed to stress the he South Asian countries for settlement environmental issues to reduce poverty, achieve sustainable development and human security. Similarly, they highlight the need to initiate negotiation and suggest environmental diplomacy as a tool to settle environmental conflicts. Meanwhile, about 78 % respondents were worried about insufficient institutional capacity to settle environmental conflicts regional levels. Therefore, most of them (95%) suggested the global environmental institutions like the United Nations Environment, the United Framework Conventions on Climate Change and the World Bank to play an effective role to settle environmental conflicts. Perhaps, the World Bank has played a historical role in settlement of water dispute and its momentous outcome in the form of the Indus Water Treaty (Table 4.14)

4.5. Environmental diplomacy: Climate change, energy and water security

Environmental diplomacy can play an effective role transforming the energy security, regional energy trade, development and environmental security nexus. There were substantial gaps in energy policies in Pakistan which were pointing out the conflicts among state entities. Additionally, the governance structure of Pakistan has been changed after 18th amendment. The Ministry of Energy is facing some legislative barriers and conflict with provinces particularly on issues of bill collection, tax and environment. Hence, there is a potential to utilize environmental diplomacy for conflict settlement. Alike, environmental diplomacy can enable states to cope with environmental challenges, sovereignty concerns and disputes arising from regional energy trade as well as reap the benefits of cooperation, fostering economic development and energy security (Ali and Zia, 2017). The results highlight many gaps in technical, economic, environmental, social and political aspects in regional energy policies. These gaps are reducing the energy trade feasibility, hindering the implementation of SAARC Framework Agreement on Energy Cooperation, arising disputes which likely to complicate the complicated geopolitical circumstances and reducing the opportunity to secure energy. There is a lack of regional cooperation due to geopolitical tension which has squashed the capacity of political forums to settle the disputes and barriers in regional energy trade. Therefore, circumstances require a negotiating tool, non-aggressive in nature and emphasizing on sustainable energy as basic human right as well as a commodity for development beyond political interests.

The water conflicts among the provinces of Pakistan are back dated before independence in 1947. Unfortunately, the conflicts are still pending for settlement. The main conflicts on royalties, dam constructions and ownership between Punjab and Khyber Pakhtunkhwa (KPK) as well as on water quantity between Sindh and Punjab. Furthermore, the water resources management become provincial subject after 18th amendment, enhanced the autonomy of provinces without considering underlying causes of conflicts and future impacts. The change in governance structure will complex the attributes of allocation, equity, rights and conflicts. Meanwhile, increasing demand, change in governance structure, excessive pressure on water resources, fragile governance, and climate change are escalation the scarcity and conflicts. The IRSA accord has insufficient capacity to reconcile conflicts and manage water resources due to its technical, economic, environmental, social and political limitations. These

conflicts are challenging socio-economic development, livelihood, access to clean water, distribution, national security, peace, poverty alleviation and environmental security. Therefore, there is need to provoke a comprehensive mechanism or accord to settle inter-provincial conflicts. Besides intrastate conflicts, the lack of cooperation on international basins in South Asia is eliciting conflicts. The paucity of cooperation on management of Ganges-Brahmaputra-Meghna river basins among Bangladesh, India and Nepal and the Indus river basin between India and Pakistan is commencing mistrust, conflict, tension (Uprety and Salman, 2011), underdevelopment and poverty. Meanwhile, conflict on Kabul river between Afghanistan and Pakistan is apprehending tension and mistrust. The paradigm of conflict, water and environmental security in South Asia postulates cooperation, understanding of benefits and diplomatic negotiation to decree international water law, ensure equity, development and environmental security (Hassan *et al.*, 2017; Tir and Stinnett, 2012). Historically, the Indus Water Treaty, Treaty of Mahakali, and Treaty on Sharing of Ganges Water Treaty were product of successful diplomacy. Consequently, a new track of diplomacy can settle the conflicts. But conventional diplomacy is contrived by political agenda and interests and incertitude in the region due to geopolitical context. Therefore, environmental diplomacy can candid the conflicts due to its soft, non-aggrieve characteristics based on basic human rights, sustainability and environmental conservation. The environmental diplomacy will predict the availability of water, reduce uncertainty, values the ecosystem services, build knowledge, secure socio-economic benefits, negotiate political agenda, consider and adapt climate change.

The climate change has more threatened the developing countries, complexed their socioeconomic and environmental problems as well as exacerbated the conflicts. For instance, the climate change is a federal subject while formulation, implementation and monitoring of compliance of environmental regulations is now provincial subject after the 18th amendment in Pakistan. Many conflicts are mounting due to interposition in jurisdiction of each other and unclear directions. Meanwhile, implementation of mitigation and adaptation is joint venture of Ministry of Climate Change, provinces and many ministries in including Ministry of Water Resources, Ministry of Energy, Ministry of Food Security, Planning and Development Division, Provincial Environmental Protection Agencies, Ministry of Foreign Affairs, and Mistry of Industries along with some institutions including National Disaster Management

Authority (NDMA), Water and Power Development Authority (WAPDA), National Energy Efficiency and Conservation Authority (NEECA), Pakistan Metrological Department (PMD) etc. There are numerous conflicts about jurisdiction, engagement of human resources, data availability, capacity, regulatory measures, set objectives and financial resources. Alike, the limited regional cooperation on climate change has been observed during the study. The regional declarations (Dhaka Declaration on Climate Change and Thimphu Statement on Climate Change) are incomplete, insufficient and peanut capacity. Furthermore, an intermittent debate on consequences of climate change was noticed on regional forums. At the same time, the impacts of climate are more frequently and severely damaging the region (Table 4.13). Therefore, strong cooperation, negotiation and diplomacy beyond game theory and territory can remedy the divesting impact of climate change in context of Pakistan and South Asia.

