Journal of Management and Administrative Sciences
https://jmas.pk
(ISSN 2790-7899)
Vol. 5, No. 1, June 2025

The Role of State in Natural Gas Resource Management and Allocation Policy: The Case of CNG Sector in Pakistan

Muhammad Moin Zafar [1*], Dr. Kashif Rathore [1]

[1.] *Institute of Administrative Sciences (IAS), University of The Punjab, Lahore, Pakistan;* mueen92@ymail.com

Article Information

Article history:
Submitted: 12th June, 2025
Accepted: 22nd June, 2025
Published: 30th June, 2025

Volume No. 05
Issue No. 01
ISSN: 2790-7899

Keywords:
Natural Resource Management;
Natural Gas;
CNG Sector;
Energy Policy;
Pakistan Energy Crisis

Abstract

Effective resource management is essential for the continued progress and economic growth of any country. Natural gas is one of the resources which fulfill most energy requirements of Pakistan. Since 1990s, Pakistan is facing serious energy crisis which compromised its economic growth seriously. At the same time, the country had to spend hefty amount of foreign exchange on the import of petrol and diesel to fulfill energy requirements of different sectors. In order to resolve these crises and save heavy amount of foreign exchange, the Government of Pakistan introduced Compressed Natural Gas (CNG) an alternative fuel for vehicles in 1992. This paper analyzes official documents and published research to discuss the effectiveness of natural gas management with reference to its allocation to the CNG sector by the successive governments in Pakistan. Qualitative research strategy has been adopted to triangulate documentary evidence with interview data and it has been found out that although Pakistan has got the resource potential to cater the CNG sector, but successive governments since 1990s have not been able to effectively manage it. Failure to formulate a sound policy for natural gas management and allocation to different sectors and failure to initiate enough exploration projects were the key reasons identified.

Introduction

All countries have to make serious and persistent efforts in a globalized world for their sustainable growth and development so that the nation may be able to survive and prosper in the era of 'new political economy' (Haque, 2002). It has become inevitable for the countries to focus on economic prosperity not only to provide its citizens with the basic needs but also for a sustainable and honorable survival in a globalized environment. It is quite understandable that a country would not be able to provide citizens with basic amenities of life and minimum services if it does not possess enough resources, or fails to develop or manage resources it is bestowed with (Baumol, 1986; Bérenger & Verdier-Chouchane, 2007; Kellert, Mehta, Ebbin, & Lichtenfeld, 2000; Mujtaba, 2024; Paulsson, Koch, & Fritz, 2025; Ribeiro-Soriano, 2017; Wojcik, 2018).

Countinous economic growth demands that the state should govern and guide the efforts of all stakeholders of the country according to a structured plan in order to ensure the economic and social development of its people (Beck, Ferasso, Storopoli, & Vigoda-Gadot, 2023; Boer, 1997a; Holden, Linnerud, & Banister, 2017; Schumpeter & Backhaus, 2003). Besides other factors identified in the literature, the role of 'effective resource management' is significantly and centrally associated with sustainable economic development of a country (Burton & Kates, 1967; Costanza & Daly, 1992; Costanzo, 2011; Hidayat, Rangkuty, & Ferine, 2024; Keohane & Olmstead, 2016; Zhao & Rasoulinezhad, 2023).

Pakistan has faced serious economic crisis during the last two decades and the country has not registered any significant economic growth during this period. There are many driving factors in this regard ranging from developments in global economy to mismanagement and malfunctioning of the state institutions, but energy crisis is one of main reasons because of which Pakistan is facing current economic crisis. Energy crisis remained a primary governance issue in the last decade and till date Pakistan is unable to find any way out from this situation (Aftab, 2014; Anwar & Saeed, 2023; Hye & Riaz, 2008; Usman, Raza, Shahbaz, Ahmad, & Naveed, 2024; Valasai et al., 2017).

Nature has blessed Pakistan with several resources which may be used to generate energy. Some of the options which government of Pakistan may use are crude oil, natural gas, coal, hydro energy, nuclear power, wind energy, solar energy, bio mass & bio fuels and geo-thermal energy (Arshad, 2024; Asif, 2009; Khaliq, Atique, Hina, & Bilal, 2024; Shahbaz, Zeshan, & Afza, 2012; Sheikh, 2010).

This paper aims at studying management of natural gas resource with reference to one of its products; Compressed Natural Gas (CNG). Natural Gas remains primary source of energy generation in Pakistan since 1950s. Currently Natural Gas fulfills 29 % of country's energy requirements (Abbasi, 2014; Economic Advisor's Wing Finance Division Government of Pakistan, 2024; Mahmood et al., 2014; OGRA, 2016, 2017; Shoaib, 2013).

The commercial use of natural gas started in Pakistan in 1955 and till 1970s Natural Gas was only allocated for the industry and power generation. Though some other sources such as Oil, Hydro, Nuclear, Coal and LPG were also used to generate power (electricity) but Natural Gas remained the primary source of electricity production. However, in 1971, as a result of policy shift, government decided to provide natural gas to the domestic users in small towns and villages. Gas to domestic users, was provided at such a pace that house hold consumption of gas increased from 2% to 21% from 1971 to the year 2012 and this trend is still continuing (Abbasi, 2014; OGRA, 2016).

In 1992, again as a result of policy shift, government decided to use natural gas as a commercial fuel for transport industry in the form of Compressed Natural Gas (CNG). A rigorous public campaign was launched to communicate economic and social benefits of using CNG as an alternate fuel to petrol and diesel. As a result, till 2016, almost 3.5 million vehicles have been transferred to CNG. More than 3500 CNG filling stations have been established in more than 100 cities of the country and Pakistan has been declared as one of world's largest CNG users. Finally, in 2008 government imposed a ban on establishment of new CNG stations (Ahmed, Chaudhry, Farooq, & Riaz, 2013; Kiani, 2016).

Though Pakistan had one of the largest CNG sector in the world, but now this sector is facing serious crisis of natural gas shortfall. Shortfall of natural gas has adversely affected all stakeholders of CNG sector such as CNG station's owners, transporters and general public. Under the current policy, gas is only available to the consumers for a limited number of days in a week

which has created a lot of inconvenience for the people who have converted their vehicles to CNG and also for those passengers who travel in public transport converted to CNG (Ahmed et al., 2013; Hasnain, 2017).

Considering the current CNG crisis and reviewing the available literature regarding the principles of natural resource management this paper answers the following key research question: **Has Pakistani State effectively managed natural gas resources to utilize CNG as alternate fuel?**

A number of sub-questions are posited to answer this key question:

1. Does Pakistan have resource potential to cater CNG sector?
2. Does Pakistan have enough natural gas supply to cater CNG sector?
3. Has desirable level of natural gas exploration and development been carried out in the recent past?
4. Has state made effective policy of natural gas allocation?