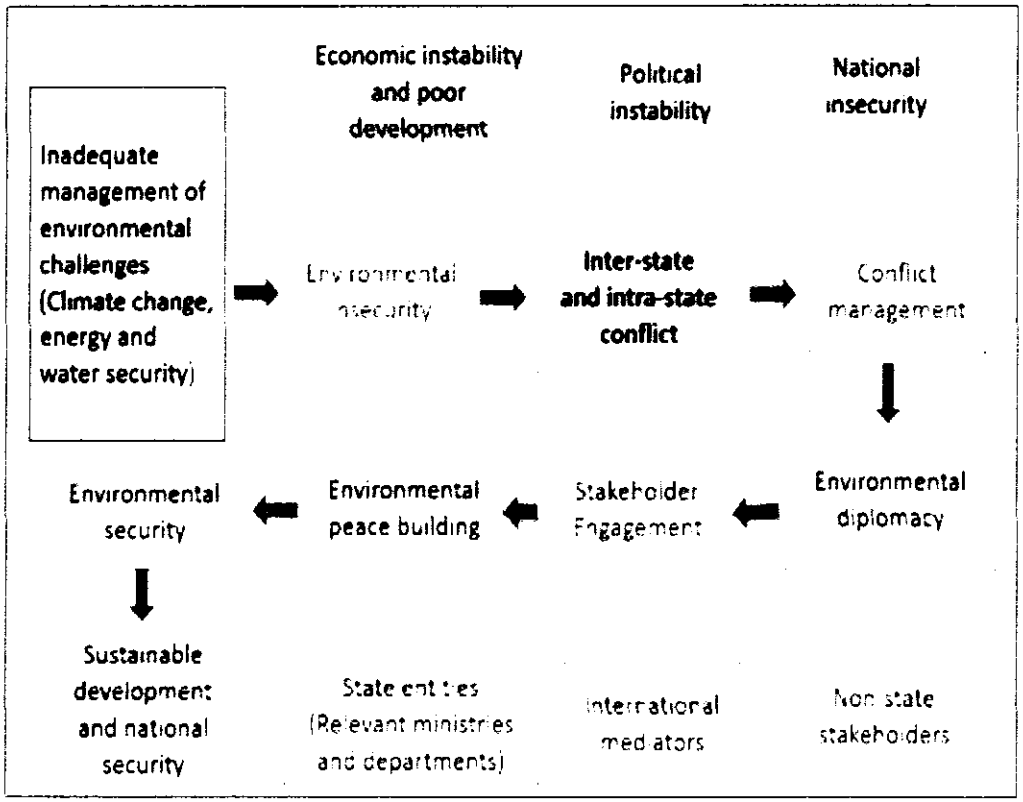

Figure 4.41 The conceptual framework for environmental diplomacy, security and development

The environmental diplomacy can cater neutral, non-aggressive and sustainability based mechanism to negotiate, settle dispute and frame cooperation on climate change in both national and regional context. It different and effective than traditional diplomacy in current geopolitical and historical narratives of South Asia due

to its neutral characteristics, engagement of variety of actors, and its negotiation capacity based on sustainability to balance social, economic, political and environmental narratives. Hence, environmental diplomacy can negotiate broader agenda of climate change, revisit regulatory and institutional framework, provide pathway to comprehensive regional agreement or strategy, settle disputes, explicate national and regional cooperation on climate change to reduce poverty, sustainable development and environmental security.

4.5.1. Institutional capacity for environmental diplomacy

4.5.1.1. National Institutions

Environmental diplomacy through the Ministry of Inter-provincial Coordination, Council of Common Interest (CCI), Ministry of Climate Change, Ministry of Energy, Private Power and Infrastructure Board (PPIB), Alternative Energy Development Board (AEDB), Ministry of Water Resources and Indus River System Authority (IRSA) could produce effective results, settle disputes regarding energy, water, climate change, environmental security and development in context of Pakistan for long-term cooperation.

4.5.1.2. Regional Institutions

The South Asian Association for Regional Cooperation (SAARC) and South Asia Cooperative Environment Programme (SACEP) can entertain the region for environmental diplomacy, negotiation and cooperation on energy security and climate change in the nexus of environmental security and development. But it is import to mention that the South Asian Association for Regional Cooperation (SAARC) being an important regional forum did not mandate the cooperation on water resources. However, the Asian Development Bank (ADB) in collaboration with research forums like South Asian Network for Development and Environmental Economics (SANDEE) and International Centre for Integrated Mountain Development (ICIMOD) as well as political forums such as South Asian Association for Regional Cooperation (SAARC), South Asia Cooperative Environment Programme (SACEP), the Economic Cooperation Organization (ECO), Association of South East Nations (ASEAN) and Shanghai Cooperation Organization (SCO) can for foster regional cooperation towards energy trade, the utilization of SAARC energy rings through SAARC energy grid like Nordic Power Pool (NORDPOOL) and Greater Mekong Sub-region (GMS),

development, energy and environmental security. Alike energy, the ADB and other regional institutions can expeditiously engage disputed parties on regional issues related to water and climate change through environmental diplomacy, active participation, negotiation, dispute settlement and cooperation for environmental security and sustainable development.

4.5.1.3. Global Institutions

The global institutions (The World Bank and United Nations) have practicable potential for environmental diplomacy and effectively settled disputes. Historically, the World Bank had provided negotiation forum for water diplomacy and played effective role in dispute settlement on shared water resources which eventually developed the bilateral water treaties in South Asia. Similarly, the United Nations Environment, International Union for Conservation of Nature (IUCN), United Nations Framework Convention on Climate Change (UNFCCC) and the World Meteorological Organization (WMO) can diplomatically involves parties to put their efforts to discuss concern regarding energy, water and climate change in context of environmental security and development, negotiate, settle conflicts and harness long-term cooperation on environmental security for sustainable future of South Asia.

4.6 The role of non-state stakeholders (the business, industry, media and nongovernmental organizations)

Christiansen, (2017) acknowledged the trade unions, media, advocacy groups, and NGOs for their active participation in decision making, exchange of information about regulations, and environmental conservation. The business groups, industries and trade can play effective and positive in the development of environmental policies and regulations, their implementation and environmental conservation as a non-state stakeholder. Their role might hamper the trade, cooperation, environmental protection and security (Neumayer, 2017). The experts identified business groups, industries and trade unions such as chambers of commerce at national level and the South Asian Association for Regional Cooperation (SAARC) Chamber of Commerce as key non-state stakeholders to promote environmental security. The experts (94%) commended the business and industry as non-state stakeholder to play an effective role to settle environmental conflicts (Table 4.15).

The environmental concerns including climate change, energy and water security requires awareness, change in behavior and environmental attitude about environmental conservation and security. According to Hamid *et al.* (2017), the media can play effective role in behavioral change, raising awareness, set choices and foster sustainable development. The experts (89%) visualized the media as a mode of awareness can play an effective role to settle environmental conflicts (Table 4.15). The NGOs can influence the improvement of environmental disclosure, performance and environmental security (Asfaw *et al.*, 2017). Schoon *et al.*(2017) stressed collaboration of NGOs with government agencies and other actors can improve the access to natural resources, build expertise, share knowledge, assess the risks and mitigate conflicts across the country and regions. Alike the role of media, 89% experts identified the NGOs as a key actor for lobbying, capacity building and settling environmental conflicts (Table 4.15). Overall, the non-state stakeholders like industry, business, media and NGOs can build trust, cooperation, settle disputes, environmental sustainability and security.

Table 4.15 The role of non-state stakeholders in environmental security and diplomacy

Aspect	Response (% age)				Std. Dev.	*Chi* square test		
	1	2	3	4		Chi-square value	*df*	P value
Business and industry	33	61	6	0	0.56	8.91[a]	2	0.01
Media	72	17	11	0	0.79	6.118[a]	1	0.04
NGOs	72	17	11	0	0.79	14.13[a]	1	0.04

(1. Strongly Agree, 2. Agree, 3. Disagree, 4. Strongly disagree) (a represents minimum expected cell frequency of 5.7, b represents minimum expected cell frequency of 8.5)

CHAPTER 5

5. CONCLUSIONS AND RECOMMENDATIONS

The results of the present study indicate a potential threat to development from environmental insecurity attributed by climate change coupled with energy crises and water scarcities both, in national and regional context. The results suggest that there is an urgent need of vibrant and judicious environmental governance initiatives with a balanced approach, integrated with challenges of energy security, water security, climate resilience and sustainable development in South Asia. The following conclusions have been drawn on the basis of results of this study:

1. In the opinion of energy experts consulted for this study, the technical consideration in energy policies should be balanced with political and sustainability criteria of economic, social and environmental consideration. But the analysis of the current energy policies in the South Asia countries do not reflect such balance between technical, political and sustainability criteria. Such gaps in energy policies will be a hindrance in achieving the targets of Sustainable Development Goal 7 of access to affordable and clean energy by 2030 to overcome energy crises and environmental insecurity. The current interim measures by governments to overcome energy crises are nothing expect utilization of unclean, unsustainable and non-renewable options further leads to environmental degradation. The economic considerations in current energy policies are dominant over technical and sustainability criteria. The energy policies in Pakistan are not adequate in terms of economic utilization, technical requirements, envisioning future energy demand and integration of energy systems. The measures to enhance social acceptance, conformance of Sustainable Development Goals and combat climate change are also inadequate. The National Power Policy 2013 is devoid of important aspects like identification of energy potential, future energy demand, right primary energy mix, access to energy, safety, energy intensity, emissions, land use, noise and job creation. The policy does not provide clear directions for regional energy trade and measures to combat climate change. The policies are also silent on regional and international obligations related to SACEP, UN-Environment and UNSDGs. The results points less focus in Power Generation Policy on hydropower being an important,