State, Socioeconomic Development & Natural Resource Management:

It is the responsibility of state to guarantee collective good of people by providing them with all basic necessities of life as well as ensuring country's overall social and economic welfare. As per the social contract theory, people vest their right of decision making in a group of people (government) so that their collective good must be ensured (Boer, 1997a; Hasan, Wang, Khoo, & Foliente, 2017; Riley, 1999; Sasan, 2021).

In developmental context, creation of opportunities for fulfillment of citizens' needs to achieve their fullest potential and their life aspirations is a basic state responsibility (De Mesquita & Downs, 2005; Dreze & Sen, 2013). At a national policy and planning level, this translates into creation of opportunities in social and economic sectors (Asad, 1961; Heyman; Paz-Fuchs, 2011; Whaites, 2008; Wojcik, 2018).

Social development is also important for any country's survival and stability. If a state could not assure a stable and equitable value system for its society, the peaceful 'play of power', the acceptance of others' mandate and institutional legitimacy may not be possible (Adelman & Morris, 1973; Paz-Fuchs, 2011). On the other hand, without having well-developed social value system it is difficult to pinpoint and criticize the wrong policies and practices on the part of the state authorities. This kind of situation may lead to over dominance, or worse, dictatorship by one section or group in the society on state policies and the consequences may be devastating (Dakhli & De Clercq, 2004; Haque, 1997; Hasan et al., 2017; Lipset, 1959).

Similarly, without taking regular and planned economic initiatives; it's often not possible for states to enjoy steady economic growth and a dignified status in the current global political context (Haque, 2002).

Whereas the postwar economists of 1950s and 1960s favored structural reforms and direct state intervention for economic development. This trend tilted in favor of neoliberal market reforms and shrinking direct role of state in economic development since 1970s. The current development thinking suggests that a state's role should be to develop a healthy and conducive microeconomic and macroeconomic environment for socioeconomic development and growth to take place. Development of such an environment includes policies and institutions for efficient and sustainable allocation and utilization of natural resources (Haque, 1997; Shiferaw, Okello, & Reddy, 2009).

Economic Development & Natural Resource Management:

Concentration of natural resources and their effective management are cited as one reason for different states of development in developing countries (Davis & Prado, 2014; Van Assche, Beunen, Duineveld, & Gruezmacher, 2017). It has been argued that it's not necessary that countries having significant amount of natural resources should also have good economic condition (Burton & Kates, 1967; Krypa, 2017). Africa is one of the classical examples that despite having plenty of natural resources could not manage these resources for economic development. Pakistan is yet another example which could not capitalize on its own despite of having significant wealth of natural resources (Suleri, Shahbaz, & Khwaja, 2010). This suggests that having natural resources is not a guarantee of economic growth and development. Rather it also depends on effective management of natural resources (Omara-Ojungu, 1992; Stern & Coleman, 2015).

Economic development theories propose that the four key factors of production, i.e. Land, Labor, Capital and Organization, which are required to produce any type of wealth, are combined and integrated in various configurations and requisite ratios according to policy considerations in order to produce the intended outcomes. Many of the agrarian economies such as Pakistan depend on just one of these factors of production, i.e. Land. Natural resources are one way in which a land may be endowed by the nature. So, if a state manages to ensure the sustainable development and supply of natural resources for domestic and commercial use, it may enable her to fulfill most of its energy requirement (Dilts, 2004). This means that resource management is vital and essential for sustained and steady economic growth and development. It has been argued that "resources are not, they become" (Zimmerman, quoted in Peters et al., 2014). It is interesting to note that the ability of an 'object' to become a 'resource' depends upon its capability to serve human needs. Copper ores is a classic example that its used to be considered mere rocks prior to the discovery of its valuable use in electrical products industry. Its ability to serve people enhanced its level of importance and made it a worthy resource. A resource can be considered as that part of any environment which has the ability to serve humans (Omara-Ojungu, 1992; Panayotou, 2016). Thus, resource management can be conceived as a policy-level decision making process taking place in settings of mutual trust in which "optimal solutions regarding the manner, timing and allocation of resources are sought within the economic, political, social and institutional framework" (Bernheim & Whinston, 1986; Stern & Coleman, 2015).

As a consequence, resources are allocated over space and time according to needs, aspirations and desires of society bounded by its technological inventiveness and institutional arrangements for socioeconomic development (Birnbaum, Bodin, & Sandström, 2015).

Referring to the aforementioned description, authors postulate that **resource management** is about making policy decisions for **development** and **allocation** of resources and these decisions must be in accordance with the citizens' needs and requirements (Birnbaum et al., 2015; Stern & Coleman, 2015). Resource allocation presupposes 'availability of resources' such that resource should be in reach of end users so that they may avail their allocated share (Burton & Kates, 1967; Mitchell, 1989; Odum & Barrett, 2004; Omara-Ojungu, 1992). Our conceptualization of the 'Resource Management' process is illustrated in Figure 1 below:

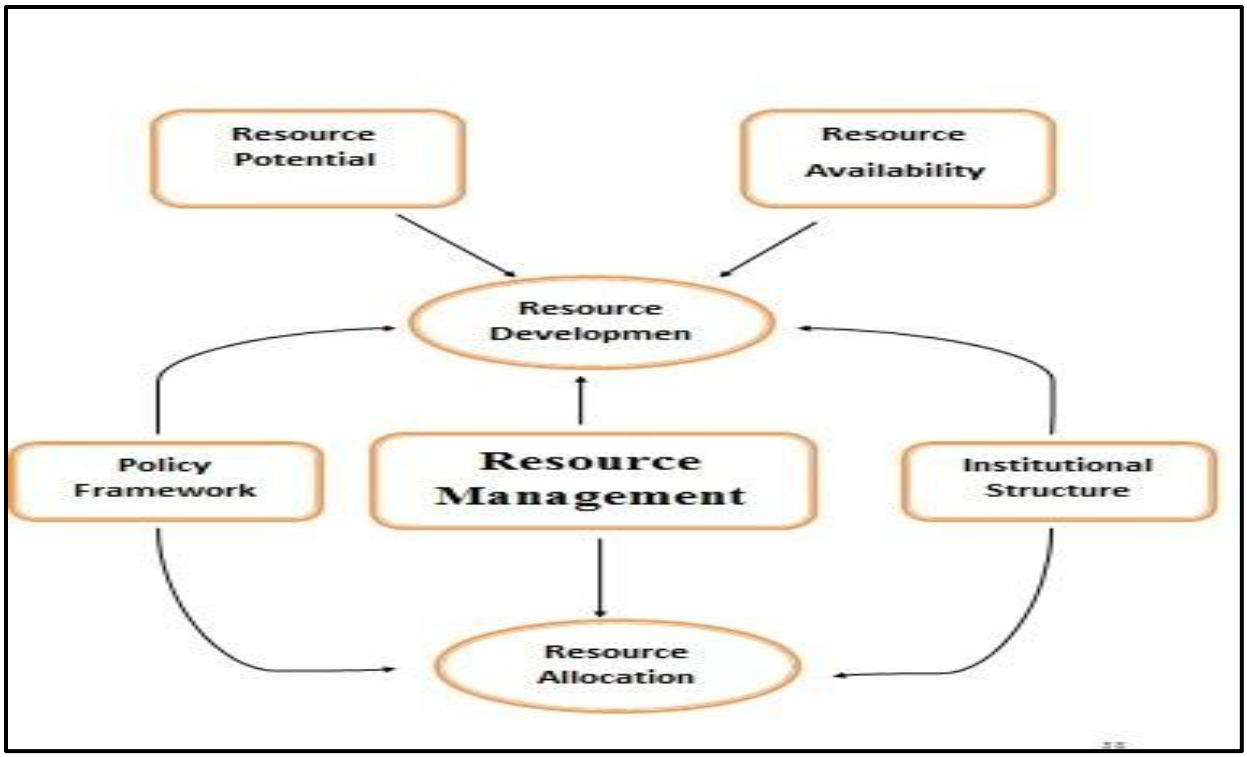

Figure 1: The Resource Management Process

Resource Development & Allocation:

This leads to a discussion of resource development. The world 'development' is very commonly used and discussed both by laypersons and scholars.

"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" may be termed as sustainable development (European Commission, 2002). While Mitchell (1989) has defined resource development as: "the actual exploration or use of a resource during the transformation of natural stuff into a commodity or service to serve human needs and aspirations".

Omara-Ojungu (1992) has mentioned following four approaches which are used to manage development and allocation of resources; Ecological Approach, Economic Approach, Technological Approach and Ethnological Approach.

Ecological approach focuses at understanding the relationship between man and its environment is very important in regard of effective resource management. It has been stated that the environment is consisted on physical and biological components. As per recommendations of Ecological approach, resource allocation is done on the basis of functional components of physical and biological environment. The ultimate goal of managing land, at this level, is to ensure sustainable use of natural resource. Ecological approach prescribes the following steps while making decisions of resource allocation; (i) Identification of community zones through ecosystem inventory (ii) Identification of natural process which leads to stability and determination, (iii) Analysis of functional component's significance through inventory data and (iv) Finally recommendation of alternatives (Odum & Barrett, 2004).

Economic approach of resource management says that the resource allocation should be done on the basis of rational decision making ('Cost and Benefit' analysis). But interestingly rational decision making is only possible in the free and competitive market economy, which itself

is an ideal situation. One of primary assumption of economic approach of resource management is that resources are scares and in order to utilize certain resources the user has to forgo others. In order to achieve maximum benefits from limited resources resource users aims at achieving economic efficiency which require certain assumptions: (i) Production factors (Land, Labor, Capital, Organization) are hardly substitutable (ii) Consumer (of different people) preferences are known and their demand can be identified (iii) Quantification of benefits from resource utilization is possible and (iv) Resource utilization leaves no Impact on Economic situation and Physical Environment (Dilts, 2004; Stratford & Mortier, 1999; Yiftachel, Peled, Hadar, & Goldwasser, 2006).

Though the concept of 'Economic Efficiency' appears very fascinating, but serious critique has been made on the basic assumptions of this concept. Several scholars have this consensus that it is very difficult to make an idea about different preferences of infinite consumers. Similarly, 100% accurate quantification of gained benefit in result of utilization of any resource is yet another impossible thing. Simple thing in perfect judgment about human behavior is that it appears as nonrealistic phenomenon because it may be the most changing thing because of being highly vulnerable to the external factors (Feenberg, 2008; Mendoza & Martins, 2006).

Though **technological** approach of resource management is an independent thought but it may also be considered as an aid to the effective implementation of Economic Approach. With special reference to industrial scenario, technological advancements and progress is defined as 'change in the methodology of production to get more volume of output with a certain amount of input resources' or in other way around 'achieving certain level of production through minimum or reduced level of utilization of resources'. It is also a fact that with the invention of modern technology and technologically driven systems, significant methodological changes in natural resource extraction has been witnessed. These systems also served the purpose of economic efficiency in the effort of resource management (Merem & Twumasi, 2008; Weeks & Adams, 2017).

While ecological, economic & technological approaches describe the dynamics of resource management from the administrative and managerial perspective, **ethnological** approach deals with resource management from community and cultural perspective. Ethnological approach suggests that not all people perceive and utilize the resources in the same way. It is the cultural differences which create different cognition of resources and resource environments according to the customs and traditions prevailing in those cultures (Cheng, Kruger, & Daniels, 2003; Leach, Mearns, & Scoones, 1999). Thus, according to ethnological approach cultural consistency is imperative for developing resource allocation strategy. For evaluating alternative policy options, it is important to determine the 'social and cultural worth' of resource policy for resource management and allocation**.** Some scholars stretch this argument by asserting that even decisions about resource development should conform to norms and expectations of local communities (Brosius, Tsing, & Zerner, 2005; Leach et al., 1999).

Resource Management of Natural Gas in Pakistan:

Nature has endowed Pakistan with plenty of natural gas reserves. According to an estimate Pakistan has got 282 Trillion Cubic Feet (TCF) of potential natural gas reserves but as matter of fact the country has only been able to recover 63 TCF of natural gas (Moeen & Memon, 2023; OGRA, 2016; Rasheed, 2014; Shair, 2024).

As shown in Table 3 below, there is a clear disparity between production and consumption of natural gas in all provinces of Pakistan except Khyber Pakhtunkhwa (KPK). The majority share of natural gas is being produced by the province Sindh (67%) followed by Baluchistan (18%),

KPK (12%) and Punjab (3%). Despite producing least amount of natural gas, Punjab consumes the lion share (47%) of the same. There may be different factors such as political, social, economic, etc., responsible for this consumption pattern. Punjab has got largest industrial sector, highly populated localities and without any element of doubt the province has significant influence on federation level policy making. On the contrary Baluchistan's situation is almost opposite: it is sparsely populated with an under developed industrial sector and has little influence on federation level policy making (Nazir, 2008).

Table 3

Province Wise Natural Gas Production (Supply) to SNGPL & SSGCL & Consumption

Province	FY 2015-2016		FY 2016-2017	
	% Production	% Consumption	% Production	% Consumption
Punjab	3	42	3	47
Sindh	68	46	67	43
Baluchistan	19	2	18	2
KPK	10	10	12	8

Source: Oil & Gas Regulation Authority, 2017

As far as sectoral allocation is concerned; power sector is the largest user of natural gas (31%) followed by industrial sector (25%), domestic sector (22%), fertilizer sector (16%), commercial sector (3%) whereas CNG sector only uses 3% of natural gas (Moeen & Memon, 2023; OGRA, 2017).