cheap, practicable and clean source of energy for Pakistan. Additionally, the analysis of Power Generation Policy identified to underpin identification of potential, future energy demand, right primary energy mix, safety, energy intensity, fuel cost, emissions, land use, water security, noise, climate change, SDGs, SACEP, access to energy and comprehend global agreements. ARE policy is looking to invoke right primary energy mix, optimize the share of renewables, safety, energy intensity, land use, noise, water security, SDGs, SACEP, access to energy and decentralized energy supply for remote areas.

2. The energy policies in the region have exalted gaps in technical, economic, environmental, social and political criteria. The results reveal that Bhutan Sustainable Hydropower Development Policy 2008 tames most of selected criteria, looks to be more technical, suitable and compatible for regional energy trade. However, consideration of selected criteria varies in other policies in the region. They have modest adequacy for regional trade and compatibility with environmental security and sustainability. The energy policies in South Asia are omitting cornerstone criteria for successful regional energy transitions, development and environmental protection including safety, competitive investment, operation and maintenance cost, interconnection cost, taxes, integration with water security and climate change, SDGs, land use, SACEP, social acceptance, political will, constraints, diplomacy, right of ownership and supply security. However, the promotion of regional energy trade has a potential to create significant opportunities to economic growth, regional cooperation, reduce dependence on fossil fuels, reduce emissions and combat climate change. Overall, regional energy policies have demure capacity for regional procurement of energy and sustainability in social-geo-political context of South Asia. In sum, energy policies in the region, regulatory mechanism, cooperation and political interest postulate to rethink and review for energy security and environmental sustainability.

3. Water scarcity is damaging Pakistan as well as South Asia more than war form social, economic, environmental and political perspective. It has challenged our civilization, food security, environmental security, ecosystem services, energy security, water for industry, transportation and economic development. The analysis of ISRSA accord (national accord in Pakistan) signals its limited capacity to tackle water and environmental insecurity at national level due to scant complaisance to water viability, hydropower development, royalty, demand and use in sectors (domestic, Industry,

Energy and Environment) other than agriculture, compensations, water loss, administrative costs, environmental aspects (vulnerability, scarcity, conservation, climate change and ecosystem services), social aspects, preferences, negotiation, change in governance structure and dispute settle mechanism. The analysis of regional water treaties indicates that effectiveness of the Indus Water Treaty has been abated due to condoning the flow variability, environmental factors, and some socioeconomic attributes. Furthermore, geopolitical tension is also affecting the cooperation on water. The Treaty on Sharing of Ganges Water has omitted water availability, dispute settlement mechanism, some socioeconomic and environmental aspects. The Treaty of Mahakali had overseen water availability, some socioeconomic and environmental aspects. The environmental factors like climate change, vulnerability and scarcity of water resources are overlooked in all treaties. They are enduring threat to sustainable development, environmental and water security in the region. However, water policies in the region had adhered most of the selected criteria but inadequate procedure, poor governance, insufficient institutional capacity, and low political commitment is hindering the effectiveness and implementation of policies. The complex nexus of water security-human security-nature assimilates the water crises with environment sustainably crises. The consistently decreasing per capita availability of water in South Asia which can commute water and environmental insecurity. Overall, comprehensive system water management strategies equipped with scientific, technical, social, economic, political and environmental wisdom are required to meet SDGs, win-win situation, water and environmental security in both national and regional context. Additionally, an urgent and effective responses from states, commissions or agencies, communities and global institutions is an imperative to ensure equity, flexibility, effectiveness, conflict settlement, cooperation and environmental security.

4. The South Asian countries has initiated the climate change governance and implementation of regulatory mechanism after the Kyoto Protocol but positive response is quite limited. The results reflected substantial gaps in technical (low carbon technology and energy sector), economic (cost evaluation of climate change, impact on GDP, willingness, cost of low carbon, carbon tax, incentives and subsidies), environmental (Paris agreement, South Asia Co-operative Environment Programme (SACEP)/SAARC initiatives, extreme weather events, and change in precipitation), social (migration, settlement, food security, public health and employment) and

political (political will, institutional capacity, and national security). It has dwindled the effectiveness of climate policies, plans, mitigation and adaptive measures in the region. The ineffectiveness of climate change policies in addition with low institutional capacity, absence data, no nationally determined contributions, immaterial research, poor planning and conflicts has high potential to mutilate human, national and environmental security discourse and sustainable development.