Institutional Framework for Natural Gas Management:

Pakistan government has established Ministry of Petroleum & Natural Resources (MPNR) to perform fuel management in the country. MPNR makes policies regarding Oil and Gas management on behalf of government of Pakistan and then all oil and gas relevant matters are being regulated by OIL & GAS Regulation Authority (OGRA). Oil and Gas Development Company Limited (OGDCL) is a state supervised institution which performs the oil and gas exploration under the as per policy guidance given by the government. Apart from OGDCL there are certain other companies that also carry out exploration operation. Distribution of natural gas is primarily done by two public sector corporations; Sui Sothern Gas Pipelines Limited (SSGPL) and Sui Northern Gas Pipelines Limited (SNGPL) (Hussain, 2013). Figure 2 illustrates Pakistan's institutional framework for natural gas management.

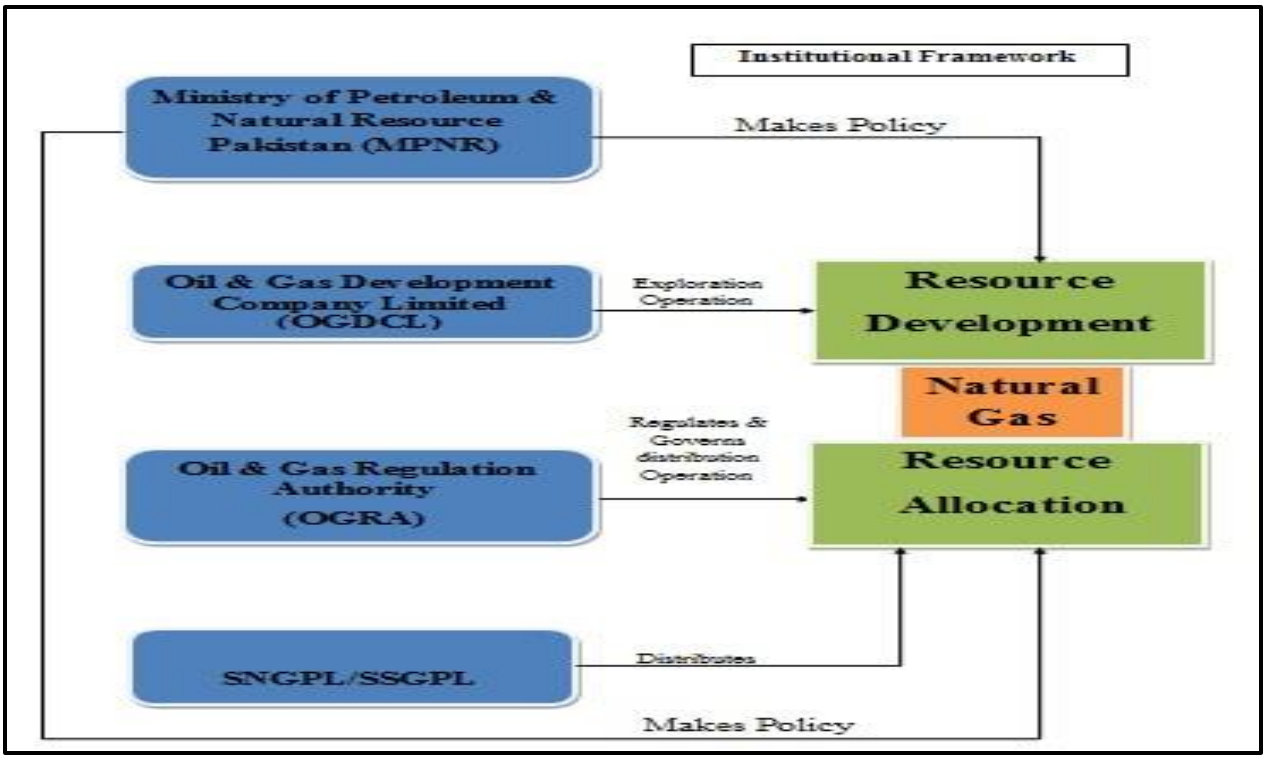

Figure 2: Pakistan's institutional framework for Natural Gas management.

Network Distribution and transmission pipelines have been established across the country by SNGPL and SSGPL. Transmission and Distribution network mileage of 13,989 Kilometers (KMs) and 161,806 KMs respectively. Additionally, there is are 41,463 KMs services gas pipelines that caters of more than 10 million consumers nationwide (Economic Advisor's Wing Finance Division Government of Pakistan, 2024).

Policy Framework for Resource Management of Natural Gas in Pakistan:

'Pakistan Natural Gas: Policy Analysis & Way Forward' (2023) is one of the recent policy documents which elaborates that how LPG would be used to support energy needs of the country (Moeen & Memon, 2023). Previously in 2013 Government of Pakistan issued National Minerals Policy that describes all policy guidelines to develop natural gas in order to fulfill requirement of Pakistani domestic and commercial sectors. MPNR has the mandate of making policies for the continuous development and progress of mineral sector in Pakistan. Exploration of mineral resources is one of the key objectives of the mentioned in the said policy by developing sophisticated administrative structure and building capacity of both federal and provincial institutions (Hussain, 2013). It is clear from Table 4 that the allocation of natural gas to domestic sector is the prime priority of the government while CNG sector stands fourth in priority list. Governments' intention to give first priority to domestic sector provides evidence that this is a politically driven policy for maximizing vote bank.

Table 4

Natural Gas Priority & Criteria Matrix for Different Sectors

Sector	Priority	Criteria
** Domestic ** Commercial Sectors	1st	** Yearly Target Set by Federal Govt. ** Encouraged
** Fertilizer ** Industrial Sector (Process Gas)	2nd	As Per Federal Govt. Decision (Keeping Domestic Needs & Supply Position in View)
Independent Power Plants/ WAPDA & KESC Power Plants	3rd	On Nine Months Basis
** General Industrial ** CNG Sectors	4th	** 12 Months for Process Gas/Nine Months for all others usages ** As per Existing Arrangement
WAPDA's & KESC Power Plants Captive Power Sectors	5th	** Dual fired power plants with a capacity of up to 50 MW will be encouraged for gas Supply ** Gas supply for self-power generation would be on "as and when available basis"
Cement Sector	6th	As & When Available Basis

Source:(Natural Gas Allocation Policy, 2005 & Ministry of Petrolum & Natural Resource, 2005)

Policy Initiatives for Natural Gas Management:

According to mineral report of 2013, Pakistani state aims at taking several initiatives for the effective development of Pakistan's mineral resources. Mineral wing of MPNR, with the help of all provinces, would conduct thorough analysis of all provincial level mineral sectors so that their efficiencies may be increased. The primary objective of R&D's enhancement is to replace all steps of conventional mechanisms of resource development such as; geological survey, exploration, mining, beneficiation, concentration of minerals. It has been asserted that modern technology based and non-conventional methods of exploration may transform Pakistan's mineral resources into valuable economic assets (Hussain, 2013).