5. In a sum, the analysis of existing energy, climate change, water and policies, plans and treaties had reflected substantial gaps in technical, political and sustainability aspects and curtailed potential of regional trade, combat climate change and water security. They have weak loops to ensure environmental security, environmental diplomacy and future development in both national and regional context as set in first and second objectives of this study. Meanwhile, the results revealed low capacity of regional institutions like South Asia Co-operative Environment Programme (SACEP) and South Asian Association for Regional Cooperation (SAARC) to environmental security, development and promote environmental diplomacy. It has been concluded on the basis of the results that the current scenario of environmental security and development in complex nexus with climate change energy and water security reflected the need of involvement of non-state stakeholders (media, NGOs, business and industry) to lunge sustainability. Hence, the quest for environmental diplomacy is a pursuance to initiate negotiation, trust building, environmental peacemaking and the cooperation for sustainable development, viable national and environmental security in context of both Pakistan and South Asia.

On the basis of the present study following measures are suggested to incorporate in energy, water and climate change policies to ensure environmental security and sustainable development in South Asia:

1. The Ministry of Energy should:

- Balance the technical, political and sustainability aspects in energy policies in Pakistan as well as avoid interim, unclean, unsustainable and non-renewable options that threats environmental security and sustainability. As, the results presented that the energy policies in Pakistan had more focused on economic and technical aspects but did not balance the social and environmental aspects. This unbalanced approach is leading to rely on interim, unclean, unsustainable and non-renewable options which is threatening environmental security.

- Envision the SDGs, Paris agreement, SACEP and SAARC provisions to ensure energy security in coordination with Ministry of Planning and Development, the effective utilization of economic and technical requirements, future energy demand and integration of energy systems in energy policies of Pakistan.
- More focus on hydropower being a practicable, cheaper, and clean energy for Pakistan in Power Generation Policy. Pakistan has successfully generated cheaper and sustainable electricity from hydropower over the decades. Hence, Private Power and Infrastructure Board (PPIB) should take practical measures for hydropower development.
- Address the environmental concerns in coordination with the Ministry of Climate Change clearly in the Power Generation Policy, keeping in view the current scenario of climate change and its complex nexus with energy, water and environmental security. Integrate the energy security, climate change and water security nexus in energy policies in Pakistan
- Enhance the capacity of ARE policy through visualizing the right primary energy mix, optimize the share of renewables, safety, energy intensity, land use, noise, water security, SDGs, SACEP, access to energy and decentralized energy supply for remote areas.
- Revisit the National Power policy and add guidelines for regional energy trade.

2. The Alternative Energy Development Board (AEDB) should consider ARE as a suitable option for remote areas of Sindh and Baluchistan which have poor road infrastructure and the high cost of transmission lines.

3. The Ministry of Water Resources in collaboration with Indus River System Authority (IRSA) should:

- Direct Water and Power Development Authority (WAPDA) to introduce the integrated water resource management in Pakistan.
- Revise the IRSA accord, ensure implementation of National Water Policy of Pakistan and structure the water governance in provinces according to 18th amendment
- The National Water Policy refers Provincial Environmental Protection Acts and Climate Change Act 2017as a legal framework which have low capacity for water resources management. Hence, there should be independent Water Act.

- Engage officials in collaboration of the Ministry of Foreign Affairs with Afghanistan on settlement of water dispute.

4. The Ministry of Water Resources and Ministry of Inter-provincial Coordination in coordination with IRSA and Council of Common Interest should negotiate for the settlement of disputes regarding royalties, dam construction, ownership, the understanding of consequences of water insecurity, value the ecosystem services, recognize the worth of water resources among the provinces and build new reservoir on Indus River Basin as soon as possible.

5. The Government of Pakistan in coordination of the Ministry of Climate Change should redefine the climate change governance structure in Pakistan according to 18th amendment, review the climate change policies and plans according to provisions of SDGs and Paris agreement (assess the Nationally Determined Contributions (NDCs).

6. The Governments in South Asia in collaboration with the Ministries of Foreign Affairs should:

- Formulate and implement the regional energy policy like European Energy Strategy. Since complex geo-political circumstances may demote the success of regional energy policy. Review of SAARC Framework Agreement on Energy Cooperation and development of regional energy guideline will be convenient for member states. The member states have an opportunity to develop guidelines by following the mechanism of South Africa Energy Pool, East Africa Energy Pool, Nordic Power Pool and Greater Mekong Sub-region.
- Review the regulatory mechanism, develop a mutual administrative mechanism for duties, taxes, land use and secure supply and harmonize the individual energy policies with regional requirements for energy trade and SDGs.
- Develop a competitive market for regional energy trade to change the traditional political mind set and rethink about rethink about historical mistrust.
- Identify the requirements of dispute settlement, initiate the negotiation and diplomacy. However, environmental diplomacy through global institutes (UNEP, IUCN, World Bank) might be useful in geo-political context of South Asia.
- Initiate environmental diplomacy and revisit the Indus Water Treaty, ensure data exchange in time, measure the capacity of commissions for cooperation,

comply the provisions of water treaties, neutral the mistrust and collaborate to cooperate on water resource management in South Asia

- Revisit Dhaka Declaration on Climate Change and Thimphu Statement on Climate Change to develop comprehensive regional guidelines for climate change mitigations.
- Conduct detailed climate vulnerability assessment, develop climate change inventory for each country and integrate environmental challenges (energy, water and climate change) in national policies and foreign policy
- Rationalize the technical, human, financial and administrative disagreement to mitigate climate change in Pakistan as well as South Asia because it has been observed low priority of the governments, insignificant budget, inadequate technical and human resources to combat climate change in South Asia.
- Initiate the diplomatic negotiations to enhance the capacity of SAARC to mitigate of climate change and practice environmental diplomacy to render cooperation between provincial entities, ministries and regional cooperation.
- Utilize the non-state stakeholders like business, industry, media and NGOs to ensure environmental sustainability and security.
- Initiate the environmental diplomacy for trust building, dispute settlement for long-term cooperation, sustainable development and environmental security.

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Annexure 1 Energy security, environmental security and development

Annexure 1(a) The significance and existing ranking of energy policies in Pakistan through MCDA

Criteria		Significance Ranking	NPP	PGP	ARE Policy
Technical					
Identification of potential (energy resources)	C1	84	10	10	90
Future energy demand	C2	80	10	10	60
Right Primary energy mix	C3	79	10	10	37
Efficiency	C4	85	40	45	80
Reliability	C5	77	50	80	82
Maturity	C6	69	80	60	63
Safety	C7	69	10	10	10
Economic					
Competitive investment	C8	74	70	66	77
Operation and maintenance cost	C9	73	55	74	73
Fuel cost	C10	71	75	10	65
Net present value	C11	68	53	50	57
Payback period	C12	76	40	47	65
Service life	C13	74	10	10	10
Equivalent annual cost	C14	65	10	10	70
Affordability	C15	80	70	80	80
Subsidies	C16	70	75	67	83
Compatibility with industrial growth	C17	78	10	10	10

Tax	C18	63	43	44	51
Environmental					
Emissions	C19	80	10	10	60
Land use	C20	70	10	10	10
Noise	C21	65	10	10	10
Water security	C22	85	10	10	10
Climate change	C23	70	10	10	38
Sustainable development goals	C24	75	30	30	40
South Asia Co-operative Environment Programme	C25	60	10	10	10
Socio-political					
Access to energy as basic human right	C26	83	10	10	60
Social Acceptability	C27	78	60	58	75
Job creation	C28	68	10	70	60
Social benefits	C29	80	70	72	65
Cooperation	C30	77	70	80	75

Annexure 1(b) Significance ranking and existing ranking of selected criteria in energy policies in South Asia

Technical									
Criteria	**Significance Ranking**	**AFG**	**BGD**	**BTN**	**IND**	**MDV**	**NPL**	**PAK**	**SLK**
C1	83	84	85	86	85	83	80	85	84
C2	79	55	63	81	10	10	80	10	74
C3	80	10	60	75	57	55	70	56	65

C4	68	30	45	60	55	40	57	55	56
C5	71	40	59	64	10	10	10	10	10
Economic									
C6	80	10	10	77	10	10	10	10	10
C7	71	51	10	73	10	10	10	10	10
C8	83	10	77	85	10	73	83	10	79
C9	72	10	10	73	10	10	10	10	10
C10	83	80	83	86	85	83	84	85	83
C11	68	40	45	70	10	65	49	10	10
Environmental									
C12	68	10	69	70	60	62	55	10	40
C13	67	10	10	65	10	10	10	10	10
C14	80	10	10	10	58	10	10	10	10
C15	69	10	10	10	56	10	10	10	10
C16	72	10	10	10	10	10	10	30	10
C18	55	10	10	10	10	10	10	10	10
Social									
C19	81	60	72	80	75	70	78	10	65
C20	74	50	10	10	10	68	60	50	59
C21	73	60	59	70	53	60	65	53	60
C22	72	57	10	77	10	70	60	10	70
C23	72	40	45	70	50	59	65	50	60
Political									
C24	92	90	90	90	90	90	90	90	90
C25	78	70	10	78	10	10	10	10	10

C26	77	50	10	70	10	10	60	10	55
C27	81	10	10	70	10	10	10	10	10
C28	83	10	10	10	10	10	10	10	10

Annexure 1(c) Significance ranking and existing ranking of selected criteria in ARE policies in region

Technical							
Criteria	**Significance Ranking**	**AFG**	**BGD**	**BTN**	**IND**	**NPL**	**PAK**
C1	83	83	85	84	86	80	86
C2	79	61	70	75	75	70	75
C3	80	69	70	73	70	65	70
C4	68	57	10	64	75	10	71
C5	71	50	53	50	10	10	10
Economic							
C6	80	25	60	52	65	25	65
C7	71	10	10	65	10	10	10
C8	83	10	10	80	39	79	40
C9	72	10	10	10	10	10	10
C10	83	80	83	84	85	83	85
C11	68	60	69	62	67	60	60
Environmental							
C12	68	47	70	70	63	55	55
C13	67	10	10	67	10	10	10
C14	80	10	10	10	55	10	10
C15	69	10	10	10	55	10	42
C16	72	10	10	10	10	10	40