It has been intended that Technical Education & Vocational Training Authority (TEVTA) should design, plan and execute such training and educational programs which may result in capacity development of people so that they may further contribute to the progress of mineral industry. State also has this intention to support this program by offering scholarships, loans and other incentives so that capable people should get motivation to participate and be a valuable potential resource for the mineral resource industry (Hussain, 2013; Shah, Rahman, Ajmal, & Hamidullah, 2011; Sohail, Huang, Bailey, Akhtar, & Talib, 2013).

Research Design and Methodology

Till this stage, analysis of official statistics was undertaken to describe natural gas management and policy in Pakistan. From this point onwards, qualitative interviews were conducted to gather information from an 'expert perspective' and validate descriptive analysis of natural gas management and policy in Pakistan. Qualitative research strategy has been adopted and cross-sectional design has been used to collect, interpret and analyze interview data about

natural gas and CNG management in Pakistan. 'Post positivist school of thought' has followed for analysis purpose that uses Constructionist paradigm. Reality has been understood through qualitative ways of inquiry and subjective methods of interpretation. Empirical logical ways of inductive reasoning have been used to discuss findings. Data collected through interviews is compared with the official and published statistics (Bryman, 2016; Hyde, 2000; McNabb, 2015; Sanders, 2012).

Sampling Frame, Sampling Strategy & Sampling Technique:

As mentioned above MPNR, OGRA, OGDCL, SNGPL/SSGPL, and All Pakistan Compressed Natural Gas Association (APCNGA) are the main stakeholders of natural gas and CNG sector. So, for that matter key informants of each mentioned organization were interviewed. 'Purposive sampling', one technique of non-probability sampling, has been used to select most relevant respondents for collection of required information in order to understand crisis of CNG sector (Patton, 1990).

Results & Discussion

As presented in the Figure 1 (The Resource Management Process) resource management is all about policy decisions regarding **Resource Development** and **Resource Allocation** which is being done through institutions established to perform said functions.

Resource Development (Natural Gas Production) & CNG Sector (Pakistan):

Most of the interviewees agreed that the main reason for CNG crisis in Pakistan is poor policy making by successive governments. Although successive governments saw encouragement of CNG sector as a popular strategy, they but it appears as they did not foresee the repercussions of allocating natural gas to CNG sector. Subsequently no arrangements have been made to ensure continuous supply of natural gas to the CNG sector which resulted in the crisis faced by CNG sector. This said claims seems conceivable in the light of following explanations given by interviewees:

> *"……. But unfortunately they didn't make any feasibility considering coming 25 years scenario that whether it would be available after 20 years or not. They didn't estimate that how many gas stations would be installed and how much quantity of gas would be available there. Because of that mismanagement currently we are facing shortage of gas in domestic and other sectors."*
>
> *"……. Now the situation is Pakistan has got largest CNG sector in the world, but the country is not following the international practices in regard of Gas development and allocation to CNG sector."*
>
> *"If you will make an effort to find facts you will come to know that after introduction of CNG SNGPL's UFG has been increased to great extent. Where that quantity is going and why this number is enhanced after introduction of CNG. It was a real blunder. The decision has been made without conduct any proper study and analysis. They must have worked out the prudent use of natural* gas instead of throwing it for natural gas."

Several reports by OGRA confirm the interviewees' understanding. The gap between demand and allocation of natural gas to CNG sector kept on widening continuously from the year 2000 onwards (Mirza, 2012). The natural gas allocated to CNG sector was 107 MMcfD in 2005-2006 that increased threefold to 310 MMcfD in 2012, and then reduced to 170 MMcfD despite projected demand of 900 MMcfD in 2016-17 (Mirza, 2012; OGRA, 2016, 2017). It has been asserted that If continuous increase in demand of natural gas by CNG sector would have been

considered by the state policy makers and more exploration projects would have been initiated, the situation might have been much better (Ahmed et al., 2013).

Resource development entails two major elements; resource potential and resource availability. As far as resource potential is concerned, Pakistan has natural gas reserves for more than 100 years to cater all sectors which use natural gas for their operations (Rasheed, 2014). But the recoverable reserve of natural gas is even not enough for 10 years (Kiani, 2016). Because of lack of natural gas exploration projects, the government does not have enough natural gas supply to cater above mentioned sectors. This has happened because governments didn't envision the future needs (natural gas supply requirements) of CNG sector when and after it was introduced in 1992 (Ahmed et al., 2013; Davis & Prado, 2014; Krypa, 2017; Stern & Coleman, 2015).

Natural Gas Allocation Management & CNG Sector:

In 2016-2017, most of the natural gas has been consumed by power and fertilizer sectors. On the contrary, CNG sector is among one of the smallest user of natural gas. CNG sector consumed only 4% of total natural gas production in 2017 while it was 11% in the year 2005 when there was no load shedding of natural gas for CNG sector (OGRA, 2016).

Interview data clearly indicates that natural gas allocation policy is largely a political process in Pakistan with little effective input from the technical side. Responses from different state officials working in institutions that manag natural gas sector show that they do not own or acknowledge the natural gas allocation policy made by the political governments over the period of time.

> *"I am unable to understand what parameters government is using to allocate gas to different sectors."*
>
> *"……. One thing is clear neither it is for the sake of people benefit nor to generate employment opportunities, rather all is done on political basis."*
>
> *"We do not have this sense of making proper planning for resources allocation."*
>
> *"…… The fact of the matter is the main problem is with government's priority about the allocation of natural gas for different sectors."*

Documentary evidence can be corroborated with published literature to explain effectiveness of natural gas management. Literature has given four main approaches to allocation of natural resources: Ecological Approach, Economic Approach, Technological Approach and Ethnological Approach. All these four approaches focus on different parameters of resource allocation. Ecological Approach emphasizes 'consideration for future generations', Economic Approach emphasizes 'benefit maximization', Technical Approach emphasizes 'technological advancement', and Ethnological Approach emphasizes 'perceived worth of the allocation decision' (Omara-Ojungu, 1992). Documentary evidence suggests that governments in Pakistan have adopted ethnological approach of natural gas management and allocation, because domestic and commercial consumers are greatest in numbers and have been given first priority in terms of natural gas allocation in order to maximize its political benefits (see Table 4).

As far as allocation of natural gas to CNG sector is concerned this research, on the basis of available evidence, is unable to find any coherent logical grounds on the basis of which governments were making natural gas allocation decisions for CNG sector after it was introduced as an alternative fuel in 1992. It appears that successive governments have been unclear regarding the rationale of natural gas allocation policy with reference to CNG sector. In 1992 when government introduced CNG as an alternative fuel and encouraged investment in this sector, it was argued that using CNG as an alternative fuel will enable the country to save hefty amount of foreign exchange spent on import of Oil & Diesel and it will also make the environment 'green'

(Abbasi, 2014). There is a clear evidence that at that time government used 'Economic Approach' (Odum & Barrett, 2004). However, once huge private investments were made into CNG sector, decrease of natural gas supply to CNG sector led to gradual decay of this sector. This has resulted in loss of public and private investment of billions of rupees over a number of years that doesn't conforms the primary assumptions of both economic and ethnological approach (Ahmed et al., 2013; Kiani, 2016; Odum & Barrett, 2004).

Another explanation given by representatives of government institutions is, due to declining natural gas reserves it is not in the best economic interest of the country to allocate natural gas to CNG sector.

> *"…….Planning commission of Pakistan's declaration that natural sources are depleting over the period of time."*
>
> *"…….It was a total absurd decision. They must have prudent approach in order to get maximum output from depleting natural gas resource."*

It has been stated that this should have been considered in 1992 when technical feasibilities for CNG sector were developed. Right now, this argument may be used by someone as an explanation for reduction of allocation of natural gas to CNG sector, but it cannot be used as a justification for the destruction of CNG sector. It is the responsibility of the state to take care of property and collective needs of its citizens to ensure decorous survival of the society (Asad, 1961; Boer, 1997b). The state cannot put livelihood of 54,000 families and at least 108 billion rupees of private capital investment on stake just to get maximum benefit from allocation of natural gas. Questions have been raised that if CNG sector was not beneficial in economic terms then why citizens were encouraged to invest in this sector in the very first place; and once people have invested heavily in this sector, there could be no economic justification to gradually destroy it (SMEDA, 2005; OGRA, 2016).

In the financial year 2016-2017 UFG, T&D and other losses were estimated at 375 MMcfD which is almost 10 % percent of total natural gas production in that year, and more than double the total allocation of natural gas to CNG sector (OGRA, 2017). During its peak time in 2005 CNG sector consumed 11% of total natural gas production. In 2016-17, CNG sector was allocated only 5% of the total natural gas production. In the light of above presented facts, it can be ascertained that if government could be able to control line losses by 4 to 5 percent of total natural gas production, it would be able to effectively close the gap between demand and supply of natural gas in CNG sector.

Regulation of CNG Sector:

Apart from natural gas supply, the regulation of CNG sector was also not up to mark. Uncontrolled and non-bounded licensing has been done by OGRA since 1992 and as a result 3500 CNG stations have been established till 2015-16 (OGRA, 2017). This provides a hint of poor sectoral regulation and lack of synchronization among the relevant state institutions. On one hand a state institution is encouraging private investment in CNG sector and on the other hand political governments are reducing allocation of natural gas to CNG sector on regular basis (Batagoda, Joseph, & Ratnasiri, 2014; DoE, 2009; Gomes, 2013; Jose, 2015; Pasindu, 2017; Ratner, 2017; Shoaib, 2013).

Conclusion

The main research question posited in this study was: Has Pakistani state effectively managed natural gas resources to utilize CNG as alternate fuel for vehicles? After analyzing

interviewee's responses in the light of official statistics and published data, the authors summarize their findings in the following presented matrix.

Table 5

Natural Gas Management Analysis Matrix

Dimension of Under Study Subject Matter	Current Situation	Evidence Synthesis	Policy Option
Does Pakistan have resource potential to cater CNG sector?	Yes	Total Resource (Gas) Potential:: 282 TCF Total (Recoverable) Gas Reserves:: 32 TCF (Rasheed, 2014; OGRA, 2013)	State should take concrete measures to recover potential resource in order to enhance gas supply
Does Pakistan have enough natural gas supply to cater CNG sector?	No	Current gas shortfall is 4 MMcfD (Hasnain, 2017)	State should take concrete measures to recover potential resource in order to enhance gas supply
Has desirable level of natural gas exploration and development been carried out in the recent past?	No	Recoverable Gas Reserves are 27 TCF since last decade (OGRA,2013,2016&2017)	State should immediately start more exploration projects to use potential reserves available in the country
Has state made effective policy of natural gas allocation?	No	Government never made a long term & comprehensive policy to CNG sector (Unanimous Response of Interviewees)	A comprehensive policy framework should be developed while envisioning at least next 30 years dynamics

Form the results discussed above, in the light of interviewee's responses and officially published data, it may be concluded that the Pakistani state has not been able to effectively manage natural gas resource to develop CNG as a stable sector and use CNG as an alternate fuel for vehicles. Natural gas allocation to CNG sector and CNG sector's regulation were not managed effective mainly because 1) natural gas exploration and development initiatives were not enough to cater demand of the CNG sector and 2) sectoral allocation of natural gas is more of a political choice than a rational choice.

Future Directions

A limitation of this study is that primary data to validate documentary evidence has been collected from state officials and APCNGA representatives. Other stakeholders such as politicians and general public are not interviewed. This paper analyzed policy making with reference to natural gas development and allocation in Pakistan. The issue may further be explained by conducting a cross national analysis on policy process and exploring factors other than political that may lead to different levels of effectiveness of natural gas management and allocation choices.

References

Abbasi, A. H. (2014). *Rethinking Pakistan's Energy Equation: Iran-Pakistan Gas Pipeline*: Sustainable Development Policy Institute.

Adelman, I., & Morris, C. T. (1973). *Economic growth and social equity in developing countries*: Stanford University Press.

Aftab, S. (2014). Pakistan's energy crisis: causes, consequences and possible remedies. *Norwegian Peace Building Resource Center*.

Ahmed, A., Chaudhry, A. G., Farooq, H., & Riaz, A. (2013). Short Fall of Compressed Natural Gas (Cng) And Issues of Affected Community ; A Anthropological Study of Vehicle Owner's In Islamabad And Rawalpindi. *Sci.Int(Lahore)*, 623-626.

Anwar, T., & Saeed, K. (2023). Energy Crisis of Pakistan: Analyzing Governance Issues. *Journal of Contemporary Macroeconomic Issues, 4*(2), 39-51.

Arshad, M. (2024). Sustainability of renewable energy options as compared to coal-fired power plants in Pakistan. *Green and Low-Carbon Economy, 2*(3), 162-173.

Asad, M. (1961). *The principles of state and government in Islam*: Univ of California Press.

Asif, M. (2009). Sustainable energy options for Pakistan. *Renewable and Sustainable Energy Reviews, 13*(4), 903-909.

Batagoda, B., Joseph, E. P., & Ratnasiri, J. (2014). Natural Gas–New Energy Resource in Sri Lanka.

Baumol, W. J. (1986). Productivity growth, convergence, and welfare: what the long-run data show. *The American Economic Review*, 1072-1085.

Beck, D., Ferasso, M., Storopoli, J., & Vigoda-Gadot, E. (2023). Achieving the sustainable development goals through stakeholder value creation: Building up smart sustainable cities and communities. *Journal of Cleaner Production, 399*, 136501.

Bérenger, V., & Verdier-Chouchane, A. (2007). Multidimensional measures of well-being: standard of living and quality of life across countries. *World Development, 35*(7), 1259-1276.

Bernheim, B. D., & Whinston, M. D. (1986). Menu auctions, resource allocation, and economic influence. *The quarterly journal of economics, 101*(1), 1-31.

Birnbaum, S., Bodin, Ö., & Sandström, A. (2015). Tracing the sources of legitimacy: the impact of deliberation in participatory natural resource management. *Policy sciences, 48*(4), 443-461.

Boer, L. (1997a). The State in a Changing World. *Third World Quarterly*, 935-940.

Boer, L. (1997b). The State in a Changing World. [World Development Report 1997, The World Bank]. *Third World Quarterly, 18*(5), 935-940. Retrieved from http://www.jstor.org/stable/3993108

Brosius, P. J., Tsing, A. L., & Zerner, C. (2005). *Communities and conservation: histories and politics of community-based natural resource management*: Rowman Altamira.

Bryman, A. (2016). *Social research methods*: Oxford university press.

Burton, I., & Kates, R. W. (1967). Readings in resource management and conservation.

Cheng, A. S., Kruger, L. E., & Daniels, S. E. (2003). " Place" as an Integrating Concept in Natural Resource Politics: Propositions for a Social Science Research Agenda. *Society &Natural Resources, 16*(2), 87-104.

Costanza, R., & Daly, H. E. (1992). Natural capital and sustainable development. *Conservation biology, 6*(1), 37-46.

Costanzo, G. L. (2011). The contribution of the asset management industry to long-term growth. *OECD Journal: Financial Market Trends, 2011*(1), 87-96.
Dakhli, M., & De Clercq, D. (2004). Human capital, social capital, and innovation: a multi-country study. *Entrepreneurship & regional development, 16*(2), 107-128.
Davis, K. E., & Prado, M. M. (2014). Law, Regulation, and Development. In *International Development: Ideas, experience, and prospects*. London: Oxford University Press.
De Mesquita, B. B., & Downs, G. W. (2005). Development and democracy. *Foreign Affairs*, 77-86.
Dilts, D. A. (2004). *Introduction to Microeconomics*. Purdue University.
DoE. (2009). Overview of Energy Policies of Bhutan. In: Ministry of Economic Affairs Thimphu, Bhutan.
Dreze, J., & Sen, A. (2013). *An Uncertain Glory: India and its Contradictions*. New York.
Economic Advisor's Wing Finance Division Government of Pakistan. (2024). *Pakistan Economic Survey 2023-24*. Retrieved from Islamabad: https://finance.gov.pk/survey/chapter_24/Highlights.pdf
Feenberg, A. (2008). From critical theory of technology to the rational critique of rationality. *Social Epistemology, 22*(1), 5-28.
Gomes, I. (2013). *Natural Gas in Pakistan and Bangladesh–current issues and trends*.
Haque, M. S. (1997). Incongruity between bureaucracy and society in developing nations: a critique. *Peace & Change, 22*(4), 432-462.
Haque, M. S. (2002). Structures of new public management in Malaysia and Singapore: Alternative views. *The Journal of Comparative Asian Development, 1*(1), 71-86.
Hasan, S., Wang, X., Khoo, Y. B., & Foliente, G. (2017). Accessibility and socio-economic development of human settlements. *PloS one, 12*(6), e0179620.
Hasnain, K. (2017). Gas crisis worsens in Punjab. Retrieved from https://www.dawn.com/news/1308749
Heyman, S. J. The First Duty of Government: Protection, Liberty and the Fourteenth Amendment'(1991). *Duke LJ, 41*, 507, 515.
Hidayat, M., Rangkuty, D. M., & Ferine, K. F. (2024). The influence of natural resources, energy consumption, and renewable energy on economic growth in ASEAN region countries. *International Journal of Energy Economics and Policy, 14*(3), 332-338.
Holden, E., Linnerud, K., & Banister, D. (2017). The imperatives of sustainable development. *Sustainable Development, 25*(3), 213-226.
Hussain, A. (2013). *National Mineral policy*. Retrieved from Islamabad:
Hyde, K. F. (2000). Recognising deductive processes in qualitative research. *Qualitative market research: An international journal, 3*(2), 82-90.
Hye, Q. M. A., & Riaz, S. (2008). Causality between Energy Consumption and Economic Growth.
Jose, D. M., Lella, Jaydeep & Nawale, Akanksha. (2015). *Status Report on Conventional and Renewable Energy Sources of Nepal*. Retrieved from
Kellert, S. R., Mehta, J. N., Ebbin, S. A., & Lichtenfeld, L. L. (2000). Community natural resource management: promise, rhetoric, and reality. *Society & Natural Resources, 13*(8), 705-715.
Keohane, M. N. O., & Olmstead, S. M. (2016). *Markets and the Environment*: Island Press.
Khaliq, A., Atique, A., Hina, H., & Bilal, A. (2024). Impact of electricity generation, consumption, energy trade, and ICT on the environment in Pakistan: a NARDL and ARDL analysis. *International Journal of Sustainable Development & World Ecology, 31*(3), 279-297.

Kiani, K. (2016). CNG deregulation leaves users at market's mercy. Retrieved from https://www.dawn.com/news/1303610

Krypa, N. (2017). Social Economic Development and the Human Resources Management. *Academic Journal of Interdisciplinary Studies, 6*(1), 73.

Leach, M., Mearns, R., & Scoones, I. (1999). Environmental entitlements: dynamics and institutions in community-based natural resource management. *World Development, 27*(2), 225-247.

Lipset, S. M. (1959). Some social requisites of democracy: Economic development and political legitimacy. *American political science review, 53*(1), 69-105.

Mahmood, A., Javaid, N., Zafar, A., Riaz, R. A., Ahmed, S., & Razzaq, S. (2014). Pakistan's overall energy potential assessment, comparison of LNG, TAPI and IPI gas projects. *Renewable and Sustainable Energy Reviews, 31*, 182-193.

McNabb, D. E. (2015). *Research Methods in Public Administration and Nonprofit Management*: Routledge.

Mendoza, G. A., & Martins, H. (2006). Multi-criteria decision analysis in natural resource management: a critical review of methods and new modelling paradigms. *Forest ecology and management, 230*(1), 1-22.

Merem, E. C., & Twumasi, Y. A. (2008). Using Geospatial Information Technology in Natural Resources Management: The Case of Urban Land Management In West Africa. *Sensors* 608-619.

Mirza. (2012). CNG sector may consume 27pc of local gas supply in five years

Mitchell, J. F. (1989). The "greenhouse" effect and climate change. *Reviews of Geophysics, 27*(1), 115-139.

Moeen, M. S., & Memon, F. A. (2023). *Pakistan Natural Gas: Policy Analysis & Way Forward*. Retrieved from Islamabad: file:///D:/2.%20Moin/01.Academia/00.Research/02_Research%20Papers/20/Natural%20Gas%20Policy%20(2023).pdf

Mujtaba, A. (2024). Economic Development and Social Welfare: Assessing the Relationship. *Physical Education, Health and Social Sciences, 2*(4), 1-10.

Nazir, M. (2008). The problems and issues of federalism in Pakistan. *Journal of Pakistan Vision, 9*(1), 109-128.

Odum, E. P., & Barrett, G. W. (2004). *Fundamentals of Ecology*. United State Thomson.

OGRA. (2016). State of the Regulated Petroleum Industry 2015-2016.

OGRA. (2017). *State of the Regulated Petroleum Industry 2016-2017*. Retrieved from Islamabad:

Omara-Ojungu, P. H. (1992). *Resource management in developing countries*: Longman Scientific & Technical.

Panayotou, T. (2016). Economic growth and the environment. *The environment in anthropology*, 140-148.

Pasindu, B. M. C., Hemapala, K.T.M.U. & Siriwardena, K.K.W. . (2017). A Least Cost Long - Term Energy Supply Strategy for Sri Lanka using Petroleum, Coal and Natural Gas. *ENGINEER, 03*, 55-66.

Patton, M. Q. (1990). *Qualitative evaluation and research methods*: SAGE Publications, inc.

Paulsson, A., Koch, M., & Fritz, M. (2025). Diminishing returns of growth? Economic performance, needs satisfaction and ecological impacts of OECD welfare states. *Critical Social Policy, 45*(1), 3-26.

Paz-Fuchs, A. (2011). The social contract revisited: The modern welfare state. *OVERVIEW AND CRITICAL REPORT. The Foundation for Law, Justice and Society in affiliation with The Centre for Socio-Legal Studies, University of Oxford www. fljs. org (dostp: 31.01. 2013)*.

Rasheed, A. A. (2014, Octobar Tuesday). Gas load management plan for winter: gas provision to CNG, industrial sectors linked with weather intensity. *Bisuness Recorder*.

Ratner, M. (2017). *India's Natural Gas: A Small Part of the Energy Mix*. Retrieved from

Ribeiro-Soriano, D. (2017). Small business and entrepreneurship: their role in economic and social development. In: Taylor & Francis.

Riley, P. (1999). *Will and political legitimacy: A critical exposition of social contract theory in Hobbes, Locke, Rousseau, Kant, and Hegel*: iUniverse.

Sanders, T. J. (2012). A comparison of qualitative and quantitative operationalizations of strategic management constructs. *Research in Business and Economics Journal, 6*, 1.

Sasan, J. M. V. (2021). The Social Contract Theories of Thomas Hobbes and John Locke: Comparative Analysis. *Shanlax International Journal of Arts, Science and Humanities, 9*(1), 34-45.

Schumpeter, J., & Backhaus, U. (2003). The theory of economic development. *Joseph Alois Schumpeter*, 61-116.

Shah, I. H., Rahman, F., Ajmal, M., & Hamidullah, H. M. (2011). SITUATION ANALYSIS OF TECHNICAL EDUCATION AND VOCATIONAL TRAINING: A CASE STUDY FROM PAKISTAN. *International Journal Of Academic Research, 3*(1).

Shahbaz, M., Zeshan, M., & Afza, T. (2012). Is energy consumption effective to spur economic growth in Pakistan? New evidence from bounds test to level relationships and Granger causality tests. *Economic Modelling, 29*(6), 2310-2319.

Shair, W. (2024). Depleting Natural Gas Reserves. *The Nation*.

Sheikh, M. A. (2010). Energy and renewable energy scenario of Pakistan. *Renewable and Sustainable Energy Reviews, 14*(1), 354-363.

Shiferaw, B. A., Okello, J., & Reddy, R. V. (2009). Adoption and adaptation of natural resource management innovations in smallholder agriculture: reflections on key lessons and best practices. *Environment, development and sustainability, 11*(3), 601-619.

Shoaib, M. (2013). Pakistan Economic Survey 2012–13. *Ministry of Finance, Government of Pakistan*.

Sohail, M. T., Huang, D., Bailey, E., Akhtar, M. M., & Talib, M. A. (2013). Regulatory framework of mineral resources sector in Pakistan and investment proposal to Chinese Companies in Pakistan. *American Journal of Industrial and Business Management, 3*(05), 514.

Stern, M. J., & Coleman, K. J. (2015). The multidimensionality of trust: Applications in collaborative natural resource management. *Society & Natural Resources, 28*(2), 117-132.

Stratford, N., & Mortier, R. (1999). *An economic approach to adaptive resource management.* Paper presented at the Hot Topics in Operating Systems, 1999. Proceedings of the Seventh Workshop on.

Suleri, A., Shahbaz, B., & Khwaja, M. Z. (2010). In *Natural Resources: Blessing or Curse*. Islamabad: Sustainable Development Policy Institute.

Usman, M., Raza, K., Shahbaz, P., Ahmad, I., & Naveed, R. T. (2024). Effects of electrical crisis in Pakistan sustainable policies in the electricity sector: the case of Pakistan. *Innovative Research: Uniting Multidisciplinary Insights, 2*, 201-210.

Valasai, G. D., Uqaili, M. A., Memon, H. R., Samoo, S. R., Mirjat, N. H., & Harijan, K. (2017). Overcoming electricity crisis in Pakistan: A review of sustainable electricity options. *Renewable and Sustainable Energy Reviews, 72*, 734-745.

Van Assche, K., Beunen, R., Duineveld, M., & Gruezmacher, M. (2017). Power/knowledge and natural resource management: Foucaultian foundations in the analysis of adaptive governance. *Journal of Environmental Policy & Planning, 19*(3), 308-322.

Weeks, R., & Adams, V. (2017). Research priorities for conservation and natural resource management in Oceania's small island developing states. *Conservation biology*.

Whaites, A. (2008). States in development: Understanding state-building. *Londres, Departamento para el Desarrollo Internacional de Reino Unido (Documento de trabajo)*.

Wojcik, D. (2018). *The New Oxford Handbook of Economic Geography*: Oxford University Press.

Yiftachel, P., Peled, D., Hadar, I., & Goldwasser, D. (2006). *Resource allocation among development phases: an economic approach.* Paper presented at the Proceedings of the 2006 international workshop on Economics driven software engineering research.

Zhao, L., & Rasoulinezhad, E. (2023). Role of natural resources utilization efficiency in achieving green economic recovery: evidence from BRICS countries. *Resources Policy, 80*, 103164.