C18	55	10	10	10	10	10	10
Social							
C19	81	62	60	62	71	67	60
C20	74	55	10	10	10	61	60
C21	73	57	61	75	60	62	60
C22	72	60	10	70	10	50	10
C23	72	56	60	74	63	60	64
Political							
C24	92	90	90	90	90	90	90
C25	78	54	10	77	10	10	10
C26	77	50	10	25	38	57	40
C27	81	10	10	65	10	10	10
C28	83	10	10	10	10	10	10

Annexure 2 Water, environmental security and development in South Asia

Annexure 2(a) Significance ranking and existing ranking of selected criteria in water policy and accord in Pakistan

Criteria	National Context (Significance Ranking)	IRSA Accord	National Water Policy
Technical			
C1	89	10	40
C2	72	30	70
C3	75	80	10
C4	65	75	75
C5	87	65	80
C6	93	50	85

Economic			
C7	82	10	60
C8	70	10	56
C9	74	60	70
C10	75	10	10
C11	71	10	40
C12	76	10	60
Environmental			
C13	86	10	75
C14	78	10	80
C15	73	10	60
C16	67	10	70
C17	84	10	75
C18	85	10	80
Social			
C19	74	10	67
C20	64	10	10
C21	65	10	70
C22	66	60	70
Political			
C23	87	60	65
C24	79	75	76
C25	69	30	60
C26	74	60	65
C27	70	65	73

C28	67	70	70
C29	68	57	60
C30	83	60	77
C31	81	10	64
C32	62	20	65

Annexure 2(b) Significance ranking and existing ranking of selected criteria in regional water treaties

Criteria	Regional Context (Significance Ranking)	The Indus Water Treaty	Treaty on Sharing of Ganges Water	Treaty of Mahakali
Technical				
C1	86	10	10	10
C2	66	67	58	63
C3	74	60	78	78
C4	79	10	80	80
C5	82	60	56	55
C6	80	79	75	76
Economic				
C7	78	40	45	43
C8	77	10	10	10
C9	66	20	60	72
C10	73	10	10	10
C11	63	10	10	10
C12	68	10	10	10
Environmental				

C13	78	10	10	10
C14	82	10	10	10
C15	72	10	10	10
C16	66	33	31	30
C17	81	10	10	10
C18	79	30	10	26
Social				
C19	70	10	10	10
C20	73	10	10	10
C21	70	68	61	65
C22	77	70	75	73
Political				
C23	84	67	78	80
C24	82	65	77	74
C25	72	75	69	75
C26	75	64	70	72
C27	70	70	70	70
C28	74	76	75	75
C29	64	65	66	62
C30	83	70	73	72
C31	83	70	30	67
C32	79	60	70	70

Annexure 2(c) Significance ranking and existing ranking of selected criteria in regional water policies

Criteria	Regional Context (Significance Ranking)	BGD	BTN	IND	NPL	PAK	SLK
Technical							
C1	86	10	70	40	80	40	75
C2	66	60	69	74	30	70	57
C3	74	10	10	10	10	10	10
C4	79	10	10	10	10	75	10
C5	82	75	80	80	55	80	68
C6	80	55	75	70	60	85	60
Economic							
C7	78	60	61	70	30	60	45
C8	77	69	67	59	40	56	40
C9	66	75	81	60	30	70	56
C10	73	10	30	10	10	10	10
C11	63	65	70	60	40	40	40
C12	68	78	75	77	50	60	50
Environmental							
C13	78	30	60	79	35	75	60
C14	82	10	50	75	10	80	10
C15	72	60	55	70	10	60	10
C16	66	40	57	60	30	70	40
C17	81	55	65	72	10	75	45

C18	79	60	70	78	50	80	55
Social							
C19	70	80	70	64	55	67	60
C20	73	10	10	10	10	10	10
C21	70	75	65	60	40	70	65
C22	77	80	79	80	53	70	70
Political							
C23	84	66	74	70	60	65	61
C24	82	70	75	76	55	76	65
C25	72	75	70	80	60	60	65
C26	75	80	76	81	55	65	70
C27	71	70	75	70	56	73	60
C28	74	76	75	79	60	70	70
C29	64	67	70	78	40	60	65
C30	83	77	70	60	10	77	78
C31	83	70	65	75	30	64	45
C32	79	70	58	60	40	65	59

Annexure 3 Climate change, environmental security and development

Annexure 3(a) Significance ranking and existing ranking of selected criteria in CC policy and Framework in Pakistan

Criteria	National Context (Significance Ranking)	National Climate Change Policy	Framework for Implementation of Climate Change Policy
Technical			
C1	82	70	72
C2	80	69	74
C3	73	65	70
C4	78	75	75
C5	69	60	68
Economic			
C6	77	30	40
C7	78	40	53
C8	62	10	10
C9	74	10	10
C10	77	40	60
C11	43	10	10
C12	64	25	30
Environmental			
C13	77	75	70
C14	76	80	79
C15	81	72	70
C16	83	75	70
C17	71	70	65
C18	79	40	30

C19	63	40	10
C20	71	70	65
C21	69	10	60
Social			
C22	76	60	30
C23	70	70	40
C24	67	40	10
C25	77	65	68
C26	79	70	60
C27	66	50	50
Political			
C28	85	65	65
C29	77	75	70
C30	78	60	60
C31	76	10	10
C32	72	65	10

Annexure 3(b) Significance ranking and existing ranking of selected criteria in CC policies and plans in regional context

Criteria	Regional Context (Significance Ranking)	AFG	BGD	BTN	IND	MDV	NPL	PAK	SLK
Technical									
C1	76	60	75	70	72	75	73	70	80
C2	75	50	66	60	75	65	71	70	75
C3	70	10	68	54	69	75	60	65	60

C4	72	30	60	65	75	68	40	75	65
C5	66	45	70	65	60	55	55	60	65
Economic									
C6	72	10	70	35	30	70	30	30	40
C7	72	30	66	60	40	75	63	40	65
C8	64	10	40	57	45	30	40	10	30
C9	70	10	50	10	10	10	10	10	10
C10	77	10	59	40	50	53	56	40	35
C11	51	10	10	10	10	10	10	10	10
C12	65	10	45	10	40	40	30	25	45
Environmental									
C13	72	20	60	55	73	75	71	75	72
C14	75	60	55	67	75	73	65	80	78
C15	80	55	60	73	77	80	70	72	77
C16	80	50	57	63	76	65	60	75	60
C17	67	60	63	57	70	68	71	70	70
C18	72	10	30	40	65	55	60	40	50
C19	62	10	30	36	40	30	45	40	50
C20	74	40	78	68	70	75	67	70	75
C21	67	58	64	62	65	70	64	10	65
Social									
C22	68	60	65	70	70	65	67	60	63
C23	66	52	76	30	65	72	70	70	72
C24	67	10	70	45	70	77	72	40	78

C25	78	43	73	55	64	73	63	65	76
C26	77	30	57	53	76	70	68	70	72
C27	67	10	40	40	50	65	52	50	55
Political									
C28	84	55	65	70	70	74	76	65	68
C29	80	40	73	70	73	64	69	75	70
C30	76	45	60	51	60	59	63	60	64
C31	75	10	30	36	65	78	42	10	40
C32	76	30	60	63	70	75	60	65	58

Annexure 4

QUESTIONNAIRE FOR EXPERT OPNION

This questionnaire is the PhD research on "The relationship of environmental security with development at national and regional level. Gathering the information from expert in context of environmental security and development for academic purpose only.

General Information

Qualification: _____ Experience:_____

Area of Expertise's:_____

Email: _____

Country:

(•) Afghanistan ( ) Bangladesh ( ) Bhutan ( ) India ( ) Maldev ( ) Nepal ( ) Pakistan

( ) Srilanka

Environmental security and Development

1. The development is linked with environmental security

(•) Strongly Agree ( ) Agree ( ) Disagree ( ) Strongly Disagree

2. Environmental factors are an essential component of an emerging discourse of International Relations

(•) Strongly Agree ( ) Agree ( ) Disagree ( ) Strongly Disagree

3. Environmental factors have a significant impact on foreign policy

(•) Strongly Agree ( ) Agree ( ) Disagree ( ) Strongly Disagree

4. Environmental insecurity and mismanagement of resources can destabilize the state

(•) Strongly Agree ( ) Agree ( ) Disagree ( ) Strongly Disagree

5. Environmental challenges such as climate change water and energy security are destabilizing the South Asia.

(•) Strongly Agree ( ) Agree ( ) Disagree ( ) Strongly Disagree

6. Climate change is complicating the nexus of water and energy security

( ) Strongly Agree ( ) Agree ( ) Disagree (•) Strongly Disagree

7. The South Asian countries have integrated climate change, water and energy security nexus in their national policies and discourse of international relations

◉ Strongly Agree ○ Agree ○ Disagree ○ Strongly Disagree

8. Which one is leading cause of conflicts in South Asia?

◉ Water ○ Energy ○ Climate Change

9. The South Asian countries should settle environmental issue to alleviate poverty, sustain development and human security

◉ Strongly Agree ○ Agree ○ Disagree ○ Strongly Disagree

10. There is need to initiate negotiation and environmental diplomacy to settle environmental conflicts

◉ Strongly Agree ○ Agree ○ Disagree ○ Strongly Disagree

11. There is sufficient institutional capacity to settle environmental conflicts regional levels

◉ Strongly Agree ○ Agree ○ Disagree ○ Strongly Disagree

12. The global environmental institutions can play an effective role to settle environmental conflicts.

◉ Strongly Agree ○ Agree ○ Disagree ○ Strongly Disagree

13. The business and industry as non-state stakeholder can play an effective role to settle environmental conflicts.

◉ Strongly Agree ○ Agree ○ Disagree ○ Strongly Disagree

14. The media as a mode of awareness and non-state stakeholder can play an effective role to settle environmental conflicts.

◉ Strongly Agree ○ Agree ○ Disagree ○ Strongly Disagree

15. The NGOs as non-state stakeholder, establish lobbying and capacity building can play an effective role to settle environmental conflicts.

◉ Strongly Agree ○ Agree ○ Disagree ○ Strongly Disagree

Comments: