Editors
Nevzat SIMSEK
Hayal Ayca SIMSEK

ECONOMICS AND POLITICS OF ENERGY IN CENTRAL ASIA AND CAUCASUS

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AKHMET YASSAWI UNIVERSITY

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Phone: +7 (727) 279 97 94 Fax: +7 (727) 279 24 26
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To our Beloved Mums,
Fatma Şimşek and Ayşegul Eker
Words are never enough to thank you
for all that you do...

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Contributors

Anastassios Gentzoglanis is Professor at the Faculty of Business Administration at the Université De Sherbrooke, Québec, Canada.
Anca-Elena Mihalache is Senior Analyst in the Energy Policy Group, Romania.
Can Deniz Koksal is from Akdeniz University, Antalya, Turkey.
Cumhur Cicekci is from Middle East Technical University, Ankara, Turkey and Undersecretariat of Treasury, Ankara, Turkey.
Eda Yalcin Kayacan is from the Department of Econometrics at Dokuz Eylul University, Izmir, Turkey.
Emrah Oz is from Middle East Technical University, Ankara, Turkey.
Farkhod Aminjonov is Senior Research Fellow at the Eurasian Research Institute, Almaty, Kazakhstan.
Hasan Sayilan is at the Geography Department at Ankara University, Ankara, Turkey.
Hayal Ayca Simsek is Visiting Research Fellow at the Eurasian Research Institute, Almaty, Kazakhstan and Associate Professor at Dokuz Eylul University, Izmir, Turkey.
Josua David Cowley is from the Department of Business Administration at Dokuz Eylul University, Izmir, Turkey.
Lidiya Parkhomchik is Senior Research Fellow at the Eurasian Research Institute, Almaty, Kazakhstan.
Mehmet Vedat Pazarlioglu is Professor at the Department of Econometrics at Dokuz Eylul University , Izmir, Turkey.
Muzaffer Ercan Yilmaz is Professor at the Department of International Relations at Bandirma Onyedi Eylul University, Balikesir, Turkey.
Nevzat Simsek is the Director of Eurasian Research Institute, Almaty, Kazakhstan and Associate Professor in Dokuz Eylul University, Izmir, Turkey.
Nurgul Satybaldiyeva is at KazNTU after K.I. Satpayev, Almaty, Kazakhstan.
Saule Akhmetkaliyeva is Junior Senior Research Fellow at the Eurasian Research Institute, Almaty, Kazakhstan.
Sidika Basci is from Yildirim Beyazit University, Ankara, Turkey.
Yessengali Oskenbayev is at the Center for Development Research (ZEF), Bonn, Germany.

Foreword

The Eurasian region has been gaining great importance especially due to high natural resources and geopolitical and strategical location of the region countries in the world during the globalisation process. Energy dynamics in Central Asian and Caucasian countries have been attracting the attention of both other world countries and international organisations. In this respect, issues such as the development of energy markets, increasing energy efficiency and productivity, pricing policies on energy resources, mainly on oil and natural gas and increasing energy investments in the region have been significantly important for both regional and global actors.

On the other hand, maintaining energy demand and energy supply security in the region, the development of oil and natural gas pipelines and financing of energy projects in the region countries are some of the prominent issues that should be analysed in detail. Analysing the region with regard to energy priorities is not only important for academicians but also for policy makers in order to achieve a higher growth and development rate in the Eurasian Region.

Under these circumstances, analysing the economic and political aspects of the energy dynamics in the Eurasian region has become crucially important for both regional and global priorities of world countries. In this sense, international and regional energy policies regarding regional energy resources and energy economics have great emphasis on developing new energy projects in the region. In this sense, this book, namely, ‘’Economics and Politics of Energy in Central Asia and Caucasus’ provide the readers with detailed analysis of the developments in the Eurasian region especially regarding the economic and political perspectives on energy issues in the Eurasian region.

The book includes papers that are analysing energy security, energy priorities and initiatives in the region and issues in regional development and regional cooporation. Some of these papers were presented in 1st International Congress on Economics, Finance and Energy (EFE’2014) which was organised by Khoca Akhmet Yassawi International Kazakh-Turkish University between 12-14 June 2014 in Almaty in Kazakhstan.I would like to thank to the authors for their precious contributions to the book. My special thanks will be for the editors, the Director of the Eurasian Research Institute and coordinator of EFE’2014, Assoc. Professor Nevzat Simsek and the visiting research fellow Assoc. Professor Hayal Ayca Simsek for their valuable efforts to prepare this book. I wish this publication will be beneficial for the readers.

Professor Musa YILDIZ, PhD
President of the Board of Trustees
Khoca Akhmet Yassawi
International Kazakh-Turkish University

Preface

Central Asia and Caucasus has always been economically powerful regions throughout the world history. However, in the beginning of 21st century, Central Asia and Caucasus with its high oil and natural gas reserves regained importance and these countries have attracted attention with their high economic potentials. It seems that the energy dependence of the world countries to this region will continue quite a while. In this respect, analysing the energy dynamics of the region countries from economic and political perspectives is significantly important. The issues are mostly regarding economic development, regional energy investments, energy supply and energy security, regional opportunities and threats, regional impacts of the future global energy requirements and the roles of regional and global powers in energy policies in Central Asia and Caucasus. As most of the region countries have close historical and cultural ties and common language, they can solve their problems relating economy, finance and energy with discussions in a common platform.

With this book, namely, Economics and Politics of Energy in Central Asia and Caucasus, we intend to give a general overview on the development of energy policies, initiatives and priorities with economic and political perspectives, to make a contribution to the rare literature, to evaluate the recent developments in the Eurasian region, especially in the Central Asian and Caucasus in changing world conditions, to share these analysis with the partners and to develop future projections. Economic and political aspects of energy issues in Central Asian and Caucasian countries are taken into consideration regarding the interaction hinterland of these countries and the global world structure. We also aim to give detailed information about the related issues to not only professional scholars and experts but also to graduate students.

The book consists of two chapters. Both chapters include detailed analysis on economic and political aspects of energy dynamics in Central Asia and Caucasus. The first chapter is related to the energy in the region with economic and security perspectives. In this chapter, the theoretical perspectives of energy security, the relation between economic growth, economic development strategies and energy policies, regional energy initiatives and financing methods of energy projects in the region are revealed. The second chapter provides information on the political aspects of the energy policies in Central Asia. In this chapter, the conflict in the energy issues in the Caspian Sea region, regional cooperation in the Caspian Sea region, the importance of Silk Road Project and Turkey's role in this project, Turkey's role for sustainable gas supply in Eurasia, Russian and Ukrainian gas transit powers and water management in Central Asia are analysed in detail.

We would like to present our thanks to Prof Osman Horata and Prof Musa Yildiz, former and present Presidents of the Board of Trustees of Khoca Akhmet Yassawi International Kazakh-Turkish University and the other Members of the Board of Trustees for their unlimited support. We also thank to Farkhod Aminjonov for his help during the preparation process. We wish this book will attract the interest of a wide range of readers and we hope that it will contribute for further research in the fields of economic, political and energy studies about Central Asia and Caucasus.

Nevzat SIMSEK
Hayal Ayca SIMSEK
Almaty, 2016

Almaty, 2016

PART I

Introduction

1. Theoretical Perspectives on Energy Security

NEVZAT SIMSEK AND HAYAL AYCA SIMSEK

Abstract

Theorically, energy security is defined as sufficient and affordable energy supply of resources, a definition, which actually involves both the viability of vital energy systems and other dimentions of energy security such as internal policy dimensions, economic dimensions, geopolitical dimensions and security policy dimensions. Analysing vital energy systems and their vulnerabilities, risks and resilience is significantly important for energy security. Not only the economic and technical aspects of energy security such as energy stocks, flows, infrastructure, markets and prices but also the political aspects of the concept such as institutional roots of energy security and political stability should be deeply analysed while explaining various aspects of energy security in theoretical perspectives.

In this regard, internationally coordinated and multilateral security measures should be used to achieve a comprehensive and favorable framework for energy security. On the other hand, sustainability is also an essential aspect of this framework in order to achieve a continuous energy supply of resources.

Keywords: Energy demand security, Energy supply security

1. Introduction

In this paper, we try to examine both the definition and economic importance of the concept of energy security and to discuss the policies and strategies to stimulate energy security for all countries. For this reason, in the first section we put forward different definitions for energy security and demonstrate the importance of energy security for all economies. In this sense, we illustrate the factors that affect energy security, the factors which indicate some particular characteristics of energy security. In the second section, after making a concrete definition of energy security, we give a brief explanation about different dimensions of energy security. In the third and fourth sections, we explain the factors that affect the security of energy supply and the security of energy demand respectively. In the fourth section, we also put forward the risks for energy security. In the fifth section, we analyse the priorities for energy security. Lastly, in the sixth section, we make concluding remarks and give suggestions for achieving a sustainable energy security by implementing concrete energy policies.

2. Defining Energy Security

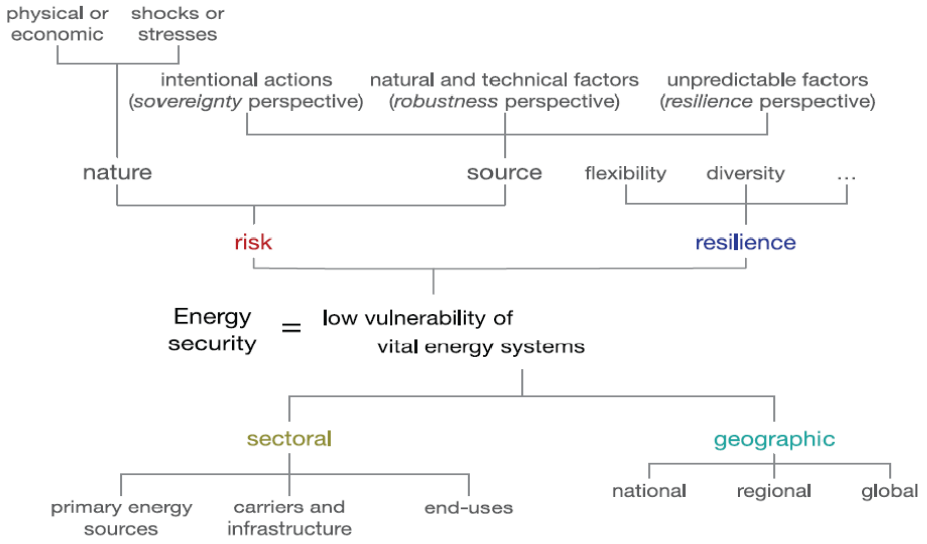
Energy security can be defined in several ways, which actually include the idea of avoiding sudden changes in the availability of energy relative to demand. Besides, increased continuity is an essential element of the definition. In this respect, energy security can be defined mainly in three ways. In the first definition, energy security is defined as the continuity of energy commodity supplies. In this sense, increases of the relative scarcity level of energy are a sign of insecurity. Sometimes price volatility is also seen as a sign of insecurity. If this definition is accepted, it becomes essential to assess the trade-off between decreasing volatility and increasing cost in order to determine efficient security levels. In the second definition, subjective severity filters are introduced to distinguish between secure and insecure levels of continuity. The definition by the International Energy Agency can be an example for this definition: Energy security is defined in terms of uninterrupted availability of energy sources at an affordable price (IEA, 2014:13). In this definition, despite the advantages of the use of subjective severity filters, these filters may include the risk of causing the concept of security imprecise and difficult to measure. The main reason for this is that continuity and price levels, which can be regarded as insecure for one country can be regarded as completely secure for another one. In the third definition, the scope of the impact measure is extended to not only the price and continuity but also to the economy and the environment (Winzer, 2011:5-6).

A definition by the Asia Pacific Energy Research Center can be an example for the third type of definition: Energy security is defined as the ability of an economy to guarantee the availability of energy resource supply in a sustainable and timely manner with the energy price being at a level that will not adversely affect the economic performance of the country. According to this definition, Asia Pacific Energy Research Center makes emphasis on '4 A Approach' in defining energy security: Availibility, Accessability, Affordability and Acceptability (APERK, 2007:1-2). In this sense, energy security is affected by physical (availability) and geopolitical (accessability) of energy sources and price and cost of infrastructures (affordability) of energy and environmental (acceptability) of energy as well (Labandeira and Manzano, 2012:7).

According to Flaherty and Filho (2013:13), energy security in a purely economic sense can be defined as the capacity of a country to meet all its energy needs with its own energy resources or energy, which it can take from other countries. However, energy security includes physical, security, price and geopolitical security in its nature. In another definition by Baumann (2008:4), energy security is defined as 'reliable supplies at a reasonable price'. Here, three main aspects of energy security are essential: supply security, sustainability and competitiveness. High dependence on foreign supply of energy results in uncertainty and sometimes insecurity, because energy security is actually all about 'security'. Problems about energy security can harm an economy's total output, political stability and personal wellbeing of citizens. Hence, a sufficient energy supply is both a precondition for economic growth and for the legitimacy within a political entity.

A broader definition of energy security is made by Cherp and Jewell (2014:418): Energy security is defined as the *low vulnerability* of *vital energy systems*. This definition points out three main areas, where closer contextual specifications of energy security can be developed such as delineating *vital energy systems*, exploring their *vulnerabilities* and understanding the political process that leads to the prioritization of certain energy systems and vulnerabilities (*securitization*). Vital energy systems are energy systems (energy resources, technologies and uses linked together by energy flows) that support critical social functions. Vital energy systems can be delineated according to geographical and sectoral boundaries (See Figure 1.1.).

Figure 1.1. **Factors Affecting Energy Security**



Source: Adopted from Cherp and Jewell, 2014: 419

Vulnerabilities of vital energy systems are combinations of their exposure to risks and their resilience. In this respect, in a useful energy security analysis, risks can be explored by affordable, reasonable, competitive, cost-reflective or fair prices. On the other hand, the perspective of resilience sees the origin of risks in largely unpredictable social, economic and technological factors. It origins from ecology, economics and complex systems analysis. Both vital energy systems and their vulnerabilities are not only objective issues, but also political constructs defined and prioritized by various social actors. The term 'vital' depends not only characteristics of a particular energy systems but also on its historical significance and on the power of associated institutional interests (Cherp and Jewell, 2014:419). Here, securitization gains importance. Especially, the questions such as which energy systems are vital? and which vulnerabilities these energy systems involve? should be analysed in detail, in order to make a concrete definition of energy security.

3. Dimensions of Energy Security

When energy security is defined as ''sufficient and affordable energy supply of resources'', the dimensions of energy can be classified as internal policy dimensions, economic dimensions, geopolitical dimensions and security policy dimensions. All these issues are regarded as key dimensions for stabilizing and safeguarding energy supply (See Table 1.1.).

Table 1.1. **Dimensions of Energy Security**

Internal Dimensions	Economic Dimensions	Geopolitical Dimensions	Security Policy Dimensions
High Financial Support for Maintenance and Extension of Energy Networks	A High Quality of Energy	Concerted Actions to Secure World Trade in Energy Goods	Close Cooperation With Vulnerable Countries
Increasing Energy Efficiency/ Productivity	Scarcity and Global Distribution of Energy Resources	Using 'soft Power' When Necessary	Using 'Hard Power' When Necessary

Source: Authors' compilation

Internal dimensions for energy security firstly includes extensive financial acquisitions for maintenance and extension of energy networks. Growing energy demand (especially demand for electricity) requires massive investments. In this sense, enhancing infrastructural investments (building terminals and storage facilities, modernizing mature plants, etc.) and maintenance of infrastructure have crucial importance for providing energy for all consumers and are of vital importance also for local and national authorities. Another issue regarded in internal dimensions for energy security is increasing energy efficiency or productivity in order to improve internal energy security. Here, efficiency stands for saving energy and lowering costs both for consumers and producers. In industrial sector it also stands for the lesser use of energy per unit produced. Internal dimensions for energy security also include improving alternative sources of energy such as renewables and nuclear. Because alternative energy sources can reduce import dependence and contribute to supply security.

Economic dimensions for energy security include the quality of energy. In this sense, the quality of energy should be high enough to meet energy demand. This is actually coherent with the definition of energy security. Because ''a sufficient and affordable supply of energy'' includes implementation of rules for functioning markets by the government or the other actors to serve adequate energy for both consumers and industrial users at a reasonable price. Another issue in economic dimensions for energy security is scarcity and global distribution of fossil fuels, which is a major factor of insecurity. Here, not only the durable relation between exporter and importer countries but also the high dependence to specific geographical source of supply are an important obstacles for perpetual meet of high energy demand in world countries. That is why, two important issues are crucial for energy users in their strategies for increasing energy supply or reducing their energy dependence: long term contracts and energy diversification. Here, the main reason for this is that long term contracts

are legal foundations for perpetual energy supply and energy diversification leads to new transit routes and origins of resources. In economic perspective, another issue for energy security is increased support for technological development, because important inventions in fuel efficiency, the use of alternative sources of energy or related technologies directly increase energy security by lowering costs (Baumann, 2008:7).

Geopolitical dimensions for energy security includes concerted action to secure worldwide trade in energy goods. In geopolitical perspective, the free flow of energy resources and services is an adequate means to avoid short term supply problems and to encourage both the quality of energy services and technological innovation. Not only high import dependency and shortages due to the scarcity of fossil fuels, but also international or transnational terrorism and political instability are main problems related with geopolitical dimensions for energy security in worldwide. Therefore, the geopolitical dimensions require strategic concepts and holistic means to deal with these problems. In this sense, developing a coherent, integrated and strategic foreign energy policy (which is called ‘’soft power’’) is crucially needed for all countries that have problems with energy security (Labandeira and Manzano, 2012:10).

Security policy dimensions for energy security include close cooperation with vulnerable countries (which face various terrorist attacks and imminent threats), including information sharing, training and debates on best practices. Besides, international agencies such as BM and NATO can give technical and operational assistance to the countries in danger. In this sense, physical protection of infrastructure of energy sources (terminals, refineries, pipelines, etc.) against terrorist attacks and spill-over of regional conflicts in order to settle conflicts and secure transit routes by using military forces (which is called ‘’hard power’’) can sometimes be inevitably needed to deal with energy security problems (Baumann, 2008:10).

Energy security in a broader perspective should be analyzed in terms of energy supply and energy demand, because energy security, the definition of which is actually based on securing a well-functioning energy system has these two main aspects. The relative importance of these two aspects mostly depends on the role of the countries involved in energy economy. In this respect, it is essential to put forward the main characteristics of security of energy supply and security of energy demand.

4. Security of Energy Supply

Definitions for energy security also include definitions for security of energy supply. Here, the availability aspect (stable and uninterrupted supply) and price aspect (low cost/affordable price) give the definition of security in energy supply. Security of supply depends on a set of well-functioning infrastructure route from energy extraction to transportation, transformation, refining and distribution to the energy users. The importance of a well-functioning network has made energy dependency a central concept in the energy security. Security of supply is analyzed through both quantitative and qualitative methods. In literature, great efforts have been made in using various indicators to compare different energy systems regarding energy security and evaluating strategies for strengthening security of supply. The indicators mostly include import dependency the cost of disturbance (blackouts, price hikes, etc.) (Johansson, 2013:201).

Security of energy supply involves important aspects that make it essential for not only end-users and producers but also for importer and exporter countries. These include supply of primary energy, upstream markets and imports, domestic markets and infrastructure and economic vulnerability (See Table 1.2.).

Table 1.2. **Factors Affecting Security of Energy Supply**

Supply of Primary Energy	Upstream Markets and Imports	Domestic Markets and Infrastructure	Economic Vulnerability
Resource Availability	Providing Higher Energy Security	Reliability of The Energy System	Volatility in Prices-Including The Effect of Price Shocks
Average Production Cost/Cost Fluctuations	Reducing Risks Through Diversity	Vulnerability of The Energy System	Direct and Indirect Costs of Supply Interruption
	Reducing Risks Through Financial Portfolio	Resilience of The Energy System	
	Reducing risks by forming reliable supply and transit routes		

Source: Authors's compilation

Supply of primary energy is an essential aspect of security of energy supply, because an adequate amount of primary energy to meet energy demand is a precondition for security of energy supply. There are two factors that affect

supply of primary energy such as resource availability and average production cost/cost fluctuations. Long term assessments of resource availability are important not only for global energy resources but also for certain regional resources. Here, interactions between technology, demand and supply of different resources are assessed. These interactions can be regarded as physical, economic, and political aspects of resource supply. While physical aspects include factors such as estimates of fossil fuels, geological restrictions on extraction rates and renewable energy sources, economic and political aspects include factors such as political stability and investments in exploration and extraction activities. When security is regarded as a problem of high cost and scarce sources, recommendations to reduce costs and increase resources should be made. But long term assessments can be uncertain and can overestimate the potential of primary fuels. Besides, scarcity depends not only supply but also demand. That is why, complementary sensitivity analysis should be made to evaluate the vulnerability of the systems and reduce uncertainty. Average production cost and cost fluctuations are the other factors that affect the supply of primary energy. High production cost can be a factor of insecurity in supply of primary energy because it can vary rapidly or unpredictably. Besides, price volatility can affect this process. But price volatility is not only a result of development in primary energy supply but also depends on disturbances in other stages of energy chain (Mansson, et al., 2014:4).

Upstream markets and imports are the other important aspects of security of energy supply. Importing energy is regarded as a negative factor for a country because it faces outside risks (deliberate cuts of exporter/transit countries, threats to cut off or possibility of using energy as a 'weapon', etc.). These risks should be reduced to provide higher energy security (The Parliamentary Office of Science and Technology, 2012:3). There are mainly three ways to reduce these risks such as reducing the risks through diversity, reducing the risks through financial portfolios and reducing the risks by forming reliable supply and transit routes. Diversity can be used to spread the risks as much as possible. So, while vulnerability can decrease, resilience can increase. Sometimes financial portfolios are used to reduce the risks. With this method, specific risks can be separated from systematic risks more easily and also the individual risk premiums for each import route can be calculated. But to be applicable, all risk parameters need to be known, which is sometimes not possible. Forming a reliable supply and transit route includes some steps of implementation. Firstly; the risk in each supply corridor should be calculated by using the average socio-economic risk of each transit country. Secondly, an algorithm should be used to minimize the total import risk and maximize the flow of energy through the energy corridors (Mansson, et al., 2014:6).

Domestic markets and infrastructure are also other aspects of the security of energy supply. In this respect, the infrastructure and market design should be sufficient to provide an adequate level of energy security. A sufficient infrastructure can be analyzed in various aspects such as reliability, vulnerability and resilience. Reliability is an important aspect of infrastructure because low reliability can result in costly outages for energy users, while high reliability can include costly investments in energy infrastructure. On the other hand, vulnerability is an important aspect to understand the dynamic behavior of the energy system in response to a disturbance or to identify causes of instability in the energy system. Resilience is also important because resilience of the energy system shows the ability of the entire system to respond or rapidly recover and how the disturbance directly influences the energy system. These aspects can also be regarded in terms of technical performance of current energy systems (The Parliamentary Office of Science and Technology, 2012:2).

Economic vulnerability is another substantial aspect of the security of energy supply. Disturbance in all supply stages may result in price instability or high costs. Therefore, macroeconomic effects of high (volatile) prices and cost of supply interruptions should be regarded in this respect. Macroeconomic effects of high (volatile) prices include negative impacts on potential welfare and welfare loss mainly is a result of a persistent decline in energy supply (mainly oil production). Also the probability, occurrence, duration and magnitude of a price shock is important. Besides, the direct/indirect costs of supply interruption for end-users can be a result of economic vulnerability. Here, willingness to pay to avoid an outage, lost production during an outage, market behavior and the negative effects of a real supply interruption can affect the direct/indirect costs of supply interruption (Mansson, et al., 2014:7).

On the other hand, an increase in energy prices can primarily slow down the economic growth rate. Besides, volatile prices can cause uncertainty about the future. For example, consumers can increase their savings and postpone purchases of energy-intensive goods. Uncertainty about future energy prices is the main way of energy shocks to influence economy. In this sense, volatile prices, which are regarded as a sign of economic vulnerability, have negative impacts on investments and as a result economic activity (Labandeira and Manzano, 2012:12).

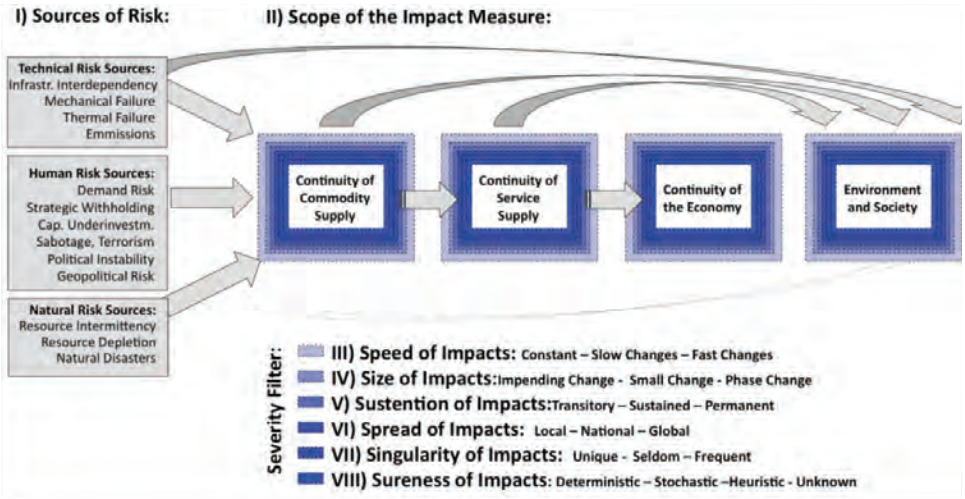
5. Security of Energy Demand and Risks

Both for energy importer and energy exporter countries, security of demand has equal importance to security of supply. Stable prices and open transporta-

tion routes lead to mutual interests for both exporters and importers of energy. However, differences in price levels and optimal exploration rates can cause conflicts between energy importer countries (consumers) and energy exporter countries (producers). Because while importer countries seek to keep prices at the lowest level to meet their energy demand, exporter countries need to keep prices at the highest level so as not to face significant losses in demand. Climate policy is also regarded as an important threat to the security of demand of exporter countries, because climate change can lead to have incentives for energy efficiency and expansion of renewables (Johansson, 2013:202).

Security of energy demand and supply actually faces a number of threats when we define energy security as ‘’the absence of protection from or adaptability to threats that are caused by or have an impact on the energy supply chain or energy demand’’. These threats can also be regarded as risks for security of energy demand and energy supply. In this respect, these risks differ along several aspects such as source of risk, scope of the impact measure, speed of threat impacts, size of threat impacts, sustention of threat impacts, spread of threat impacts, singularity of threat impacts and sureness of threats (See Figure 1.2.).

Figure 1.2. **Risks for Energy Security**



Source: Adopted from Winzer, 2011:10.

The source of risk describes the type of risks such as technical risk sources, human risk sources and natural risk sources. Technical risk sources include the failures in infrastructure such as transmission lines, power plants, transportation routes and communication networks due to mechanical or thermal failure. Human risk sources include fluctuations in demand, strategic withholding of supplies, capacity underinvestment, terrorism, political instability and

geopolitical instability. Natural risk sources include stochastic intermissions of renewable energy supplies, the depletion of fossil fuel stocks and natural disasters.

The scope of the impact measure describes energy security to be measured. The majority of risks affect four main categories such as continuity of commodity supplies, continuity of service supplies, economic continuity and human safety and environmental sustainability. Continuity of commodity supplies is affected by the risks that have impact on the availability or the price of energy commodities such as oil, natural gas, etc. Continuity of service supplies is affected by risks that can change the availability or the price of energy services such as heating, lighting, communication and transport. Economic continuity of the country is affected by changes that take place in both continuity of commodity supplies and continuity of service supplies due to changes in the availability or the price of energy commodities and energy services. As a result, human safety and environmental sustainability can be affected by risks that occur in the process of provision and consumption of energy commodities such as nuclear proliferation and water pollution (Winzer, 2011:10).

In this respect, the environmental risk factor can have a large impact on both human health and safety and economies of countries. For instance, air pollution, which has serious negative impacts on human health, thus human security should be regarded as an important risk factor for security of energy supply and demand. Besides, energy exploitation also negatively affects water resources and puts pressure on human health and human safety and gives damage to environmental sustainability (Johansson, 2013:203).

The speed of threat impacts describes the time scale on which the impacts of risk can occur. The speed can vary in different forms such as constant scarcity, slow stresses and fast shocks. While constant scarcity can be observed in renewable energy potential of a country, slow stresses can be seen as a depletion of fossil fuels, accumulation of greenhouse gasses or growing demand. Fast shocks can be observed in the form of political disruptions, technical failure or intermittency. Besides, stresses and shocks can be determined as short-term and long-term impacts (Labandeira and Manzano, 2012:8).

The size of threat impacts describes the magnitude of changes in scarcity in an energy area. The size of threat impacts can be regarded in three different levels such as impeding changes, small changes and phase changes. Impeding changes can be threats like reduced reserve margins. They have negative impacts on the energy area but not directly on the consumers. Small changes can be threats

like price volatility. They have a direct impact on the consumers but not on the way in which the system works. Phase changes can be threats like delivery disruptions. They both have a direct impact on the consumers and on the way in which the system works (European Commission, 2001:64).

The sustention of threat impacts describes the duration during which the impacts of threat persist. Three types of threat impacts can be regarded as transitory impact, sustained impact and permanent impact. Threats like short-term price volatility or small interruptions have a transitory impact, while threats that occur at a slower speed or threats that exceed a certain size of speed have a sustained impact. When it is not possible for the system to return to the initial levels after the threat occurs such as the depletion of fossil fuels, this has a permanent impact.

The spread of threat impacts describes the size of the whole geographical area which is affected. Three different levels of threat impact can be observed in this risk factor such as local level, national level and global level. Threats that can vary in a regional area within a country such as technical component failures can have an impact on local level. In this respect, physical and technological of energy can generate various risks of natural or technical hazards or threats. For instance; damage to hydroelectric dams, oil tankers, and nuclear plants that result from technical errors can have devastating effects on the region (Johansson, 2013:202). Threats that can influence an importer country as a whole such as disruption of exports due to political risk can have an impact on national level. Threats that can affect the whole country simultaneously and have environmental effects such as climate change can have an impact on global level.

The singularity of threat impacts describes their frequency of recurrence. These threat impacts also canbe distinguished in three levels such as unique threat impacts, infrequent threat impacts and frequent threat impacts. Threats that have not been seen before, such as nuclear wars, have a unique impact, while threats that were seen in the past but not very often, such as political disruptions have an infrequent impact. Threats that occur very often such as alterations of wind-speeds or many types of technical faults have a frequent impact.

The sureness of threats describes the level of uncertainty about the threats. These threats can vary in four different levels such as predicted threats, probabilistic threats, heuristic threats and unknown threats. Threats where the end of production from existing wells can be calculated, such as fuel depletion, can be regarded as predicted threats. Threats where the time of occurrence is not

usually known but the probability can be calculated according to past experience, such as resource intermittency or technical failure, can be regarded as probabilistic threats. Threats that can be expected but so hard to be predicted, such as political disruptions or terrorist attacks, can be regarded as heuristic threats. Threats which cannot be discovered until the final impacts are felt such as, global warming, can be regarded as unknown threats (Winzer, 2011:12).

6. Priorities for Energy Security

Ensuring and maintaining energy security requires the implementation of specific principles, which actually are essential for putting forward the priorities for energy security for both importer and exporter countries throughout the world. As mentioned in the previous parts these principles include diversification of supply, resilience, integration and information. All these principles have vital importance for achieving energy security and determining the priorities for energy security.

Diversification of supply is important for energy security because multiplying a supply source can reduce the impact of a disruption in supply from one source by providing alternatives for both exporter (producer) and importer (consumer) countries. Diversification of supply should be accompanied by resilience. Resilience can include many aspects such as sufficient spare production capacity, strategic reserves, adequate storage capacity and measures to respond to disruptions that can have wider effects on regions. Recognizing the reality of integration is also important. For instance, oil markets affect the whole world and can have integrated effects on all consumers all around the world. That is why, security is crucial for the stability of this market. Information is also important for energy security, because high-quality information is necessary for a well-functioning market. In international level, improving information about world markets and energy prospects and integrating information from exporter (producer) countries to importer (consumer) countries is of vital importance for energy security throughout the world (Yergin; 2006:76).

The security of energy supply and energy demand for both countries (importers and exporters) need to be analyzed according to specific characteristics regarding the priorities. In this sense, the priorities for energy security can be regarded as the control over growing energy demand and the management of high-dependence to energy supply (See Table 1.3.).

One priority for energy security is the control over growing demand. Current energy consumption trends have shown that most countries in the world have

been massively dependent to energy imports for their energy supplies. In this sense, effective instruments such as taxation, legislation and other market instruments should be implemented in order to control the growing demand. In order to increase the control over growing demand, the authorities have been implementing horizontal policies and sectoral policies. Horizontal policies are the policies to be implemented to ensure the energy prices to reflect real costs and to encourage energy savings. These policies include strengthening the domestic markets, implementing energy taxes, implementing energy saving policies and disseminating new technologies.

Strengthening the domestic markets involves markets such as natural gas and electricity. In this respect, more competition is needed between national energy operators and the new regulatory powers because in this way, enhancing competition in an integrated market can be conductive to uncoupling the price of energy resources such as oil and natural gas. In this way, high volatility in prices (the problem of economic vulnerability) can be solved. Another way of an efficient control over growing demand is implementing energy taxes.

Table 1.3. **Priorities for Energy Security**

The Control Over Growing Demand	**The Management of High-Dependence To Energy Supply**
Implementation of Horizontal Policies	**The Management of Domestic Energy Supply**
Strengthening Domestic Markets	Implementing Policies to Increase the Efficiency of Energy Supply Management
Implementing Energy Taxes	(Increased Interconnections, High Share of Renewables or Non-Dependent Energy Sources, High Strategic Reserves and Diversification)
Implementing Energy Saving Policies	(Developing Less-Pollutant Energy Sources Such As Renewables and Nuclear Energy and Preserving Access to Energy Resources)
Disseminating New Technologies	Implementing Energy Security Policies for Energy Supply
Implementation of Sectoral Policies	Implementing Energy Security Policies For Energy Demand
Reducing The Imbalance Between Modes of Transport	(A Reduced Use of Energy Through Energy Efficiency and Conservation)
(Providing Financial Incentives for Importers for Energy Resources; Creating A Competitive Energy Industry for Exporters)	**The Maintenance of Competition Among Supply Sources**

Table 1.3. (Continued) **Priorities for Energy Security**

Implementing Energy-Efficient Policies for Buildings to Increase Energy Savings	A Tight Control Over Competition Rules
(Greater Use of Economically Viable Energy-Efficient Technologies, Implementation of Targeted Energy Saving Rules and Encouragement of Using Renewables in Buildings)	An Open Fuel Distribution Market
	Energy Policies To Avoid Price Disruptions
	Low Economic Costs of Energy Policy Intervention
	Ensuring Foreign Energy Supply
	Close Relations Between Producer Countries and Importer Countries
	Developments in Energy Resources and Transportation Routes
	Diversification of Geographic Sources of Energy Supply

Source: Authors's compilation

As known, taxation is regarded as the most efficient and flexible instrument to encourage operators to change their behavior. In this sense, energy taxes should be used as an efficient instrument to eliminate national distortions and distortions between energy producers, to encourage energy saving and to internalize the external costs and to contribute to the reduction of CO_2 emissions (European Commission, 2001:69). For example, harmonization of tax rates on fuel to stabilize value-added tax (VAT) revenues when the economies face with significant fluctuations in energy prices can be an efficient horizontal policy to reduce economic vulnerability.

The other way of controlling growing demand is implementing energy saving policies. By implementing energy saving policies, diversifying sources by improving energy efficiency in accordance with prioritization in different fields sectors, such as buildings and giving support for the development of vehicles with precise targets, countries aim to achieve a high level of efficiency in energy sector and to increase security for both energy demand and energy supply. Energy saving policies can be implemented in various ways that will help the consumers to benefit from energy resources at affordable prices (with less cost) and in the most efficient way (getting the highest benefit) (Mansson, et al.,

2014:2). Disseminating new technologies is another way to control growing demand. New technologies that consume little energy should be developed and also governments should establish markets for these new technologies to be used. In these markets, the conditions should ensure that dissemination of new technologies can be used widely. In other words, market conditions should ensure that technological discoveries are more widely and rapidly used.

In order to increase the control over growing demand, the authorities have also been implementing sectoral policies. Sectoral policies include reducing the imbalance between modes of transport and implementing energy-efficient policies for buildings to increase energy savings. In this sense, sectoral improvements in energy use have been planning to encourage an efficient and environmentally friendly use of energy.

Recently, the imbalance between modes of transport has seriously increased. Especially with a significant increase in the road transport, reducing emission has gained great importance. Policies to reduce emission can include various policies, such as revitalization of railways; modernization of public services in road transport; development of short sea shipping; reorganization of road transport sector (including tightening up the enforcement of social and safety regulations, encouraging diversification of logistics-related activities); enforcement of infrastructural investments to get rid of bottlenecks in rail network; development of a new generation of electric; hybrid or gas-powered cars and implementation of 'polluter pays principle; which will help to put the most of the costs of transport on the polluter in order to promote more environmentally friendly and efficient ways of energy use (European Commission, 2001: 69).

By reducing the imbalance between modes of transport, both the importer and exporter countries can benefit from the energy resources. While the importer countries aim to get rid of the negative impacts of high oil prices by reducing their energy consumption or trying to search for alternative energy sources, such as renewables, the exporter countries focus on domestic resource depletion and CO_2 emission constraints. In this sense, in order to contribute to energy security, the importer countries seek to provide financial incentives to get benefit from energy resources, decouple economic activities with energy and get more interested in energy diversification. On the other hand, the exporter countries, with the aim of making contribution to energy security, try to create a competitive energy industry, encourage long-term energy investments, reconstruct new industries that operate in an efficient way and increase their energy production technologies (APERK, 2007:67).

Another sectoral policy in order to increase the control over growing demand is implementing energy-efficient policies for buildings to increase energy savings. Greater energy savings in buildings can be achieved by greater use of economically viable energy-efficient technologies. Greater energy savings in buildings, reducing energy requirements and improving the security of supply also helps to reduce CO_2 emissions. In this sense, implementation of targeted energy saving rules and encouragement of using renewables in buildings can increase energy savings in buildings. Implementation of targeted energy saving rules include rules for energy consumption standards and investment projects for buildings together with introduction of standard energy certificates, which can encourage investments in energy savings. On the other hand, encouragement of using renewables in buildings includes rules of provisions governing heat and air conditioning system, which can be linked with renewables (European Commission, 2001: 71).

Second important priority for energy security can be regarded as the management of high-dependence to energy supply. Adopting a responsible policy for managing dependence to supply is equally important as controlling over demand for priorities for energy supply. The management of high-dependence to supply includes the management of domestic energy supply, the maintenance of competition among supply sources and ensuring foreign energy supply.

The management of domestic energy supply is an important part of managing supply dependence and involves significant policies to increase the efficiency of supply management, such as developing less-pollutant energy sources (renewables and nuclear energy) and preserving access to energy resources. Here, managing domestic energy supply necessitates using energy security policies regarding both the demand side and supply side of the energy resources.

Energy security policies that are essential for the security of supply in energy sources can be classified in the form of various strategies and tools such as, increased interconnections; high share of renewables or non-dependent energy technologies (coal, nuclear energy, etc.); high amount of strategic reserves of fossil fuels and diversification in oil and gas sectors. On the other hand, energy security policies that are essential for the security of demand in energy sources can be regarded as a reduced use of energy through energy efficiency and conservation (Labandeira and Manzano, 2012:13).

The implementation and effects of energy security policies on the economies can differ according to the development level of the countries. Energy security policies for developing countries mainly include foreign infrastructure

investments, regional cooperation for resources, capital and risk sharing and renewable energy development, while energy security policies for developed countries include mainly market mechanisms for resource allocations. As these countries have various financial resources, they can invest on research and development activities on new energy resources in order to enhance long term business opportunities in the energy sector (APERK, 2007:68).

In the management of domestic energy supply, developing less-pollutant energy sources (renewables and nuclear energy) plays an essential role. The main reason for this is that promoting renewable energy sources, such as hydrogen and co-generation, can reduce the external costs of adopting energy and can contribute efforts for increasing security in energy supply by having positive effects on environment and rural population. On the other hand, nuclear energy, which is another less-pollutant energy resource can reduce greenhouse gas emission. Here, increasing supports on research about nuclear energy and increasing efforts on nuclear safety are essential for the high use of this less-pollutant energy source. Preserving access to energy resources is another important part of managing domestic supply. Governments should find new ways of preserving access to energy resources such as strengthening their countries' strategic oil stocks mechanisms and establishing strategic oil reserves to avoid price fluctuations and disruptions and to contribute to energy safety.

Maintenance of competition among supply sources is another important part of the management of high-dependence to supply. In order to maintain the competition in the energy sector, especially in oil sector downstream, the control of competition rules should be tightened. An open fuel distribution market is necessary for an efficient competition in energy markets. Besides, prices of oil products in the market should be systematically compared in order to avoid price disruptions (European Commission, 2001:72). Here, the competition rules can be determined by various actors and these actors actually intervene the energy markets when necessary. In this sense, energy security itself should not be regarded as the only reason for energy policy intervention but it should be regarded as a concept that allows the countries to protect their welfare in a proper and balanced manner (Labandeira and Manzano, 2012:12). Of course the economic costs of an energy policy intervention should be carefully determined and taken into account before the implementation process.

Ensuring foreign supply of energy sources is the last essential part of the management of high-dependence to supply. In order to ensure foreign supply, the relations with the producer countries (suppliers) should be increased in all matters of common interest such as improvement of price mechanisms, conclusion

of agreements, the use of reserve stocks for mutual benefit, protection of the environment and technology transfer. Especially developments in oil and gas resources and transportation routes to open up oil and gas production should be carefully examined. On the other hand, supply networks should be strengthened to ensure the steady procurement of energy sources at reasonable prices in the long-run. In this regard, the construction of new oil and gas pipelines will help to transfer oil and gas from the producer countries (suppliers) to the importer countries (consumers) and improve the security of supply by diversifying geographic sources of energy supply (European Commission, 2001:73).

In the last three decades, energy security has become a substantial component of a broad research field. In economic and political literature, a wide range of research have been made on security in energy supply and energy demand. The meaning of energy security varies according to the definitions and dimensions of energy security. When energy security is defined as 'low vulnerability of vital energy systems', the concepts of vital energy systems, their vulnerabilities, risks and resilience should be analyzed. On the other hand, all these concepts do not only reflect economic and technical properties of energy security such as energy stocks, flows, infrastructure, markets and prices, but also reflect the political perspectives, institutional roots of energy security concept and political stability.

In this regard, not only economic and technical implementations of energy security policies, but also internationally coordinated and multilateral security measures should be used to achieve a comprehensive and favorable framework for energy security for all countries. Sustainability is also an essential aspect of this framework, because achieving a sustainable energy security would include all dimensions of energy security ranging from economic, technical, political and social dimensions. In this sense, a sustainable and comprehensive energy security policy can help to take necessary measures rapidly and correctly against supply risks that occur during the process of energy supply and can form a complementary and comprehensive framework for a stable and sufficient energy supply.

In a comprehensive framework for energy security, economic stability (price stability, stable energy markets, etc.), economic development and political stability are preconditions for achieving sustainable energy sources at affordable prices. In this sense, a comprehensive conceptualization can help to explain energy security concept and inform reliable and convenient energy security policies by answering specific questions such as which energy systems are vital?, which kind of vulnerabilities and risks do these energy systems involve?

and what is their resilience? Giving satisfactory answers for these questions would bring new questions to be answered with regard to energy security for exporter and importer countries respectively.

For importer countries, can the high energy dependence of importer countries be reduced?, can an increasingly integrated domestic market have an effect on the other importer countries?, should more reserves be stocked or new energy resources, such as renewables, be included in importer countries? for both importer and exporter countries, there are some other questions to be answered such as what should supply and investment promotion agreements contain?, how can the development of energy transport routes be ensured?, what measures should be taken to increase energy saving?, and lastly and more importantly what measures should be taken in the long-term to evolve a sustainable energy security for all countries?

Giving satisfactory answers to all the questions above would advance the research on energy security and reinforce policy making and better policy analysis. As the concept of energy security has a political aspect, answering these questions satiably would also help the authorities to promote appropriate and comprehensive energy security policies and to strengthen the dialogues between the importer and exporter countries in order to increase the mutual collaborat on in energy field.

7. The Rest of This Book

In the book Part II includes energy security issues and economic aspects of energy policy in Central Asia and Caucasus. In Part II, second section prepared by Farkhod Aminjonov titled ‘Central Asian Regional Energy Initiatives: Challenges and Opportunities’ provides information about the regional energy systems and discusses effective enforcement energy mechanism to implement regional level projects. Third section titled ‘Financing Energy Projects: A Comparative Approach of Competing Methodologies’ which is prepared by Anastassios Gentzoglanis reviews the current methodologies and approaches used in project finance and focuses on the development of policies that reduce risks and enhances investors to invest in renewable energy projects. Fourth section prepared by Eda Yalcın Kayacan, Joshua David Cowley and Vedat Pazarlioglu titled ‘Economic Growth, Energy Consumption and Carbon Dioxide Emissions: A Multivariate Co-Integration and Causality Analysis for Central Asia Countries’ investigates the causal relationships between economic growth, energy consumption and carbon dioxide emissions for the Central Asian Countries, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan

and Uzbekistan, for the period from 1990 to 2012. Fifth section titled 'The Relationship between Energy and Economic Growth: An Empirical Evaluation on Central Asian Countries and Azerbaijan' prepared by Sidika Basci, Cumhur Cicekci and Emrah Oz reviews the nature of energy industry in countries in Central Asia and Azerbaijan and analyzes the effect of energy use on economic growth in these countries. Sixth section prepared byYessengali Oskenbayev and Nurgul Satybaldiyeva titled 'Natural Resource Abundance, Institutional Quality and Economic Growth in CIS Countries' focuses on the point-source natural resource abundant production, energy production in CIS countries and discusses that squeezzing out diffuse resource production activities and the natural resource abundance is a nonlinear function of the institutional quality.

Part III includes the political aspects of energy policy in Central Asia. In Part III, seventh section prepared by Anca-Elena Mihalache titled 'A Game of Central Asia Hold'em' discusses the European Union and its engagement in Central Asia and the need to ensure energy diversification in the region. Eighth section titled 'Regional Cooperation in the Caspian Sea Region in the Context of the Eurasian Integration' prepared by Lidiya Parkhomchik focuses on the current backgrounds of the regional cooperation in the Caspian Sea region in the context of the Eurasian integration and highlightes the political preconditions for strengthening regional collaboration in the Caspian region. Ninth section prepared by Muzaffer Ercan Yilmaz titled 'The Conflict over the Energy Issue in the Caspian Sea Region' provides an analytical discussion on the energy dimension of international conflict among the Caspian states with respect to the Caspian Sea and its surrounding region. Tenth section titled 'Comparative Analysis of Russian and Ukrainian Gas Transit Powers' prepared by Farkhod Aminjonov analyzes changing dynamics of the Russian and Ukrainian gas transit powers over the last two decades in the Central Asian region. Eleventh section titled 'The Project of the Present-Day Silk Road: TRACECA and Turkey's Role' prepared by Hasan Sayilan focuses on the historical progress, objectives and significance of the TRACECA Project and Turkey's key role, investments and technical aids in the Project. Twelfth section prepared by Can Deniz Koksal titled 'The Importance of Turkey as a Potential Gateway Country in Eurasia for Sustainable Gas Supply' discusses the process of possible energy routes and corridors in Eurasia with regard to Turkey's key role in the region. Thirteenth and the last section prepared by Saule Akhmetkaliyeva titled 'Water Management in Central Asia' provides an overview of water management issues and current legislations in Central Asia regarding the importance of the management of available water resources in the Central Asian states.

8. Conclusion

We have to emphasize that at the end, by considering the fact that geopolitics is not a static issue, any stable region today is most likely to be in instability in future and that is why countries should trade with a large number of countries instead of being highly dependent on a few countries. This aim can only be achieved by long-run political and international policies because of the structure of the industry. For example, import-dependency in energy is also related to the foreign policy of the country. While producer countries have been trying to control energy supply, importer countries have been trying to provide security in energy supply by making state to state agreements. However, the geopolitical consequences of these agreements should not only be interpreted in perspectives of economics. Because import-dependency means that an economy has to depend on a certain good from a foreign source so as to carry out its normal functions properly, as a result, this dependency affects inevitably the country's foreign policy.

In this sense, the governments need to avoid the actions which endanger energy supply and this prevents the country from implementing a broader foreign policy. We do not mean that a country should have good relations with any country because of energy-dependency, which is a short-sighted policy proposal. Rather, as it can be dangerous to concentrate on any specific country in terms of energy security, it would be a better solution for countries to focus on their own resources and trade with a large number of countries (country diversification), which is a long-run policy for these countries.

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PART II

Economic Aspects of Energy Policy in Central Asia and Caucasus

2. Central Asian Regional Energy Initiatives: Challenges and Opportunities

FARKHOD AMINJONOV

Abstract

Central Asian energy sectors were designed in such way that turned regional state actors into interdependent units of a complex Central Asian Energy System. Resource-sharing mechanism ensured stability and reliability of energy supplies in the region. However, over the last decade the energy system has undergone significant transformation and the resource sharing mechanism could not withstand geopolitical realities. Disintegration of the Central Asian Energy System to a different extent affects the level of energy security in Central Asia. In an attempt to respond to energy insecurities several regional level energy mechanisms were put in place. Despite the fact that these mechanisms operate within a well-developed conceptual framework, they lack effective enforcement mechanism to implement regional level projects.

Keywords: Energy security, Regional cooperation, Water-energy nexus, and The CAES

1. Introduction

The Central Asian Energy System (CAES) was designed and built during the Soviet period, when political borders and sovereignty issue were not an obstacle to ensure parallel operation of national energy sectors. Resource sharing mechanism ensured stability and reliability of energy supplies to meet population and economic needs. The mechanism was quite simple: upstream countries of Kyrgyzstan and Tajikistan ensured a continuous flow of water to the downstream countries and downstream countries of Kazakhstan, Turkmenistan and Uzbekistan channeled fuel and gas to their upstream neighbors. However, over the last two decades the CAES has undergone structural transformation forcing regional state actors to pursue policies that distance them from each other in energy sector. Disintegration of the CAES is negatively affecting the level of energy security in Central Asia and thus, requires urgent attention to be dealt with. However, due to financial and technological limitations as well as political constraints Central Asian countries are sometimes not capable or often unwilling to address energy security problems through regional cooperation. Acknowledging the importance of such cooperation several regional level governance mechanisms were put in place to strengthen it. State actors as well as international institutions, NGOs and private companies are encouraged to pull their resources to address energy security challenges in the region through a number of multilateral programs in energy sector. However, the fact that the CAES is in the process of disintegration implies that these programs are not sufficient enough to facilitate energy trade and improve the level of energy security in Central Asia. This paper aims to analyze regional programs and initiatives designed to improve the level of energy security and facilitate energy led economic growth of the Central Asian countries.

2. Regional Energy Governance Mechanisms in Central Asia

Cooperation between energy state actors and international institutions in the areas of oil, natural gas and hydropower (major projects) production and transportation aims to contribute to improve security of the CAES. There are a number of multilateral institutions that promote initiatives and implement projects in energy sector in Central Asia such as European Bank of Reconstruction and Development, International Monetary Fund, UNDP, Islamic Development Bank and etc. However, the Asia Development Bank within the Central Asia Regional Economic Cooperation (CAREC) and the World Bank through Central Asia Energy-Water Development Program, Central Asia South Asia Regional Electricity Trade Project, Rogun Regional Water Reservoir and Hydropower Project in Tajikistan are the most active ones (Deniz Derya, 2011). In

addition to these programs there are also intergovernmental organizations such as the Shanghai Cooperation Organization, the Commonwealth of Independent States and the Eurasian Economic Union, which can provide regulatory mechanism to improve regional cooperation in energy sector.

These programs and intergovernmental platforms are supposed to bring together state actors and multinational institutions so that they can accumulate resources and coordinate their responses to energy security threats. However, the above-mentioned platforms lack effective enforcement mechanism to implement terms of agreements and ensure the realization of regional level projects in energy sector. None of the existing mechanisms is specifically designed to improve energy security through facilitating regional cooperation. Even though the name of some programs and institutions focus on Central Asia it mainly represents geographical scope within which various projects in energy sector are implemented. While projects developed to engage representatives of several Central Asian states or tackle regional level problems remain in the form of recommendations.

3. The Central Asian Regional Economic Cooperation

The Central Asian Regional Economic Cooperation is probably the largest and the most effective regional initiative in terms of a number of practically implemented projects in energy sector. The CAREC is a program of partnership among 10 countries (Afghanistan, Azerbaijan, Kazakhstan, Kyrgyz Republic, Mongolia, Pakistan, People's Republic of China, Tajikistan, Turkmenistan and Uzbekistan) supported by 6 multilateral institutions (Asian Development Bank (ADB), European Bank for Reconstruction and Development (EBRD), International Monetary Fund (IMF), Islamic Development Bank (IsDB), United Nations Development Program, World Bank) (CAREC). The initiative "CAREC 2020 - Good Neighbors, Good Partners, and Good Prospects" (CAREC) perfectly lines up with the idea that the regional cooperation in energy sector contributes to reliable, secure and stable supplies of energy sources, which in its turn is believed to lead to economic growth and development. The CAREC has indeed developed conceptually quite an impressive mechanism to promote regional trade and improve the level of energy security. However, the analysis shows that to a large extent regional level energy projects have been avoided or limited to technical assistance. In this sense, Central Asia is currently perceived more as a geographical territory composed of separate units within which the institution implements local and national energy projects.

The overall input of the CAREC for thirteen years amounted 24,6 billion dollars worth 158 projects in such areas of cooperation as transport, trade facilitation, trade policy and energy (CAREC). And the energy sector received 4.6 billion USD of the total investment package (CAREC). What distinguishes the CAREC from most of the regional initiatives in Central Asia is the fact that it is first, practical results oriented and second, based on mutually beneficial cooperation. Projects are implemented based on the following principles: a) country ownership; b) pragmatism and result orientation; c) 2+X principle - development of strengthened partnership. Central Asian governments and non-state institutions successfully pull their resources through Public Private Partnership initiative (CAREC).

While conceptually the CAREC has developed a very comprehensive framework to promote projects designed to contribute to energy security and energy led economic growth through regional cooperation, there have been a very few regional level initiatives in energy sector (CAREC). Analysis of projects initiated within the CAREC and separately promoted by ADB shows that out of 83 projects for the last 2 decades only 4 are regional and three more engage several Central Asian states. And all these projects are in the form of technical assistance (CAREC).

Among economically sound initiatives the CAREC distinguishes those that will require domestic investments (energy efficiency and clean energy) and those that can be realized through the cross-border investment measures (cross-border energy transmission, facilitation of access/transit to third-country energy market, production for export, integration of energy markets and etc). Tensions in relationships among Central Asian countries over some major energy projects and other political factors force regional state actors to pursue energy policies, which distance them from each other. As a result, Central Asian countries' energy policies prioritize local and country level energy development initiatives. Since the CAREC usually respond to governments' request to assist in implementation of energy projects, which are usually local in nature, it is not surprising that small projects constitute the absolute majority of the CAREC initiatives.

Another challenge preventing the implementation of regional level energy initiatives is the fact that the CAREC prioritizes cooperation with external customers, which are competing for Central Asian energy resources. It is argued that integration of energy markets will solve the problem of uneven distribution of energy resources among the CAREC countries and address some problems in energy sector though optimizing existing energy interrelationships. Greater regional cooperation and trading energy resources are indeed possible for two reasons: first, the fact that Central Asian hydrocarbon producers are surrounded by countries thirsty for energy resources either due to rapidly growing ener-

gy intense economies (China, Europe, Turkey), inherited energy infrastructure and interdependent energy sectors (Russia) or simply because they lack energy resources to meet their basic energy needs (South Asian countries); and, there is also yet unexploited hydropower potential of Kyrgyzstan and Tajikistan that can increase the level of renewable and clean energy sources in the overall energy balance in all CAREC member states.

Table 2.1. **Energy Security Projects**

Title	Country	Funding Agency	Funding Type	Year	Status
Central Asia Regional Economic Cooperation: Power Sector Regional Master Plan	REG	ADB	Technical Assistance	2010	Ongoing
Central Asia Regional Economic Cooperation (CAREC) Members Electricity Regulators Forum (CMERF)	REG	ADB	Technical Assistance	2007	Ongoing
Establishment of the CAREC Members Electricity Regulators Forum	REG	ADB, Shared, PPIAF	Technical Assistance	2005	Completed
Regional Power Transmission Modernization Project in the Central Asian Republics	REG	ADB, Shared	Technical Assistance	2000	Completed
Central Asia-South Asia Regional Electricity Market Project	AFG, KGZ, TAJ	ADB, Shared	Technical Assistance	2007	Ongoing
Improved Management of Shared Water Resources in Central Asia	KAZ, KGZ, TAJ, UZB	ADB, Shared	Technical Assistance	2003	Completed
Regional Gas Transmission Improvement Project in the Central Asian Republics	KAZ, KGZ, TAJ, UZB	ADB, GKAZ, GKGZ, GTAJ, GTKM, GUZB	Technical Assistance	2002	Completed

Source: Adapted from http://www.carecprogram.org/index.php?page=all-energy-projects

However, with the current pace of natural gas export capacity increase, Central Asian states would not be able to meet the demand in all directions including (Russia 45 bcm/y, China 80 bcm/y, Iran 8 bcm/y, South Asia 33 bcm/y, Europe around 30 bcm/y). Natural gas export capacity of Kazakhstan, Uzbekistan and Turkmenistan combined does not exceed 60 bcm/y. In this regard, regional energy trade within one corridor may negatively impact availability of energy resources in other directions. While more powerful states use economic and political leverage to influence decision-making and ensure energy flows towards their direction, less powerful countries are counting on multilateral institutions to secure energy supplies. In this competition the latter is progressing comparatively slowly. Russia inherited energy transporting infrastructure and China has connected its market with energy producing Central Asian regions via newly built pipeline networks. And the energy trade between regional producers and two major external customers is conducted on the bilateral basis separately from CAREC framework. Unfortunately, energy projects in the South Asian and European directions are still in the process of negotiations.

4. Energy Club of the Shanghai Cooperation Organization

The Shanghai Cooperation Organization was created on June 15, 2001 with full membership of the Republic of Kazakhstan, the People's Republic of China, the Kyrgyz Republic, the Russian Federation, the Republic of Tajikistan and the Republic of Uzbekistan. Having started as a security organization with a particular focus on joining forces to fight against three – isms (terrorism, extremism and separatism), its activity was soon extended to economic cooperation. A political scientist Mr. Zhao Huasheng once argued that "if the SCO is unable to bring economic benefits to the Central Asian member states, it is likely that they will focus their attention elsewhere, away from the SCO, leading to the weakening and irrelevance of the organization" (Zhao, 2006). Energy as a strategic commodity had immediately drawn attention of state actors within the organization. Governmental representatives of the SCO member states many times declared the necessity to establish an effective regional mechanism regulating energy sector. However, it is the bilateral agreements that are being ascribed to the achievements of the organization in Central Asian energy sector.

Russian President Vladimir Putin first presented the idea to create the SCO Energy Club during the International Conference on "Central Asian Energy market: tendencies and perspectives" back in 2005 in Tashkent, Uzbekistan (SCOEC). But, it is only eight years later in December 2013 SCO member states signed a memorandum on formally creating the SCO Energy Club. According to the Russian Minister of Energy Anatoliy Yanovskiy the main ob-

jective of the Club is to form recommendations to the SCO member states on how to behave in dynamically changing regional energy markets and ensure stability of energy demand/supply balance. Since it is a club decisions taken within the Energy Club do not have an enforcement power (KAZENERGY). Even though this mechanism of the SCO to deal with energy security issues is still quite vague, this is the only organization that encompasses almost all Central Asian states and two major external energy importers (Russia and China), while holding other states interested in region's natural resources (India, Iran, Pakistan, Afghanistan, etc.) in the status of observers.

There is an overall agreement among heads of states that "reliable and mutually beneficial partnership in energy sector strengthens security and stability across the SCO region" (Shanghai Cooperation Organization, 2007). This partnership (among producing, transit and consuming states), however, is limited to ensuring stability in moving energy out of the region to China and Russia from and through Central Asian states. The SCO member countries signed a "Treaty on Long-Term Good-Neighborliness, Friendship and Cooperation between the Member States of the Shanghai Cooperation Organization" according to which they base their relationships on principles of equality and mutual benefit (SECTSCO, 2007). However, both Russia and China consider Central Asian countries as sources of energy and the partnership is limited to moving energy out of the region. This in its turn does not directly contribute to improve the level of energy security of the Central Asian states.

Despite many declarations by heads of states and governments that they support regional cooperation, most of the energy projects are implemented on a bilateral or trilateral basis (http://arkz.info/news, 2013). Bilateral agreements separately with several member states that in combination cover a wider range of a particular issue make the illusion of ongoing regional cooperation. For instance, China signs contracts with Central Asian states to secure the movement of natural gas through transit countries. Bilateral format of negotiations and conducting agreements is then presented as an achievement of the SCO regional mechanism. An agreement to build a gas pipeline (the D pipeline) from Turkmenistan via Uzbekistan, Tajikistan and Kyrgyzstan to China was recently concluded. The total value of the project has not been specified yet. But it is expected that the construction of transit sections will cost around 6,5 billion USD. The break up of the total sum: the Kyrgyz section – 1.3 billion USD, the Uzbek section – 2.2 billion USD, and the Tajik section – 3 billion USD. Line D of the CAGP will be financed 100 percent by China (Jarosiewicz, 2013). The SCO achievement is in fact active Chinese energy policy realization in Central Asia.

China does not invest in Central Asian energy sector through the SCO regulatory mechanism. It invests using a bilateral format. During the last visit of Chinese leader, Xi Jinping, to Turkmenistan, Kazakhstan, Uzbekistan and Kyrgyzstan from 3-13 September 2013 signed investment and loan agreements worth 48 billion USD out of which Kazakhstan gets 30 billion USD, Uzbekistan 15 billion USD and Kyrgyzstan 3 billion USD (Yakobashvili, 2016).

And again, what represents more sort of a bilateral cooperation, in the end is presented as the cooperation within the SCO member states. Despite long lasting negotiations on establishing the SCO Bank this level of integration has not been achieved yet and cooperation in energy sector remains in the format of interbank relationship. Chairman of Kazakhstan's Development Bank, Jamishev has stressed the importance of four investment projects within the SCO framework worth 3.5 billion dollars initiated with Kazakhstan's contribution through the Development Bank of Kazakhstan of 900 million dollars (primeminister.kz, 2014).[1] However, most of the projects are financed through bilateral interbank agreements, which are then presented as the investment initiatives within the SCO.

The SCO member states sometimes engage in the dialogue with different expectations, which prevents reaching consensus on a number of issues and develop energy strategy and action plan on further implementation of regional level energy projects. In 2007 during the 2nd session of the Eurasian Economic Forum in Xi'an the SCO Secretary-General Bolat Nurgaliev stated that "for the time being the member states of the Shanghai Cooperation Organization do not have a united position over the common strategic energy concept" (SECTSCO, 2007). Apparently they still do not have it.

The SCO Energy Club as it was mentioned earlier is just a formally existing agency main objective of which is to recommend which path to be taken in regional energy sector cooperation. There is, however, another framework for cooperation, which can choose energy sector as a priority area. Most of the economic and as a result energy projects are being slowed down due to the fact that decisions taken by the SCO bodies must be implemented in accordance with the procedures of member countries' national legislation (Ingmar, 2007).

1 "KBD allocated 900 million USD for projects realization within the framework of the SCO member states' cooperation," (БРК выделил 900 млн долларов на реализацию проектов в рамках взаимодействия стран ШОС) 2014, Prime Minister official website, primeminister.kz

5. The Eurasian Economic Union

The Eurasian Economic Union (EEU) will be launched on January 1, 2015 according to the agreement signed by the leaders of Armenia, Belarus, Kazakhstan and Russia. An agreement to incorporate Kyrgyzstan in the EEU was signed on December 23, 2014 and it is expecting to be joining the Union on May 1, 2015 (Itar-TASS, 2014). Tajikistan is another candidate. The EEU is the final stage of an economic integration process, which started back in 2000. In 1999 Belarus, Kazakhstan, Kyrgyzstan, Russia and Tajikistan signed an agreement on Customs Union and Common Economic Space (http://www.rfembassy.kz, 2013). The document determined three levels of integration: Eurasian Economic Community; Common Economic Space and the Customs Union of Belarus, Kazakhstan and Russia; and the Common Economic Space.

As a successor of the Eurasian Economic Community (EurAsEC) and the Customs Union (CU) the EEU has inherited a mechanism designed to regulate a wide range of intergovernmental relations. The only pressing issue that has always been on the agenda and is not yet resolved is the free movement of energy resources. In this regard, to have a clear vision of what to expect from energy export/import relationships by the newly established EEU, it is important to understand how does regional level cooperation in energy sector used to operate within the EurAsEC and the CU.

The EurAsEC was created in 2000 with full membership of all five countries. For the period of ten years the EurAsEC had developed two conditions that can potentially turn the organization into an effective mechanism in promoting regional cooperation in energy sector: its vision of economic (including energy sector) integration; and, institutional mechanisms.

The Council on Energy Policy is the main agency responsible for the development and implementation of regional level energy projects. Along with the Council on Energy Policy other agencies had been involved in the process of establishing a unified energy system: a) Electricity and Nuclear Policy Department; b) Oil and Gas Policy Department; c) Advisory Committee for Electricity; d) Advisory Committee for Oil and Gas.

In 2003 the Council on Energy Policy adopted fundamentals of EurAsEC's energy policy aimed at establishing unified energy, information and transportation systems (http://evrazes.org, 2003). The policy prioritizes joint activity oriented towards rational use of energy resources and formation of the common complementary fuel-energy complexes of the Community member states

based on increasing efficiency of energy systems, development of transit potential and creation of favorable conditions to increase intergovernmental supply of energy resources.

It was expected that the next stage of economic integration, which was the Customs Union of Belarus, Kazakhstan and Russia of 2010 (www.mfa.kz), would turn plans to liberalize energy markets into reality. Even though to certain extent barriers preventing free movement of resources have been eliminated, neither the EurAsEC nor the CU succeeded to develop an effective regional mechanism regulating energy trade. Russia being the strongest supporter of an economic integration confronts the formation of common energy markets, which bear additional financial loss.

Energy (re) export/import as well as transit relations have always been an important issue on the CU agenda. Belarus imports Russian energy resources for discounted price and large quantities based on annually renewed bilateral agreements. Russia and Kazakhstan agreed to regulate current supplies of crude oil and oil products for a year starting from January 1, 2014. However, Russia keeps the bilateral format for regulation of the movement of these particular types of energy resources. Out of 140 products of the group 27 only 6 of them do not fall under the regulation of the Union, including natural gas in a gasified form, crude oil and oil products and electricity (http://www.tsouz.ru).[2] Absence of common oil, gas and electricity markets within the Customs Union raise concerns in both Kazakhstan and Belarus.

A country that imports more energy resources, not regulated by the CU than exports them loses more, because custom tariffs increase the price for a unit of energy sold to external markets. For instance, for January-March 2013 the volume of Kazakhstani crude oil and gas condensate supplies to Russia accounted for 17 692,8 (8 207,1 thousand dollars) tons, while Russian export to Kazakhstan was almost 100 times more – 1 977 205,7 (769 268,6 thousand dollars) tons (www.tsouz.ru, 2013 and www.eurasiancommission.org, 2013). In this regard, Kazakhstan would want these items of the 27 group to move freely within the territory of the Union. Currently, Russia – Kazakhstan energy export/import relations are regulated by a bilateral agreement signed only for the year of 2014. Even though Russian government applies preferential pricing policy towards members of the Union, in the absence of an effective/multilateral mechanism designed to regulate energy movement most of the CU/EEU member states will remain vulnerable.

2 Group 27: Mineral fuels, oil and products of its distillation; Bituminous substances; mineral waxes (ГРУППА 27: ТОПЛИВО МИНЕРАЛЬНОЕ, НЕФТЬ И ПРОДУКТЫ ИХ ПЕРЕГОНКИ; БИТУМИНОЗНЫЕ ВЕЩЕСТВА; ВОСКИ МИНЕРАЛЬНЫЕ)

Unregulated major energy supplies, however, are negatively affecting the volume of energy trade among Union member states. The volume of energy trade among Customs Union member states is accounted for 34,9% in 2011, 33,4% in 2012, and 28,9% in 2013. This contradicts one of the main principles of the Union interaction, which are the increasing trading dynamics and energy trade driven economic development. Besides, slowly decreasing energy trade patterns, in the absence of common terms of regulation protectionist measures are sometimes employed. For instance, import of Russian oil products was restricted by the government's decree of the Republic of Kazakhstan in April 23, 2013.

Minister of Energy and Infrastructure of the Eurasian Economic Committee, Danial Akhmetov once claimed that common oil and gas market between Belarus, Kazakhstan and Russia could be formed by January 1, 2015 (www.belta.by/ru, 2013). This statement was followed by the announcement that the Union member states are not yet ready to completely liberalize energy markets. The chairman of the Eurasian Economic Commission, Viktor Xristenko, later announced that common oil and gas market would be formed by 2025. And here is how the President of Belarus reacted to it: "We bought the product, processed and then sold it – the gain is ours. We are told that this is a specific product and thus we'll do it this way… Russia first suggested taking it to the level of bilateral agreements. That is why we started these negotiations" (news.tut.by, 2014).[3] Same was the reaction from Kazakhstani side.

Russia strongly opposes liberalization of energy trade within the Union. One could argue that an economic loss forces Russia to confront customs tariffs removal for those particular items. But the fact that annually renewed bilateral agreements with Belarus, Kazakhstan and a future member Kyrgyzstan already exclude export tariffs for oil products, gas and electricity, imply that it is not the financial loss but rather a political leverage that Russia is not ready to give up.

Terms of the EEU will come into force on January 1, 2015. Within the EEU members states will use single mechanism regulating economy, harmonize their legislation, create unified energy – transport – communication infrastructure, coordinated tax system, trade and customs policy aiming at ensuring the free movement of goods, services, capital and labor force. But the Concept of establishing common energy markets will be adopted in 2016 and the program

3 "Lukashenko is heading to Kazakhstan to sign not the same agreement on the EEU that Belarus was expecting" (Лукашенко направился в Казахстан, чтобы подписать "не совсем тот договор о ЕАЭС, на который рассчитывала Беларусь).

will be developed by 2018. It is also expected that common electricity market of the EEU will be formed by 2019 and oil and gas market only in 2025. And the liberalization of energy markets should be accompanied by harmonization of legal basis of the Union member states and establishing supra national financial centers to implement regional level energy projects (eurasiancommission.org, 2014). Even though Russian government applies preferential energy pricing and customs tariff-free policy towards members of the Union, in the absence of an effective/multilateral mechanism designed to ensure free movement of energy resource most of the EEU member states will remain vulnerable. Unfortunately, there should be a very good reason for Russia, such as to keep the Union afloat, to let the common energy markets of the EEU be formed.

6. Commonwealth of Independent States

The Commonwealth of Independent States is the oldest institutional framework founded on December 8, 1991. All five Central Asian states joined it two weeks later on December 21, 1991. Except Turkmenistan other states ratified the CIS charter and keeps the status of associate member of the organization. The CIS's competence is extended to activities in the realm of trade, finance, security, human rights, social and economic development, including cooperation in energy sector. But since it does not possess an effective enforcement mechanism, it is often considered a loose association of states rather than an organization capable to strengthen regional cooperation. However, over the quarter of century of its existence the CIS succeeded to develop a comprehensive legal basis to regulate a wide range of intergovernmental activities including in energy sector, which can be and often is used by other regional institutions in the process of development ofe their own conceptual framework of activity in the region.

The CIS energy sector governance apparatus encompasses: Intergovernmental Council for Oil and Gas; Electric Power Council of the CIS; Intergovernmental Council on cooperation in the spheres of chemicals and petro-chemicals; CIS member states' Committee on using nuclear power for peaceful purposes (http://www.e-cis.info). These agencies are supposed to promote regional cooperation in energy sector within the framework of below mentioned agreements.

Table 2.2. **Agencies Promoting Regional Cooperation in Energy**

1. Agreement on Coordination of Interstate Relations in the Power Sector of the Commonwealth of Independent States signed by the Council of Heads of Governments on February 14, 1992
2. Treaty on ensuring parallel operation of power systems of the states – members of the Commonwealth of Independent States signed by the Council of Heads of Governments on November 25, 1998
3. Decision of the Council of Heads of Governments on implementation of the Treaty on ensuring parallel operation of power systems of the states – members of the Commonwealth of Independent States on November 28, 1998
4. Agreement on transit of electricity and state's power capacities – members of the Commonwealth of Independent States on January 25, 2000
5. Agreement on mutual assistance in cases of accidents and other emergency situations at electric power facilities of states - members of the Commonwealth of Independent States on May 30, 2002
6. Agreement on cooperation of states – members of the Commonwealth of Independent States in the field of energy efficiency and conservation, signed by the Council of Head of Governments on October 7, 2002
7. Agreement on the establishment of reserves of resources and their effective use to ensure stable parallel operation of power systems of states – members of the Commonwealth of Independent States, signed by the Council of Heads of Governments on September 15, 2004
8. Decision of the CIS Economic Council of the Regulation on the Energy Council of the Commonwealth of Independent States in the new edition of March 11, 2005
9. Decision of the CIS Economic Council on the main directions and principles of cooperation of states – members of the Commonwealth of Independent States in the field of energy efficiency and conservation from March 11, 2005
10. The Concept of common electricity market formation of states – members of the Commonwealth of Independent States, approved by the decision of the Council of Heads of Governments on November 25, 2005
11. Decision of the Council of States of Governments on establishing a common time for reading electric power meters of electricity moving through interstate transmission lines in states – members of the Commonwealth of Independent States of November 24, 2006
12. Agreement on harmonization of customs procedures when moving electricity across the customs borders of states – members of the Commonwealth of Independent States on November 22, 2007
13. Protocol on amendment sand additions to the agreement on coordination of interstate relations in the field of energy of the Commonwealth of Independent States from February 14, 1992 on November 22, 2007
14. Agreement on the formation of a common energy market of states – members of the Commonwealth of Independent States of May 25, 2007
15. Agreement on cooperation among states – members of the Commonwealth of Independent States in the field of exploitation of interstate transmission lines of national electric power systems from November 20, 2009
16. Protocol on the stages of the formation of the common energy market of the CIS member states on May 21, 2010

Source: Author's compilation

Having such a wide-ranging conceptual framework, the CIS decided to move to a practical realization of its main objectives in energy sector. On November 20, 2009 the CIS member states have even adopted the energy sector cooperation Concept. Having input strategic importance in energy development the CIS Council declared energy sector to be key sphere of interaction in 2009. Trans-boundary transmission lines connecting several countries received a particular attention by the Council, because such networks require coordinated actions to be taken and the CIS offers platform for joint regulation (www.cis.minsk.by). The action plan adopted on May 21, 2010 took a practical approach to address first priority projects (www.e-cis.info).

Member states of the CIS still cannot agree upon using balanced methods for oil, gas, and electricity production and supply. And the main reason is that the organization encompasses most of the former Soviet republics energy systems which have broke down over two decades of independent policies in energy sector. Since regional energy systems are not properly connected it turned to be quite difficult to ensure parallel operation of CIS member states' power systems. In case the Central Asian region, only Kazakhstan's Western and Northern power grids are connected to the Russian energy system. Southern Kazakhstan together with all other Central Asian countries works in coordination within the Central Asian Power Grid. On top of that the Central Asian Power System is in the process of disintegration. Turkmenistan left the power system in 2003. However, it is the withdrawal of Uzbekistan that impacted the parallel operation of the CAES the most. Uzbekistan's withdrawal left the energy sector of Tajikistan in complete isolation. Only Kazakhstan, Kyrgyzstan and Uzbekistan to certain extent sustain energy trade on annually prolonged bilateral contracts. In this sense, as its main objective the CIS should focus on ensuring parallel operation of sub-regional energy systems rather than focusing on the unity of the energy system over the territory of all CIS countries.

One of the main drawbacks of quite an impressive conceptual basis of the CIS is the fact that most of signed intergovernmental agreements only lack enforcement power. Recommendations provided by those agreements require signing additional documents with detailed action plan. Moving to this level of interaction proved to be quite challenging. The Concept of cooperation of the CIS member states in energy sector adopted in 2009 determined a wide range of activities including nuclear power sector. In an attempt to contribute to improving the level of energy security by adding power production capacities the CIS countries approved the framework program on cooperation in developing nuclear power (www.cis.minsk.by). Within the framework of the CIS cooperation "Rosatom" and "Kazatomprom" on May 29 signed a Memorandum

of cooperation in the construction of the first Kazakhstani NPP using Russian energy reactors with the capacity from 300 up to 1200 Megawatts (sng-atom.com).[4] It was presented as one among many achievements of the organization.

Development of hydropower potential of Kyrgyzstan is also to certain extent ascribed to the fruitful cooperation within the CIS. Kyrgyzstan has prioritized construction of Kamabarata-1 and 2 HPP with total capacity of 2260 MW. First aggregate of Kambarata-2 was put into operation in 2010 with the capacity of 120 MW. In 2012 Russian company "Inter RAO UES" signed agreement with Kyrgyzstan on terms of construction Kambarata-1 HPP. It was expected to start the construction by 2013, but due to political and financial constraints it is still on the level of negotiations. Governments of Russia and Kyrgyzstan also signed agreements on building and exploitation of Upper Narin cascade HPPs (Akbulun HPP, Naryn HPP-1, Naryn HPP-2 and Naryn HPP-3) and etc. However, it is still difficult to distinguish between projects realized through bilateral agreements and those within the framework of the CIS. To the question of whether the above-mentioned projects could have been agreed upon and implemented without the CIS, the answer is probably "yes". Besides the CIS institutional apparatus does not possess an effective enforcement mechanism.

7. The World Bank's Regional Projects in Energy Sector

The World Bank is one of the main contributors to improve the level of energy security, promote energy led economic growth and encourage addressing water-energy nexus problems in Central Asia is the World Bank. The World Bank has been co-chairing and partnering with a wide range of multilateral institutions as well as international non-governmental organizations in promoting and implementing energy projects on the local, national and regional levels in the region. The WB engages in Central Asian energy sector development through three main initiatives: Central Asia Energy-Water Development Program (CAEWDP); Central Asia South Asia Regional Electricity Trade Project (CASA-1000); and, the Assessment Studies for Proposed Rogun Hydropower Project in Tajikistan.

But the most important, the WB has itself initiated several regional level programs to improve energy security and stimulate energy development in the region. Saroj Kumar Jha, World Bank Regional Director for Central Asia argued that the WB is currently supporting 32 country-specific investment projects in

4 "Russia and Kazakhstan will sign an agreement to build in the near future Nuclear Power Plant in the city of Kurchatov in Kazakhstan," (Россия и Казахстан в ближайшее время подпишут соглашение о строительстве в казахском городе Курчатов атомной электростанции), 2014.

energy and water sectors in Central Asia (www.worldbank.org). Most of these projects have regional significance. The Central Asia Energy-Water Development Program is one of those WB initiative designed not only improve water management and development of hydropower potential, but also promote regional cooperation in energy sector.

The CAEWDP is a four-year project from January 2010 to January 2014 co-financed by the World Bank and national governments of Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan (www.worldbank.org). It has three pillars of activity.

- Energy Development - to promote highest value energy investments and management. Areas of focus include: infrastructure planning, winter energy security, energy trade, energy accountability, and institutional development;
- Energy-Water Linkages - to improve the understanding of linkages between water and energy at the national and regional levels. Areas of focus include: energy-water modeling, regional hydrometeorology, climate vulnerability, and energy-water dialogue;
- Water Productivity - to enhance the productivity and efficiency of water use in both agriculture and energy sectors (web.worldbank.org).

Since 2007, the World Bank has been facilitating extensive consultations with governments of Kazakhstan, Kyrgyz Republic, Tajikistan, Uzbekistan, Turkmenistan, and Afghanistan to ensure riparian's views and concerns are taken into account in the Terms of Reference (TOR) for the assessment studies of the Rogun Hydropower Project in Tajikistan: Techno-Economic Assessment Study (TEAS); Environmental and Social Impact Assessment (ESIA) (www.worldbank.org). Consultations were also undertaken with civil society and representatives of potentially affected communities within Tajikistan. The World Bank and the Government of Tajikistan reached an agreement that starting from 2010 no new construction will commence until assessments are complete and communicated to the representatives of all countries involved (World Bank, 2014).

Upstream Kyrgyzstan and Tajikistan have a surplus of power production in the summer period. With Uzbekistan's withdrawal from the CAES, which cut the power supply possibility these countries were forced to spill water. To facilitate energy export-led economic growth the World Bank has been supporting the Central Asia-South Asia Regional Electricity Market (CASAREM) initiative to move extra-power to South Asian energy markets and generate revenues to

the budget. As a first phase of the initiative it is agreed to build a CASA-1000 transmission line to transit 1,300 MW of electricity(documents.worldbank.org). 1,222 km long, running through Kyrgyzstan, Tajikistan, Afghanistan and Pakistan (PS Datka (Kyrgyzstan) – PS Khujant (Tajikistan) – Rogun HPP (Tajikistan) – Kabul – Peshawar), including: 500 kV DC line 750 km long through Tajikistan (117 km) – Afghanistan (562 km) – Pakistan (71 km); 500 kV AC line through Kyrgyzstan (substation Datka, 452 km) – Tajikistan (PS Khujant, 20 km) with total length of 472 kmCASA-1000 (www.worldbank.org).

All three projects are closely interlinked. Improving the livelihood of people in Central Asia through the development of upstream countries' hydropower potential, export led economic growth and energy security was chosen to be a priority in WB's activity in Central Asia. Construction of giant HPPs will largely be justified only in combination with the possibility to export power to external markets. It is also argued that the development of Rogun and Kambarata dams will strengthen water management in the region.

Stability of water and energy supplies within the Central Asian region was ensured by resource-sharing mechanism developed in the Soviet era. This mechanism turned the whole region into a system of interdependent entities. When the Soviets designed this system they did not take into account country borders of the Central Asian states. Rational use of resources was the main objective. Central Asian upstream river states of Tajikistan and Kyrgyzstan released water and electricity in exchange of electricity and hydrocarbons from downstream countries. However, resource-sharing mechanism could not withstand current geopolitical realms. Independent policies of the Central Asian authorities are negatively affecting security of the Central Asian energy system causing shortage of energy and irrational use of water resources in the region. Acknowledging the seriousness of the problem, regional state actor still fail to achieve solution amenable to all. Fundamental disagreements between region's water demand for irrigation and the use of water for hydropower plants, along with disagreements over the price for fossil fuels and many other factors have led to a latent conflict between upstream and downstream countries. In this regard, the WB has chosen promotion of water-energy nexus development projects as a priority for its activity in the region.

There are two main projects capable to impact the water-energy balance in the region: Rogun and Kambarata-1. Disintegration of the CAES forced Kyrgyzstan to refocus on energy supplies from Russia and Kazakhstan and development of coal-fired TPPs to meet its growing energy needs. Uzbekistan's withdrawal from the system, however, left Tajikistan in complete isolation.

Having experienced significant shortage of energy the Tajik government turned Rogun - the highest HPP in the world into a strategically important national project expecting that it will help Tajikistan get out of energy crisis.

However, since these two projects can impact water balance in the region Uzbekistan stands against them. Uzbek authorities believe that both Rogun and Kambarata-1 'in case of dam failure' will flood 1,5 million hectares of land causing human casualties in all countries along the way (siteresources.worldbank.org). But the main reason for confronting these projects is the fact that Rogun and Kambarata dams may affect water availability for Uzbekistan's irrigation purposes. Tajikistan's officials as long as independent experts look at this project from a different angle. Having optimistic expectations that there will be no natural disaster capable to destroy the Rogun dam, Tajik authorities are focusing prospects that this project brings to not only Tajikistan but also other Central Asian states. The primary object of Rogun is to generate power to meet energy needs of Tajikistan. Surplus of electricity would allow Tajikistan gain economic revenues from exports to its neighbors (www.worldbank.org, 2014).

There is currently a surplus of electricity production in Tajikistan and Kyrgyzstan in summer period and it is argued that CASA-1000 is supposed to transport that energy to Southern neighbors. However, Afghanistan and Pakistan are mostly in need of electricity import in winter and the only projects that provide these opportunities are Rogun and Kambarata-1 (www.prezident.tj). In this sense, following the olicy of other Central Asian producers, Kyrgyzstan and Tajikistan will increase export of electricity even at the expense of domestic consumption. Desire to export electricity in wintertime will turn Rogun and Kambarata-1 into economically attractive, but with limited contribution to energy security projects.

The final reports were released on July 2014 (www.worldbank.org). According to the assessment the highest possible option of the dam was found the most economically efficient with acceptable environmental and social impact. The assessment, however, did not solve the problem of non-cooperation in the region. Assessment has been conducted over the area of upper Amudarya River and did not take into account possible consequences for downstream Central Asian countries, which was an excuse for Uzbek authorities to keep blocking those projects.

8. Conclusions

There are several regional level energy mechanisms in Central Asia, which have developed a comprehensive conceptual framework to approach energy security challenges, cooperation in energy sector and energy led economic growth. However, implementing regional level energy projects turns to be quite challenging. The CAREC institutional framework has developed an action plan on promoting and enforcing regional cooperation in energy sector. But due to a number of interstate disagreements among Central Asian countries and the fact that the CAREC mostly respond to governments' request to engage in energy projects realization of regional level initiatives in energy sector proved to be problematic. Central Asian state actors have been counting on the SCO framework to ensure stability and reliability of energy supplies between Central Asian exporters and two major consumers. However, a long awaited Energy Club of the SCO still lacks enforcement mechanism. Having the status of a club its main contribution does not go beyond providing recommendations. The Eurasian Economic Union inherited governance mechanism of the EurAsEC and the CU. But since such a vital sources of energy as natural gas, electricity, oil and oil products do not fall under the regulation of the Union it does not significantly affect regional trade in energy sector. The CIS is considered to be the oldest and the largest institutional framework in Central Asia. It has an extensive legal basis, which supposed to promote and regulate regional cooperation in the areas of oil and gas and electric power sectors. However, providing recommendations is the only tool at the CIS disposal to influence regional level cooperative dynamics. Besides, most of the CIS member states' energy sectors are physically isolated from each other, thus making it difficult to coordinate responses to energy security threats. One of the main International Institutions that actively engage in the regional level energy projects is the World Bank. The World Bank has been actively engaging in energy sector within its CAEWDP, CASA-1000 and Rogun assessment initiatives. However, disagreements between Central Asian downstream and upstream countries does not allow to practically implement initiatives designed to improve energy security and energy led trade development.

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3. Financing Energy Projects: A Comparative Approach of Competing Methodologies

ANASTASSIOS GENTZOGLANIS*

Abstract

Financing energy projects has been critical to the development of emerging and industrialized countries. Evaluating investment in renewable sources of energy involves, among other things, the right valuation and pricing of risks. The traditional methodologies take into account the existing and perceived risks but in an ad hoc approach, leading to either over- or under-investment. New methodologies have been suggested to correct the deficiencies of the traditional ones. This paper reviews the current methodologies, chiefly the NPV rule, the decoupled DNPV and the "exceeding probabilities" approach used in project finance. It turns out that investment decisions based on these methods are not always optimal. A new holistic framework developed by the UNDP-GEF, the so-called Derisking Renewable Energy Investment (DREI) model, focuses on derisking a country's business environment by identifying the barriers to and risks of investment. It focuses on the development of policies that reduce risks and incentivize investors to invest in renewable energy projects. This approach has been applied to Kazakhstan with encouraging results.

Keywords: DNPV method, Exceeding probabilities, Kazakhstan, NPV, Project finance, Project valuation, Renewable energy investment, Risk

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1. Introduction

Energy security has increasingly become a growing challenge for many countries, particularly since emerging economies, predominantly China, India and Brazil, have become important international economic players. The energy problems faced by these countries affect the world economies chiefly because the policies they use to curb the energy challenges have important long term ramifications on the supply of energy and its quality (Blázquez J. and J. M. Martín-Moreno, 2012). China for instance currently relies on coal for covering most of its energy needs but pressures from various national and international groups to decrease pollution and quickly address the problems of global climate change force China to turn to other sources of energy, particularly the import of crude oil and the development of alternative, i.e., renewable sources of energy[1].

The energy problems facing developed countries are different from the ones of developing countries. Further, the needs in energy facing developed economies are not alike either. For instance, the USA seems to have resolved its energy dependency, at least for some decades, chiefly because of the advent of new technologies and the abundance of energy in its territory. Indeed, new energy technologies make possible the exploration of new forms of oil and gas – shale oil and gas, for instance – and this makes the US a more energy-independent economy as the recent US falling oil imports make clear (EIA, 2014). Nonetheless, the European Union (EU) still relies on energy imports and energy security is a major concern for the Union (Eurostat, 2014; Europa, 2014). Given that both domestic and international policies increasingly focus on energy security, some countries have developed policies emphasizing the use of renewables as a means to reduce their oil-dependent economies[2].

The increasing reliance on renewable sources of energy raises the problems of financing of energy projects (Kaminker and Stewart, 2014). Despite the decline in cost of the alternative sources of energy, still most of them remain expensive compared to the conventional sources of energy. In addition, their intermittence makes them riskier than the conventional ones. Private financing of energy projects having a higher risk than others can only be made possible if government funds or pricing policies (feed-in tariffs, for instance) reduce the risk of these projects (Peters and Weis, 2008). Volatile energy markets and

1 China's reliance on oil imports made this country the largest importer of crude oil in the world (Yergin, 2011; BP, 2013).

2 Therefore, the EU countries put more emphasis than the US on the development of renewals. For the US and China their reliance of conventional energy sources makes the reduction of CO2 emissions a real challenge.

shaking government finances (recent financial crisis is an example) affect the risks of renewable energy projects and their chances to be realized. For developing and emerging economies international financing organizations (UNDP, IFC[3], etc.) provide grants and other support programs for the development of renewables.

This paper addresses the issues of financing energy projects with particular emphasis on renewables. It examines and presents the current methodologies used to evaluating investment projects in both developed and developing economies. Kazakhstan serves as a case study. It appears from the literature review that the current methodologies lead to decisions resulting in either an over- or under-investment. With reference to renewables, there is a higher risk of underinvestment. This is so because renewables use rather new and not yet established technologies and therefore private investors prefer financing conventional projects considering them less risky than renewables. Another element in the non-optimal decision making process is the lack of recognition of all kinds of risk.

Indeed, the standard methodologies do not adequately account for all risks and therefore the conventional decision making rules may be biased. Additional tests have been proposed to correct the standard methodologies. The decoupled net present value (DNPV) criterion is an improvement to the traditional NPV rule as it is the case with the quantitative risk analysis. These refinements in the methodologies do contribute in making a better evaluation of an energy investment project, nonetheless, they omit to take into consideration the government policies and regulations. Indeed, for capital intensive projects, the ways governments and the private sector interact to improve the financial predictability of energy investments and their returns play a significant role in the materialization of an investment project (Narbela, 2013).

By and large, risk, and therefore the return investors expect to realize, depends on the policies the governments adopt to sustain their energy industry and the security of supply (Butler and Neuhoff, 2004). Recently, the UNDP (2013)[4] proposed a methodology – the DREI[5] approach – which takes into account the barriers to investment and the relative risks associated with technology, reg-

3 UNDP stands for the United Nations Development Program, while ICF is a subsidiary of the World Bank specializing, inter alia, in financing large projects in the developing world.

4 The UNDP (2013) report is referenced as: Waissbein, O., Glemarec, Y., Bayraktar, H., & Schmidt, T.S., (2013). Derisking Renewable Energy Investment. A Framework to Support Policymakers in Selecting Public Instruments to Promote Renewable Energy Investment in Developing Countries. New York, NY: United Nations Development Programme.

5 DREI stands for Derisking Renewable Energy Investment (UNDP, 2013)

ulation and the risk of government reversal policies[6]. In its report the UNDP demonstrates, by reviewing the results of the application of this methodology to various developing countries, that derisking the business environment by the adoption of policy instruments contributes to the creation of an enabling environment which is more conducive to investment in energy projects.

Thus, no matter which methodology is used to evaluate investment in renewables, it is important for the governments to carefully articulate energy policies and set up regulatory and institutional mechanisms to create the necessary leverage for investment. The latter reduces the cost of capital and therefore the risk of the investment.

Section 2 presents the literature review by examining analytically the current methodologies used to value risks in conventional and renewable sources of energy. Section 3 examines the case of Kazakhstan to illustrate the pertinence of the UNDP-GEF methodology. Lastly, section 3 concludes.

2. Literature Review of Methodologies Used to Value Investment in Energy Projects

Various methodologies are used to evaluate the acceptability of a project. They may be classified into two broad categories, corporate finance and project finance. Many differences exist between them. One, and probably, the most important of all, is the allocation of risks. The former uses expected cash flows as a means to attract capital from creditors and shareholders. Creditors being more risk-averse than shareholders get a "seniority status" in the claim of all assets in case of liquidation of the business. Because of this preferential treatment creditors get a lower compensation than shareholders for the funds they invest in the business. By contrast, the shareholders invest in sunk[7] and non-sunk assets of the firm and assume a higher risk than creditors. As a result, they expect a higher compensation than creditors.

When risks are high, as in the case of renewables, it is more difficult to attract investors willing to commit their funds to these projects. Government subsidies and other tools providing guarantees and/or financial aid are needed to make the projects attractive. For instance, Spain, Denmark, Germany and other European countries used the Feed-in Tariffs (FiT) programs and other policies to reduce the cost and make investment in renewables attractive. By virtue of

6 See France's recent decision to call into question the wind feed-in tariff policy, Actu-environnement, 2013.

7 Sunk costs are related to long term and irreversible investments for which an investor has meager possibilities to get back his investment in case of bankruptcy.

FiTs, investors get a guaranteed price agreed on to prevail for a certain period of time and a market for their product. By and large, government programs aim at reducing the risks associated with the project and making attractive private investments in infrastructure[8].

The Discounted Cash Flow (DCF) method and the NPV rule: In corporate finance the standard tool used to value investment projects is the Net Present Value (NPV) method. Expected cash flows (CF) are discounted at a hurdle rate (r) and after summing them up the (upfront) cost of investment is subtracted to get the net present value (equation 1). A positive NPV implies that the investment project contributes to the value of the firm, while a negative NPV implies that the project does not add value to the firm and should not be accepted[9].

$$NPV = -Cost + \sum_{t=1}^{T} \frac{CF_t}{(1+r)^t} \quad (1)$$

It is a straightforward technique chiefly developed for valuing investments in financial securities. The hurdle rate used to discount cash flows is well anchored in the theory of risk quantification and management and the latter has made a lot of progress in the past thirty years. The hurdle rate is calculated using various financial techniques. It is commonly referred to as the WACC (Weighted Average Cost of Capital) which is an average rate of marginal costs of two main sources of financing, equity (E) and debt (D) weighted by the proportion of equity and debt to the total capital (equation 2).

$$WACC = k_e \frac{E}{D+E} + k_d \frac{D}{D+E} \quad (2)$$

The marginal cost of equity financing is commonly calculated using the well-known financial model, the CAPM (Capital Asset Pricing Model) based on the corporate finance theory according to which risky assets, like equity, are valued according to the degree of undiversifiable risk (equation 3). Managers (business executives) by pooling investments manage to diversify away the risks of each individual project and they get compensated for the residual risk which cannot be diversified away.

$$E(R_j) = R_F + \beta_j (R_M - R_F) \quad (3)$$

8 There is a debate (Seel et al., 2013) concerning the suitability of these programs and their contribution to the well-being of the society. But because they are costly for the government, their availability and generosity have been called into question.

9 In practice, projects with negative NPVs may be accepted, for strategic and/or other objectives.

Where $E(R_j)$ is the expected return on asset j, R_F is the risk free rate, R_M the return of an index like Dow Jones and beta (β) is the non-diversifiable risk of the asset.

Investment in infrastructure, like in energy, requires a thorough understanding of all risks and the assessment of the latter and their exact quantification is of extreme importance for those who finance such projects. In contrast to liquid financial assets, investment in infrastructure is sunk or rather illiquid, it takes time and profits may show up only in the long term. Financial resources are rather scarce and because of the lumpiness of the investment, the acceptance of a project implies that other projects cannot be accepted at the same time. Rationing is even more acute in infrastructure investments than in corporate investments. The criterion used to take the appropriate decision to invest should then be the most suitable possible. Unfortunately, the NPV criterion is besieged by criticism (Pierret, 2012). It is argued that relying on a single discount rate (the WACC) to explain the riskiness of the project may result in over — or under – investment. To get the capital required for an investment, managers must assure investors, equity owners and creditors, that they will earn at least the WACC of the investment. The NPV criterion is a top-down approach to value investment projects, although a bottom-up approach is more appropriate.

These criticisms led to the development of alternative models for valuing the risks of investment projects. Real options, decision analysis and other probability-based methods have been suggested as alternative, yet better approaches to valuation of risky investments and the development of strategies (Borison, 2005; Trigeorgis, 1996). Although these methods have a theoretical appealing, they are difficult to apply in practice and even more difficult to explain to decision makers. The latter are slow to depart from the traditional tools and reluctant to espouse new ones (Pergler and Freeman, 2008).

The Decoupled NPV rule (DNPV): Recently a new approach has been proposed (Espinoza and Rojo, 2015) with the purpose of correcting the deficiencies of the standard methodology. The new valuation methodology, the so-called decoupled NPV (DNPV), uses probabilistic analysis to measure and value the risks of an energy project. It uses option pricing theory to price the costs associated with risks and integrates these costs to the project valuation – a bottom-up approach. The DNPV approach does not refute the traditional NPV method. By pricing risks in the way it is done by the DNPV approach, the project's *risk performance* is appropriately evaluated. Nonetheless, managers still need to use the traditional NPV method to measure the *financial performance* of the project by using the unadjusted WACC criterion.

Smith and Nau (1995) and Smith and McCardle (1999) were the first ones to use neutral and actual probabilities along with decision tree analysis for valuation of risk in oil and gas investment projects. Espinoza and Rojo (2015) build on these ideas and use risk-neutral probabilities for public, i.e. market risks and actual probabilities for private, i.e., non-market risks. In their modeling, investors are viewed as insurance providers and as such they are compensated for all risks which cannot be diversified away. Therefore, investors' compensation is viewed as an insurance premium reflecting the risks (private and public) owned by each investor.

Espinoza and Rojo (2015) illustrate their arguments with a real example for a French solar project but the analysis is equally valid for any energy investment project. The authors adopt the five-step approach to manage risk as it is proposed by Buehler et al. (2008) to evaluate energy investment projects using the DNPV method. The five-step approach is an Integrated Risk Return Management (IRRM) program for corporate risk management which comprises the following steps: 1) identifying and understanding the risks of the project; 2) selecting risk ownership and identifying the risks sharing procedures; 3) determining the risk tolerance and quantifying the amount of acceptable risk; 4) choosing the risk mitigation mechanisms; and 5) monitoring and managing risks.

To make a sound valuation of an investment project, the first important step is to identify the risks of the project. Traditionally, neutral and actual probabilities are identified for each of the project's risks and using the decisions tree analysis the future outcomes are pinpointed in each of the branch of the tree. The mapping of future outcomes with the attached probabilities becomes extremely complicated as soon as the number of identified risks becomes important. The DNPV rule uses an integrated i.e., holistic approach. Although risks can be integrated in a number of different ways, according to the DNPV method, their integration should be in harmony with the firm's risk management, financial, operational and strategic objectives. The five-step approach mentioned above is thus important in pricing the risks and the valuation of the project. The details about the process undertaken in each step are given below.

Comparison of the two approaches: In contrast to the traditional NPV approach in which risk is incorporated into the discount rate, the DNPV approach requires an explicit identification of risks affecting the cash flow of the project. During this first step factors such as technical/technological, weather, operational, financial, tax, market, institutional, regulatory (mainly the hold-up risk), political, etc., are clearly identified and potential risks are assigned to each fac-

tor. At step 2, a decision must be made concerning the risks to be transferred and the risks to be owned by the owners of the firm. This is an essential step in the DNPV methodology because markets would compensate for the risks owned by the owners and the latter do not want to assume more risks than the market will compensate them. During this step, managers develop strategies to manage identifiable risks and accept the ones for which the owners want to own. Then, it is crucial to quantify the price of risk for each risk owned by the shareholders.

Step three consists in quantifying each type of risk identified above and determining which risks are more acceptable for the firm to assume. This involves the use of objective methods of risk evaluation and the use of subjective criteria for their allocation.

Step four consists in valuing the various mechanisms that could be used to mitigate the risks identified. One important difference that exists between the traditional NPV approach and the new DNPV approach is in the definition of risk. In the NPV approach risk is defined as in corporate finance, i.e., the variation of returns (in this case of cash flows) from expected returns. Defined as such, risk is a statistical concept and if it is not systematic, it can be diversified away. In the DNPV approach the definition of risk is closer to the one found in the project finance literature. In this field, risk is defined as the odds to get results worse than anticipated.

For instance, in the case of an energy project, political and institutional (regulatory) risks are high. Investors are well aware of these risks and assign a value to them. For the investors, the expected return is not the benchmark return but rather the return that they would receive if things happen as expected. If, ceteris paribus, the investment occurs and the government does not nationalize the project, investors would get what they have expected from their investment. If the investment is made and in the meantime the risk of nationalization increases, this does not increase the variation of returns but it does reduce the expected return. In contrast to portfolio investment, investors cannot diversify away this type of risks. These risks can be monitored, managed, mitigated and transferred to other parties who are more efficient to handle them.

Once these risks are rightly recognized, proper arrangements should be made to transfer them to parties capable to manage them better. In the case of major investment projects in emerging and developing economies, insurance may be obtained from various multilateral agencies and the cost of such insurance may be included in the project's cash flows. The World Bank subsidiaries, the

Multilateral Investment Guarantee Agency (MIGA)[10] and the International Finance Corporation (IFC) are the leading organizations to provide insurance for mitigating risks, particularly the political risk[11].

The fifth step specifies the way in which a project will be monitored over time. Tracking the changes that may occur increases the level of awareness of the impact of these changes on the risk of the project. Project risk monitoring also allows the examination of new factors and new information that may occur and change the nature, likelihood, or severity of potential project risks. Thus, monitoring a project is essential because it provides the opportunity to make sure that the project risk mitigation strategies have been effectively and successfully implemented. According to the ITRC (2011), project risk monitoring is part of the project management function and its main objective is to compare the predicted results of planned actions with the results actually achieved. In case of discrepancy, a change in risk mitigation actions is required.

Tracking changes is not limited to a short period of time but it should be done till the end of the life of the project. Risk reviews are thus necessary because they allow the identification of potential problems which may require a reevaluation of the technical performance of the project and/or a modification of risk mitigation measures, reallocation of resources and a revision of its profitability. To control for the adverse impact of risks and reduce the likelihood of occurrence, actions to minimize their impact is required. Risk monitoring thus becomes part of the program review and it should be managed continuously.

The DNPV approach by continuously taking into account the variation of the risk profile of the energy investment project provides a more accurate estimation of the real value of the project. It is possible therefore to take an optimal decision with respect to the investment by comparing the risk profile of a project using the DNPV rule to the financial performance of the project using the NPV rule. This is particular important for business managers, financiers, multilateral financing organizations, and other decision makers who are involved in the realization of business projects in the energy and other sectors[12].

10 In its latest report, MIGA (2014) cites three examples with respect to its support of the electricity generation and distribution in Côte d'Ivoire, Vietnam and Uganda. These MIGA-insured projects contributed to the generation and distribution of electricity and addressed power deficits that inhibit development in these countries.

11 Also these organizations offer grants and invest in infrastructure projects in conjunction with the private sector and the governments of developing countries (http://www.miga.org/resources/index.cfm?stid=1870).

12 This methodology is also vital for managers willing to acquire an existing business unit and bid for its acquisition at the right price. The recent wave of mergers and acquisitions in the energy sector in Germany, the US, India and other countries has inflated the bidding prices acquirer firms offer to grab weaker firms (http://www.power-eng.com/business/m-a.html).

All in all, the DNPV rule, by using a bottom-up approach, separates more accurately the risk from the time value of money and offers a better valuation procedure to price risk and therefore its cost. The latter is associated with the likelihood of getting lower revenues than expected or higher costs than expected and investors, to mitigate these risks, seek for parties who are better to handle them. The cost of this insurance is a direct cost associated with the project and as such it is subtracted from the expected cash flows. In that sense the latter become "riskless" and a risk-free discount rate is used to get their present value. This is in stark contrast to the NPV approach according to which the cash flows are either deflated and/or the discount rate is inflated to take into account the financial risk of the project. This is done in addition to the use of sophisticated financial models which take into account the financial risk of the project using its beta. The latter reflects the investors' risk preferences.

The DNPV rule is independent of the investors' risk preferences since it uses the risk-free rate as a hurdle rate. The DNPV criterion is a powerful methodology to be used by business executives to construct risk profiles of the revenues and costs of their investment propositions and calculate the insurance premiums necessary to cover part of the risks. By taking into account the full gamut of costs, including insurance premiums, executives get better valuations for their projects. Making business decisions based on the DNPV criterion bring better results and a higher profitability. Table 3.1. resumes the main characteristics of the traditional and recent methodologies.

Table 3.1. **Main Characteristics of the NPV and DNPV Rules for Energy Projects Evaluation**

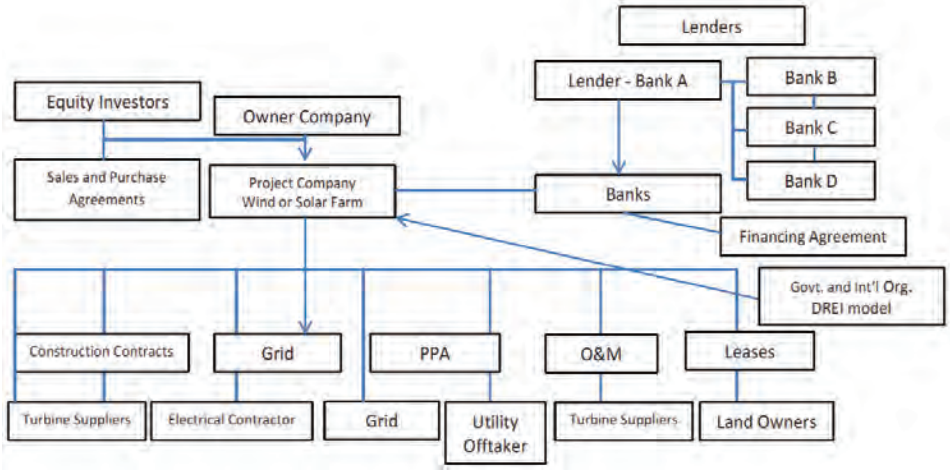
Methodology	Tool used	Discount factor	Risks	Advantages	Results
NPV	DCF	WACC	Single risk – project's beta Static model	Easy to understand Well-entrenched in business community	Over or under investment
DNPV	DCF	Risk-free rate	Multiple risks decoupled from cash flows	Less well-known – not widely applied yet	Eliminates bias leading to the right investment decision
Quantitative risk analysis	na	na	Multiple risks - probability distributions, Stochastic models	Sophisticated econometric techniques improves results	Better evaluation of risks
Monte Carlo Simulations	na	na	Multiple risks - probability distributions, Stochastic models	Easy to implement	Better evaluation of risks

Source: Author's compilation

Nonetheless, both criteria assume implicitly that the institutional and regulatory frameworks of the countries are well articulated and conducive to investment. A recent study by the UNDP (2013) demonstrates that the current methodologies, i.e., NPV and its refinements (quantitative risk analysis, Monte Carlo simulations, etc.), although useful in evaluating the financial performance of an investment project, do not automatically lead to more investment simply because the NPV is positive. These models ought to recognize the importance of government policies in derisking the business environment of a country. Derisking is the process, through the adoption of government policies, of reducing and/or transferring risk to parties better able to handle them. The UNDP uses a project finance approach to investing in infrastructure in developing economies accompanied by an evaluation of the country's investment conditions using the DREI framework. The project finance approach is the subject of the next paragraphs.

Project finance and investment methodologies: project finance is a complex institutional structure used to finance big infrastructure projects like bridges, pipelines, power grids, on-grid renewables, etc. In project finance loans are provided by a syndicate of banks and other financial institutions to make the investment project a reality. Generally, there is equity finance but its share is rather small compared to the case of corporate or private projects. Guarantees are provided by sovereign governments and international financial institutions to reduce the risks of the project but the owner of the project cannot guarantee that the loan will be repaid. So the only guarantee for a loan is the project itself. Bankers and other lenders are not entitled to repayment of the loan from other assets of the borrower but from the profits of the project itself (non-recourse finance). In case of default, the investors can seize the project, run it or sell it to get their money back. Figure 3.1. shows a non-recourse project finance structure for a wind/solar farm.

Figure 3.1. **Typical Project (Wind/Solar farm) Finance Structure**



Source: Adapted from Yescombe, 2013.

In project finance the risks are multiple, so their identification and precise valuation is an important task, should these risks be correctly partitioned among investors. The right allocation of risks makes the materialization of the energy investment possible since the risks are assumed by investors capable and willing to deal with them in a rather optimal way. In simple typical project finance deals a special purpose vehicle (SPV) company is created. The latter, called the Project Company, is a separate legal company owned by a consortium, a joint venture or many separate entities (equity investors). A bank or a syndicate of banks (if the project is very large) provide financing (senior debt) but subordinate debt (debt whose repayment ranks after repayment to senior bank or bond lenders) may also be provided (at a higher rate of interest than the senior debt) by investors as part of their equity investment. Subordinate debt called mezzanine debt is also provided by third parties such as insurance companies and other non-bank investors such as specialized funds, should the total financing of the project is less than required for its realization (Yescombe, 2013).

In project finance "due diligence" is an important task in the valuation of the project and is realized prior to the agreement of the loan. Its purpose is to review and evaluate the project's contracts and the financial, political and commercial risks. By correctly evaluating the expected revenues and their risks investors could be more alert to the capacity of the project to make the necessary payments by the required dates. Many times due diligence is required to be carried on separately at various levels of advancement of the project finance structure such as technical, commercial, financial, political, etc. Traditionally, due diligence is carried out on behalf of the bank (or consortium of the banks)

and investors examine closely how investment in a project fits well with the bank's investment strategy.

Contrary to the corporate project which may be financed by a corporation as an addition to its existing business rather than as a stand-alone project, in project finance, the Project Company is solely created for the specific project and has no business record to serve as basis for borrowing funds in the financial markets. In corporate finance, the company uses its available financial resources, cash, line of credits and retained earnings to pay for the project and if necessary to raise new financing either by borrowing using new lines of credit or equity capital or both. That is, the company makes use of corporate finance. Normally, a solid balance sheet and the company's earnings record serve as a "guarantee" for new financing of a corporate investment project.

In project finance lenders lend money on the belief that they will be repaid. They do so by paying special attention to the risks of default arising from a high level of debt inherent in project finance. Therefore, it is important for them to get precise estimates of the risks associated with the project. These risks concern a) the time of completion of the project; b) budget over-runs; c) technical problems that may occur and delay the operation of the project as designed; d) the adequacy of cash flows to cover the debt service accurately and timely.

It is customary for a bank or a syndicate to lend an amount less than the needs of the project and for a borrower to provide cash referred as "equity" up to about 25% and 30%. Despite the detailed analysis of expected revenues and costs and the assessment of project's risks, investors are prudent. They do take a very cautious approach by further assuming that the future cash flows would not be as high as originally predicted. They want to avoid problems arising from uncertain conditions such as weather, political, technical, business and regulatory. The latter could reduce the cash flows significantly and affect negatively the so-called debt service cover ratio (DSCR)[13].

In the case of a solar or wind project or any other intermittent (not continuous production) energy project, banks may be more reluctant to give loans and investment in renewable energy may be inadequate. The annual value of power production being uncertain, banks and investment firms require P values[14], usually P25, P50 and P75 at a location or other relevant information to

13 The debt service cover ratio (DSCR) is the ratio of cash available for payment of debt service at due date. If, for instance, there is $1.3 million available to make a debt payment (capital and interest) of $1 million, the DSCR is 1.3:1.

14 P values are important because they provide information on the annual value of power production from an intermittent resource with various probabilities. Thus, for a value of "P50"

determine the risks of the investment project and its ability to service its debt obligations and operating costs (Dobos et al. 2012). It is customary for a bank to use the mean estimated production of the project (P50) for deciding on the size of the loan, or in some cases a value lower than the mean (for example P75 or P90).

Thus, the bank uses prudently a financial model that allows it to estimate the DSCR ratios by making a project risk assessment using exceedance probabilities the most common of them being P90 or P95 level (the cumulative probability that the forecast average level of power production is exceeded). This determines the potential revenues of the bank and whether the interest cover is sufficient. More uncertainty results in lower P values and higher cost of capital for the firm. Investors assume more risk and a higher risk implies a higher return, thus a higher cost for the firm. Typically, in project finance equity investors use P75 and even P50 levels for their revenue forecast. The lower the exceedance probabilities, the higher would be investors' yield expectations.

Typically, loan agreements are negotiated with the bank and as such they reflect the latter's risk aversion and the assumptions it makes for the estimation of the DSCR ratios and the long term viability of the project. It is possible that certain banks would lend by assuming a more uncertain energy production and therefore a more variable (but higher) DCSR and other banks would take a more prudent approach and lend only for energy projects with minimum risk and therefore lower DCSR.

The financial models utilized by the lenders recognize that the risks are different during construction of the project and after its completion. For this reason, it is customary to divide the loan in two parts: a construction loan and a term loan. The risks being higher during construction, it is normal that the cost of lending is higher. The loan may be converted from construction to term and at the "conversion" date the terms of the loan change and consequently its cost. The length of the loans are normally 10 to 15 years but loan terms become longer as banks acquire experience with renewable energy projects. The interest rates are normally 1 to 1.5 % higher than the base rate – the interbank offer rate (IBOR)[15]. Financial covenants are also included in the financing

there is a 50% probability that the mean power production will not be reached at any given time, while for "P90", there is a 10% probability that the P90 level will not be reached (Dobos et al. 2012).

15 A lending bank may charge additional fees for setting up the loan, usually around 1% of the cost of the loan. Lending banks realize more profits by offering administrative and account services associated with the loan. Other services may accompany the loan such as derivatives allowing the project owner to manage risks associated with the fluctuation in the foreign exchange and swaps to convert fixed to floating rates and vice versa.

agreement and are generally associated with due diligence. The covenants may require that the project owner provides information about operational and financing reporting, management of bank accounts, insurance coverage, etc., on a regular basis.

Project finance has always been complex and long to implement. For this reason it has mostly applied to projects with well-established technologies and in cases where project owners have an excellent reputation and a long experience with the project in question. Renewables are a nascent industry and as such the risks are quite high. Project finance has to develop new approaches to estimate these risks and allow the further development of these technologies. In the past, project developers have had difficulties in finding a bank to loan their projects. Nowadays, banks solicit developers to offer loans that satisfy their investment needs[16].

The approach to project finance is different in the US than in other countries. In the US, there is another layer of ownership – the tax investors. Basically, the tax investors own the vast majority of the project. They remain owners for the period of time required to reap the tax benefits (10 to 15 years) and then there is a "flip" in ownership and the project usually returns to its original owner. In the US, the owners of renewable farms tend to be large companies with a heavy tax burden. In addition to the tax investors, there is another type of ownership, the group of passive tax investors. These differences are quite important and because of many sophisticated tax structures in the US, project finance has been developed in a different way in this country. This has had major effects on the ways this industry has developed in the US.

Project finance structure in the US is indeed unique but there are also differences in project finance between developed and developing economies. In the latter, the success of the development of renewables depends not only on the financing of the project but also on the capacity of a country to adopt regulatory and institutional reforms to make the business environment more stable and attract investors in energy infrastructure. These are at least the results of a recent study realized by UNDP (2013) for a number of developing economies, among then the Kazakhstan. This is the subject we now turn.

16 Project finance differs from country to country because of the difference in the tax treatment and the incentives offered for renewables. In the USA, project finance structures are more complicated than elsewhere because of the renewable energy incentive, the PTC (Production Tax Credit).

3. Investments in Renewable Energy and the DREI Approach: The Case Study of Kazakhstan[17]

The corporate finance is quite different from the project finance approach as illustrated above. The main differences lie on the way risks are evaluated and priced and the recourse creditors have on the assets of the corporation or the project. Countries may use either approach to find a solution to their energy problems but given the sheer size of the investments, they usually have recourse to international organizations for financing part of their needs.

Project finance is a well-established mechanism for large, capital-intensive investment projects. It is widely used in many infrastructure industries and it has been also used in renewables. By and large, lending banks in project finance are very conservative and their financing depends on the evaluation of certain risks, particularly the ones related to the exceedance probabilities – the probability that the revenues of the project would not be enough to cover the interest because production would fall below the estimated average. Some banks are more prudent than others and accept higher or lower exceedance probabilities. The project finance approach illustrates that the right valuation of risks is a critical step in the realization of an investment project in energy sector and particularly in renewables.

Although the specifications of mounting a project under a project finance approach depend on each individual case, the generic form presented above illustrates the complexity of this methodology. Its application to Kazakhstan's wind renewables by the UNPD (2013) highlights a number of important points that have to be taken into consideration for a successful realization of the investment.

The UNDP has been involved in various energy projects around the world and in its recent report entitled "Transforming On-Grid Renewable Energy Markets" presents the results of its involvement in financing renewable energy projects in various developing countries. One of the countries that have benefited from the UNDP operations is Kazakhstan. The primary objective of the UNDP-GEF (Global Environment Facility)[18] project was to provide a grant for the development of Kazakhstan's wind energy but soon realized that it was more important for the government of Kazakhstan to proceed with the removal

17 This section is inspired by the UNDP-GEF report (2013).

18 The GEF (Global Environment Facility) provides grants and leverages co-financing in developing countries in cooperation with international institutions, civil society organizations and the private sector, to address global environmental issues (http://www.thegef.org/gef/whatisgef).

of existing barriers to grid-connected wind energy production and the creation of the appropriate conditions for the sustainable development of Kazakhstan's wind energy market. For achieving these goals, the UNDP-GEF project developed a working framework, the Derisking Renewable Energy Investment (*DREI*) approach which identifies the main impediments to investment and the associated risks.

Kazakhstan's electricity production is mainly coal-based (close to 85% of its electricity is produced by coal) and it has therefore one of the worst records in per capita carbon footprint. At the same time, Kazakhstan has abundant wind resources most of them untapped which, if developed, could increase capacity by 354 GW. The barriers to the development of wind energy were multiple: accessibility of wind energy to the energy market; institutional and regulatory barriers; network connectivity and; above all luck of finance. Various risks were associated with the identified barriers.

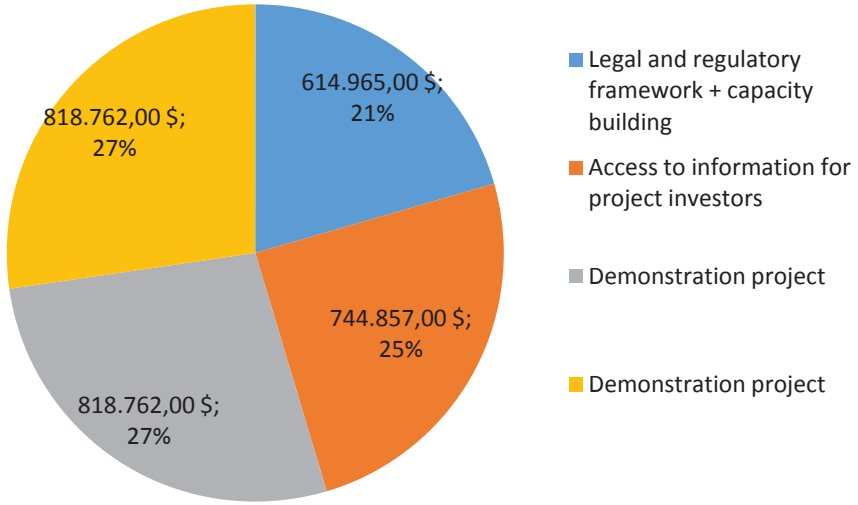
To develop the wind market, it was thus important to introduce policy measures that reduce these risks. The UNDP-GEF project provided direct financial incentives in the form of capital grants and proposed the implementation of various policy measures to reduce the risks. Derisking was one of the key elements in implementing the project. Derisking is the process of lowering, transferring and compensating the risks or the barriers to investment by adopting policies, rules, codes and regulations which would create a business environment that attracts capital investments because the risk-return profile of the investment becomes more attractive and therefore more "manageable" (Waissbein et al., 2013).

It is reasonable to expect that the derisking program incentivizes private capital and boosts investment in energy infrastructure. This was precisely the goal for the creation of the DREI analytical framework by the UNDP specialists and consultants. "At present, there are few established methodologies for establishing the value of a policy or a financial derisking instrument or articulating the leverage that they may create, for example from lower costs of capital resulting from risk reduction" (UNDP, 2013, page 68).

Kazakhstan has been one of the case studies for the implementation of the DREI methodology. Initially, the UNDP-GEF has been involved in Kazakhstan's wind energy project as a grant provider for the development and the promotion of investment in Kazakhstan's wind energy production. The initial project finance structure did not manage to attract sufficient private capital for the wind project. The UNDP-GEF had to revise its implication and redeploy

funds for a broader evaluation of Kazakhstan's energy industry and identify the constraints to investment and their associated risks. "The UNDP-GEF project, therefore, evolved to focus more heavily on addressing the barriers related to the absence of enabling policies and regulations" (UNDP, 2013, page 64). By applying the DREI framework, the UNDP-GEF project identified the barriers and associated risks which were inhibiting private sector investment in wind energy in Kazakhstan. Figure 3.2. shows the proportion of funds allocated to the evaluation of the factors hindering the development of Kazakhstan's renewable energy market and the importance of each risk factor.

Figure 3.2. **Percentage Spent by Instrument for the Transformation of Kazakhstan's Renewable Energy Market**



Source: Adapted from UNDP-GEF, 2013: 56.

As a further step to improving the attractiveness of wind investment, the UNPD-GEF project supported the development of new regulations and an institutional framework articulated under a National Wind Energy Program which made the risks in investing in renewables lower. The new law made explicit the rules for wind generators and the role could play in the Kazakhstan's energy market. Thus, the law established priorities and guarantees for the wind energy. For instance, wind energy producers got a guarantee for access to the grid, priority in dispatching and guarantee of purchase and the creation of a standardized PPA (Power Purchase Agreement). A FiT program[19] was also created to guarantee the price per MW, eliminating thereby the price volatility. These policy initiatives created a predictable cash flow for wind energy producers

19 FiT (Feed-in Tariffs) programs are popular in Europe and Asia and provide warranties of the price of KW energy to be sold to the grid by the independent power producers.

and lowered the WACC of the wind project. This is a more holistic approach to evaluating renewable energy projects and if it is properly implemented could bring the desirable outcomes. Further, by accomplishing the investment objectives in renewables Kazakhstan would reduce its greenhouse gas emissions.

In sum, the traditional models used for project valuation – the NPV and its new variant the DNPV in corporate finance and the project finance approaches, implicitly assume that a country's institutional infrastructure is well developed and articulated, transparent and impartial. The DREI approach developed by the UNDP-GEF program is more suitable for developing economies, especially the ones lacking the tradition of strong regulatory bodies and institutional infrastructure. Nonetheless, the DREI approach needs further refinements and the development of innovative methodologies to quantifying derisking policies and their effectiveness. These advancements could contribute to making better and more informed decisions contributing to the right level of investment in energy projects in both developed and developing countries.

4. Conclusions

Financing energy projects has been critical for the development of emerging and industrialized countries. The rising costs of conventional sources of energy and particularly their environmental footprint have led many countries to find new ways to promote investment in renewables. For the financiers, the renewable sources of energy are new, use less well-known technologies and are chiefly intermittent. Their integration to the network is problematic and the risks associated with their financing are considered to be high. Evaluating investment projects in renewable energy is thus a critical step and involves, among others, the right valuation and pricing of risks.

There are different methodologies which are currently used for that purpose. The main ones are the corporate finance approach and the project finance approach. Both have their advantages and disadvantages. The most serious drawback is their sensitivity to changing hypotheses, particularly the hurdle rate used to discount cash flows. As a result, they may lead to non-optimal decisions favoring either an over or under investment. It is imperative therefore that these methodologies be refined and extended to take into account all the risks and value them accordingly.

The objective of this paper was to study and critically evaluate the currently used approaches to project valuation. It compared the most widely used methods for project valuation, the NPV rule, to other investment criteria. It appears

that the NPV method fails to take into account each separate risk of a project by using a discount rate that includes a single measure of risk.

This is a main drawback since the empirical literature shows that investors using this criterion do not always take the right investment decisions. This is particularly true for energy projects where cost distributions are asymmetric. The use of a median CAPEX causes valuation errors. Projects with negative NPV may be accepted and projects with positive NPV may be rejected (Emhjellen et al., 2001). Many refinements have been proposed to remedy these deficiencies. Quantitative risk analysis and Monte Carlo simulations are certainly significant improvements and their use provides a better evaluation of risks and lead to better investment decisions.

Nonetheless, a new methodology proposed lately (Espinoza and Rojo, 2015), the DNPV approach, separates or decouples all the risks and does contribute to properly evaluate the risks and their cost. This is much better approach to value and price risk but the methodology is rather new and, at the time being, less widely used. There are no empirical applications and therefore the results of this methodology in practice are less well-known.

The review of the literature and the analysis that followed illustrate that the right valuation of risks highlighted in each model is indeed important but the most important of all is the process of derisking a country's business environment where investment would take place. The application of the UNDP-GEF derisking methodology to Kazakhstan highlights the importance of adopting a holistic approach to valuing an investment project rather than abiding to a strict mathematical evaluation of certain risks.

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4. Economic Growth, Energy Consumption and Carbon Dioxide Emissions: A Multivariate Co-Integration and Causality Analysis for Central Asia Countries

EDA YALCIN KAYACAN, JOSHUA DAVID COWLEY AND MEHMET VEDAT PAZARLIOGLU

Abstract

Energy plays a vital role in economic development and it is generally considered one of the most important elements of sustainable development. For developing countries especially, economic growth requires an extensive use of energy. Unfortunately, the most abundant from of easily accessible energy is fossil fuels and burning fossil fuels generates waste products. Carbon dioxide (CO2) which comes from consuming fossil fuels such as coal, oil and gas plays a significant role in today's global warming crisis. Ideally CO2 emissions would be limited, but doing so may impact economic growth and development This study looks at the causal relationships between Economic Growth, Energy Consumption and Carbon Dioxide Emissions for the Central Asian Countries, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, for the period from 1990 to 2012. Johansen cointegration tests and Granger causality tests based on a Multivariate Vector Error Correction Modeling are used to determine the cointegration relationships between these variables.

Keywords: Granger causality, Cointegration, Energy consumption, CO2 emissions

1. Introduction

Energy plays a crucial role in the process of economic growth and its importance cannot be ignored, especially in developing countries. The fact that economic growth accelerates energy consumption has become an important issue when considering the emission of carbon dioxide (CO_2). The increasing threat of global warming and climate change has attracted considerable attention to CO_2 emissions (Tiwari, 2011). CO_2 emission through the combustion of fossils fuels is believed to be a major cause of global warming and it is a serious threat to both the environment and human life. Therefore, knowledge of the causal relationships among energy consumption, carbon emissions and economic growth can help countries adopt green growth policies to minimize their impact on global warming.

There is a great deal of literature on the casual relationship between energy consumption, economic growth and CO_2 emissions. However, much of this empirical evidence is confused and ranges from findings of unidirectional or bi-directional causality to no causality at all. There are several different theories of how economic growth and energy consumption should affect one another. First theory is the growth hypothesis which suggests that energy consumption is a crucial component in growth. According to this hypothesis, a decrease in energy consumption causes a decrease in real GDP, so implementing energy conservation policies will likely affect the real GDP (Belke, 2010). The second theory is called the feedback hypothesis which states that there is bi-directional causality. According to this hypothesis, energy consumption and economic growth affect each other simultaneously, for this reason, policy makers should take the feedback into account when implementing regulations about energy (Saatçi, 2013). Third theory is the conservation hypothesis, which suggests a uni-directional causal relationship from GDP to energy consumption. This hypothesis claims that lower energy consumption may have little or no adverse effect on real GDP. Finally, the neutrality hypothesis indicates that energy consumption is an insignificant part of economic output and thus assumes no causality between these variables so they will not have any impact on real GDP (Csereklyei, 2012).

Three different approaches have been used to measure the relationship between CO_2 emissions, energy consumption and economic growth. First approach focuses on the relationship between CO_2 and economic growth. It was first tested by Grossman and Krueger (1993).

The second approach looks at the relationship between energy consumption and economic growth. These studies examined causality between energy con-

sumption and economic growth, starting from the work of Kraft and Kraft (1978), their pioneering study found unidirectional causality running from GNP to energy consumption in the United States. One of the most recent studies is Mudarissov (2014), who found the same relationship for Kazakhstan.

The third approach measures the dynamic relationship between CO_2 emissions, energy consumption and economic growth. Ang (2007) investigated the relationship between CO_2 emissions, energy consumption and economic growth in France from 1960 to 2000. Soytas (2007)used the same method for the United States, Ang (2008) for Malaysia, Zhang and Chang(2009) for China, Halicioglu (2009) and Soytas and Sari (2009) for Turkey, Jalil. and Mahmud (2009) for China, Ozturk and Acaravci (2010) for Turkey, Apergis and Payne (2010) for Central America, Acaravci and Ozturk (2010) for Europe, Lotfalipour (2010) for Iran, Hatzigeorgiou (2011) for Greece, Menyah and Wolde Rufael (2010) for South Africa, Pao and Tsai (2011) for BRIC countries (Brasil, The Russian Federation, India, and China) and Alam et al. (2011) for Bangladesh. It has been found that either a uni-directional or bi-directional relationships exist between the CO_2 emissions, energy consumption and economic growth.

Our research considers Central Asian countries as a case study. There are several reasons for our interest in these countries. First, Central Asian economies have some of the world's largest energy supplies, which give a strong basis for economic growth. Second, because of the global warming problem and a growing concern about the scarcity of energy sources, the causal relationship between economic growth and CO_2 has become an important issue (Alam, 2012). The fuel and energy sector of Kazakhstan is the largest contributor to its gross domestic product and specific energy consumption in the economy of Kazakhstan is very high. This suggests that the ecological situation may be deteriorating. Kyrgyzstan, which has the second largest coal reserves in Central Asia after Kazakhstan, has sufficient fuel and energy resources. Tajikistan, despite having various fuel and energy resources available, imports almost all types of primary energy. Turkmenistan is one of the world's energy powers. In the country's economy, the oil and gas sector are so large that the country has export opportunities. Uzbekistan's electric power plants have a considerable amount of extra capacity and their system provides much of the power of Turkmenistan, Tajikistan, Kyrgyzstan, and South Kazakhstan (UNECE, 2011). Given this background, knowing the relationships of multivariate co-integration and causality analysis among economic growth, energy consumption and CO_2 emissions for Central Asia countries is important, especially for these countries' economic and environmental policies.

The rest of the paper is divided into three sections. Section 2 features the methodology of multivariate co-integration and Granger causality based on VECM. The empirical results are mentioned in Section 3 and the paper ends with conclusions drawn from the research findings.

2. Data and Econometric Methodologies

The study uses annual time series data of Central Asia Countries (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) over the 1990–2012 taken from World Development Indicators, the World Bank and International Energy Agency. For the year 2012, some data was used by forecasting because of the inavailability of necessary data. All data is used in the form of natural logarithmic. Our study uses total primary energy consumption (kilotons of oil equivalent), real gross domestic product (US$) and total carbon dioxide emissions (in kilotons) as a proxy for energy consumption, economic growth and carbon emissions.

In time series regressions the time series need to be stationary in order to use the usual econometric procedures to have the proper statistical properties. A times series is stationary if it has a constant mean (μ) and variance (σ) for all t. In this case, the autocovariance function between two periods depends only on the interval from t_1 to t_2.

According to Engle and Granger (1987), a linear combination of two non-stationary series may be stationary. If such a stationarity exists, the series are co-integrated. Philips and Perron (1988) have developed a more comprehensive theory of unit root non-stationarity. The methods they devised test the null of a unit root against a stationarity alternative. These tests are similar to ADF tests, but they incorporate an automatic correction to the DF procedure to allow for autocorrelated residuals (Brooks, 2008).

Johansen Cointegration Test

The concept of co-integration can be defined as a common stochastic trend among two or more economic variables over the long run (Chang, 2010). To test for the existence of co-integration we use the trace test and maximum eigenvalue test. Johansen and Juselius (1990) have developed the maximum likelihood estimator and likelihood ratio tests for hypothesis testing in a co-integrated system. In order to outline the co-integration approach, first a *p*-dimensional Gaussian vector autoregression (VAR) model is described:

$$X_t = A_0 + A_1X_{t-1} + ... + A_pX_{t-p} + \varepsilon_t \quad (1)$$

Where X_t the vector of endogenous variables is, A_0 is the vector of deterministic terms, $A_1,...,A_p$ are the matrices of coefficients to be estimated, p is the lag length and ε_t is the vector of error terms. The VECM specification of equation (1) is then written as follows:

$$\Delta X_t = A_0 + \Pi X_{t-1} + \Gamma_1\Delta X_{t-1} +...+ \Gamma_{p-1}\Delta X_{t-p-1} + \varepsilon_t \quad (2)$$

Where Π is a matrix that provides information about long-run relationships. Π can then be decomposed into $\Pi = \alpha\ \beta$ 'where α is the error correction term that gives speed of adjustment to the long-run steady state equilibrium and β' is the matrix of long-run coefficients. Furthermore, the rank of Π determines the number of co-integration vectors and there are three possible ranks (Asteriou and Hall, 2007: 321).

If the matrix Π has a full rank ($r = k$), the variables in X_t are stationary which also implies that a VAR model estimation's variables are in level form. The VAR model results can be used to analyse the dynamic relationships among the variables.

If the rank of matrix Π is zero, then there are no co-integrating vectors. In this case the appropriate strategy is to employ a VAR model with first-differenced variables.

If the matrix Π has a reduced rank ($r \leq (k-1)$), then there are ($r \leq (k-1)$) co integration vectors. This implies that information regarding the short-run and the long-run relationships among the variables must be derived from a vector error correction model.

Johansen (1998) and Johansen and Juselius (1990) proposed to use the trace test (λ_{trace}) and/or maximum eigenvalue (λ_{max}) statistics in determining the number of co-integration vectors. The trace statistic for the null hypothesis of at most r co-integration vectors against the alternative hypothesis of $r = k$ co-integrating vectors is computed as follows:

$$\lambda_{trace}(r|k) = -T\sum_{i=r+1}^{k}\ln(1-\lambda_i) \quad (3)$$

Where λ_i is the i-th largest eigenvalue of the matrix Π.

The maximum eigenvalue statistic for testing the null hypothesis of r co-integrating vectors against the alternative of r + 1 co-integrating relations is described as follows:

$$\lambda_{\max}(r|r+1) = -T\ln(1-\lambda_{r+1}),\ r = 0,1,....,k-1 \quad (3)$$

Granger Causality in the Error Correction Modelling (ECM) Framework

The standard Granger causality approach entails estimating the vector autoregression (VAR) model in the first difference form. However, given the evidence of co-integration, results from this approach will be misleading since the system does not represent the co-integration properties among the variables (Engle and Granger, 1987). To overcome this shortcoming, one needs to estimate a vector error correction model (VECM) that is written as follows:

$$\Delta(LGDP_t) = \alpha_{10} + \sum_{i=1}^{p}\alpha_{11i}\Delta(LGDP)_{t-i} + \sum_{i=1}^{p}\alpha_{12i}(\Delta LE)_{t-i} + \sum_{i=1}^{p}\alpha_{13i}\Delta(LCO_2)_{t-i} + \varphi_{14}ECT_{t-1} + \varepsilon_{1t} \quad (4)$$

$$\Delta(LE_t) = \alpha_{20} + \sum_{i=1}^{p}\alpha_{21i}\Delta(LE)_{t-i} + \sum_{i=1}^{p}\alpha_{22i}\Delta(LGDP)_{t-i} + \sum_{i=1}^{p}\alpha_{23i}\Delta(LCO_2)_{t-i} + \varphi_{24}ECT_{t-1} + \varepsilon_{1t} \quad (5)$$

$$\Delta(LCO_2)_t = \alpha_{30} + \sum_{i=1}^{p}\alpha_{31i}\Delta(LCO_2)_{t-i} + \sum_{i=1}^{p}\alpha_{32i}\Delta(LGDP)_{t-i} + \sum_{i=1}^{p}\alpha_{33i}\Delta(LE)_{t-i} + \varphi_{34}ECT_{t-1} + \varepsilon_{1t} \quad (6)$$

Where *ECT* is the residuals of the long-run cointegration relationship and therefore ECT_{t-1} is the error correction term.

The Granger causality analysis based on the VECM specification allows testing for both the short-run and long-run causality. The short-run Granger non-causality is tested by the use of Wald test (F-test). The significance of all lagged dynamic terms of the independent variable can be examined by testing, for example the null of $H_0{:}\alpha_{33i}=0$ in equation (7). Non-rejection implies that energy consumption does not Granger cause CO_2 emissions in the short-run. On the other hand, the long-run Granger causality is tested by the t-statistic on ECT_{t-1} in each equation for which a significant t-value provides evidence of the long-run Granger causality (Odhiambo, 2009). For instance, if $\varphi_{14} \neq 0$ and $\varphi_{24} \neq 0$, then it implies bi-directional causality meaning that there exists a feed-back long-run relationship between economic growth and energy consumption. In addition, we can use the F-statistics to perform the joint significance of the lagged independent variables and the error correction term for strong Granger causality.

3. Empirical Results and Discussions

This section begins with a descriptive analysis of the data set. It then examines the unit roots and co-integration test. Finally we discuss the Granger causality test based on the VECM.

Variables:

LGDP: economic growth (Kazakhstan: LGDPKZ; Kyrgyzstan: LGDPKG; Tajikistan: LGDPTJ; Turkmenistan: LGDPTM; Uzbekistan: LGDPUZ)

LE: energy consumption (Kazakhstan: LEKZ; Kyrgyzstan: LEKG; Tajikistan: LETJ; Turkmenistan: LETM; Uzbekistan: LEUZ)

LCO: CO_2 emissions (Kazakhstan: LCOKZ; Kyrgyzstan: LCOKG; Tajikistan: LCOTJ; Turkmenistan: LCOTM; Uzbekistan: LCOUZ)

Table 4.1. illustrates the descriptive statistical analysis for the variables belonging to the five countries during the period 1990-2012. All of the data are skewed to the right (excluding LEKZ, LCOKZ, LETM, LEUZ and LCOUZ) and the fluctuations are leptokurtic LEKG, LETJ, LCOTJ, LGDPUZ and LCOUZ. The other fluctuations are platkurtic. In general, the results with leptokurtic means have a fatter tail. However, large fluctuations are more likely within these fat tails.

Table 4.1. **Descriptive Statistics**

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
LGDPKZ	10.62	10.40	11.31	10.23	0.37	0.74	1.93
LEKZ	4.74	4.76	4.90	4.54	0.12	-0.25	1.59
LCOKZ	5.26	5.28	5.42	5.07	0.11	-0.30	1.70
LGDPKG	9.39	9.34	9.81	9.10	0.22	0.66	2.21
LEKG	3.47	3.44	3.87	3.33	0.14	1.86	5.36
LCOKG	3.81	3.76	4.35	3.58	0.19	1.87	5.85
LGDPTJ	9.32	9.28	9.84	8.93	0.29	0.46	1.92
LETJ	3.41	3.37	3.72	3.33	0.12	1.88	5.16
LCOTJ	3.49	3.42	4.04	3.27	0.21	1.67	4.62
LGDPTM	9.77	9.55	10.55	9.38	0.40	0.71	2.01
LETM	4.21	4.20	4.40	4.02	0.12	-0.05	1.95
LCOTM	4.60	4.60	4.79	4.42	0.11	0.05	2.02
LGDPUZ	10.23	10.14	10.71	9.99	0.21	1.12	3.01
LEUZ	4.68	4.68	4.73	4.63	0.03	-0.16	2.04
LCOUZ	4.97	5.07	5.10	4.02	0.30	-2.89	9.44

Table 4.2. **Unit Root Test Results**

	Level		First differences	
	PP Test	**Probability**	**PP Test**	**Probability**
LGDPKZ	1.927	0.984	-2.137	0.034
LEKZ	0.028	0.681	-3.125	0.003
LCOKZ	-0.075	0.647	-2.844	0.007
LGDPKG	0.989	0.909	-2.671	0.010
LEKG	-1.273	0.181	-2.799	0.008
LCOKG	-1.255	0.186	-3.238	0.003
LGDPTJ	0.811	0.880	-2.919	0.006
LETJ	-1.294	0.175	-1.651	0.092
LCOTJ	-1.363	0.155	-3.462	0.002
LGDPTM	2.317	0.993	-3.794	0.038
LETM	0.609	0.840	-3.665	0.001
LCOTM	0.551	0.827	-4.104	0.000
LGDPUZ	1.379	0.953	-1.637	0.095
LEUZ	0.166	0.725	-5.321	0.000
LCOUZ	-1.074	0.247	-4.184	0.000

*Denotes rejection of the hypothesis at the 0.10 level

The first step in testing co-integration is to test time series variables for their stationarity. The results of the Philips-Perron unit root tests for each variable are reported in Table 4. 2. The results indicate that all series are non-stationary at their level; therefore they are stationary at their first differences.

Given that the selected variables share common integration properties, which means all of the series are and , we proceed with testing the long-run relationship between selected variables. Table 4.3. presents the results of the Johansen co-integration test as determined by the Max-Eigenvalue and trace methods, where *r* represents the number of co-integrating vectors. It can be seen that for Kazakhstan, the null hypothesis of no co-integration is rejected against the alternative of two co-integrating relationships at the 5% confidence level. The results are the same for Kyrgyzstan and Tajikistan. The results suggest the presence of two co-integrating relationships for each country. It can also be seen that for Turkmenistan, the null hypothesis of no co-integration relationships is rejected against the alternative of one co-integrating relationship.

Table 4.3. **Results of the Johansen Co-integration Test by the Max-eigenvalue and Trace Methods**

Results of Johansen co-integration rank test for LGDP LE LCO						
			Max-Eigen		Trace statistic	
	null hypothesis	Eigen value	statistic	critical value	statistic	critical value
KZ	r = 0	0.704	24.347	*21.131**	43.215	*29.797**
	r ≤ 1	0.606	18.634	*14.264**	18.868	*15.494**
	r ≤ 2	0.012	0.235	*3.841*	0.235	*3.841*
KG	r = 0	0.688	23.315	*21.131**	38.768	*29.797**
	r ≤ 1	0.537	15.389	*14.264**	15.453	*15.495*
	r ≤ 2	0.003	0.064	*3.841*	0.064	*3.841*
TJ	r = 0	0.688	23.311	*21.131**	40.476	*29.797**
	r ≤ 1	0.576	17.165	*14.264**	17.165	*15.494**
	r ≤ 2	0.000	0.000	*3.841*	0.000	*3.841*
TM	r = 0	0.796	31.826	*21.131**	46.017	*29.797**
	r ≤ 1	0.466	12.541	*14.265*	14.191	*15.495*
	r ≤ 2	0.079	1.651	*3.841*	1.651	*3.841*
UZ	r = 0	0.516	14.510	*21.132*	21.257	*29.797*
	r ≤ 1	0.284	6.684	*14.265*	6.747	*15.495*
	r ≤ 2	0.003	0.063	*3.841*	0.063	*3.841*

* Rejection of the hypothesis at the 5% significance level.

Finally, the results for Uzbekistan show that the null hypothesis of no co-integration relationships cannot be rejected at the 5% level. The existence of co-integrating relationships among GDP, energy consumption and CO_2 emissions suggests that there must be Granger causality in at least one direction especially for the countries other than Uzbekistan.

The existence of co-integration implies causality in at least one direction. The ECM enables us to distinguish between *short-run* and *long-run* Granger causality which provides an indication of the direction of causality. Table 4.3. illustrates the results of the long-run causality, short-run causality and strong causality multivariate causality test based on the error correction model (ECM) for the four countries for which we found co-integration. Because no co-integration was found for Uzbekistan, we had to examine Granger causality based on the VAR model for this country.

For Kazakhstan, we found bi-directional causality between economic growth and energy consumption, and also between economic growth and CO_2 emissions in the long-run. However, there is uni-directional causality from energy

consumption to economic growth and from CO_2 emissions to economic growth in the short-run. The results show that while energy consumption Granger causes CO_2 emissions in the long-run, CO_2 emissions probably do not Granger cause energy consumption because it falls outside the 20% confidence level. The causality between the related variables is bi-directional in the short-run. Furthermore, there is strong causality between them.

Some interesting results were also obtained for Kyrgyzstan. According to our analysis there is no causality among the related variables except that CO_2 emissions Granger cause economic growth in the long-run.

For Tajikistan, the results show the existence of mutual causalities in the long-run. So, there are feedback relationships among the related variables. But in the short-run, the only causal relationship is from economic growth to CO_2 emissions. Moreover, we found a strong causality between economic growth and CO_2 emissions.

The results for Turkmenistan are similar to those of Kyrgyzstan. In the long-run, economic growth Granger causes both energy consumption and CO_2 emissions. In the short-run, there is only a causal relationship from energy consumption to economic growth.

Finally, because there is no co-integration among the variables, we were required to use the VAR model to look for Granger causality in Uzbekistan. The results show that economic growth Granger causes CO_2 emissions and there is a uni-directional causality from energy consumption to CO_2 emissions.

Table 4.4. **Results of Granger Causality Test on Based VECM and VAR**

Granger causality test based on VECM						
	Long-run effects		Short-run effects		Strong causality	
	t-Ratio	Decision	χ2-stat	Decision	F-stat	Decision
KZ						
ΔLGDP	0.124* [4.933]	*LGDP↔LE*	12.346 *(0.002)	*LGDP←LE*	4.988* (0.020)	*LGDP←LE*
ΔLE	-2.047* [-3.038]	*LE↔LGDP*	2.102 (0.349)	*LE ≠ LGDP*	2.006 (0.180)	*LE ≠ LGDP*
ΔLGDP	0.104* [3.499]	*LGDP↔LCO*	8.836 *(0.012)	*LGDP←LCO*	4.427* (0.028)	*LGDP←LCO*
ΔCO	1.861* [2.654]	*LCO ↔LGDP*	2.604 (0.271)	*LCO ≠ LGDP*	6.400 (0.009)	*LCO ← LGDP*
ΔLE	-0.427 [-1.081]	*LE ≠ LCO*	5.642**(0.059)	*LE ↔ LCO*	9.716* (0.002)	*LE ↔ LCO*
ΔCO	1.182* [3.407]	*LCO ← LE*	4.620** (0.099)	*LCO ↔ LE*	4.787* (0.022)	*LCO ↔ LE*

Table 4.4. (Continued) **Results of Granger Causality Test on Based VECM and VAR**

KR						
ΔLGDP	-0.003 [-0.068]	*LGDP≠ LE*	1.797 (0.407)	*LGDP≠ LE*	0.642 (0.603)	*LGDP≠ LE*
ΔLE	-2.805 [-1.8151]	*LE ≠ LGDP*	1.069 (0.585)	*LE ≠ LGDP*	0.983 (0.435)	*LE ≠ LGDP*
ΔLGDP	0.143* [2.327]	*LGDP←LCO*	2.689(0.260)	*LGDP≠ LCO*	0.896 (0.473)	*LGDP≠ LCO*
ΔCO	1.868 [1.577]	*LCO ≠ LGDP*	4.058 (0.131)	*LCO ≠ LGDP*	2.294 (0.134)	*LCO ≠ LGDP*
ΔLE	0.866 [0.713]	*LE ≠ LCO*	3.062 (0.216)	*LE ≠ LCO*	1.646 (0.235)	*LE ≠ LCO*
ΔCO	0.735 [0.970]	*LCO ≠ LE*	1.790 (0.408)	*LCO ≠ LE*	2.342 (0.129)	*LCO ≠ LE*
TJ						
ΔLGDP	0.044* [2.035]	*LGDP↔LE*	0.401 (0.818)	*LGDP≠ LE*	4.492* (0.027)	*LGDP←LE*
ΔLE	3.728* [2.743]	*LE↔LGDP*	2.470 (0.290)	*LE ≠ LGDP*	0.854 (0.492)	*LE ≠ LGDP*
ΔLGDP	0.197* [2.756]	*LGDP↔LCO*	3.811 (0.148)	*LGDP≠ LCO*	4.849* (0.021)	*LGDP↔LCO*
ΔCO	-2.279* [-2.724]	*LCO ↔LGDP*	6.791* (0.033)	*LCO ← LGDP*	4.180* (0.033)	*LCO ↔LGDP*
ΔLE	2.629* [2.295]	*LE ↔ LCO*	1.070 (0.585)	*LE ≠ LCO*	0.370 (0.776)	*LE ≠ LCO*
ΔCO	-0.394** [-1.832]	*LCO ↔ LE*	1.397 (0.497)	*LCO ≠ LE*	7.620* (0.005)	*LCO ← LE*
TM						
ΔLGDP	0.041 [0.464]	*LGDP≠ LE*	13.132* (0.001)	*LGDP← LE*	11.818* (0.000)	*LGDP← LE*
ΔLE	1.836* [5.703]	*LE ← LGDP*	3.599 (0.165)	*LE ≠ LGDP*	1.314 (0.315)	*LE ≠ LGDP*
ΔLGDP	0.032 [0.223]	*LGDP≠LCO*	1.639 (0.440)	*LGDP≠LCO*	15.800* (0.000)	*LGDP←LCO*
ΔCO	0.756* [5.703]	*LCO ← LGDP*	0.566 (0.753)	*LCO ≠ LGDP*	0.211 (0.886)	*LCO ≠ LGDP*
ΔLE	-0.108 [-0.223]	*LE ≠ LCO*	2.345 (0.309)	*LE ≠ LCO*	1.511 (0.261)	*LE ≠ LCO*
ΔCO	-0.057 [-0.464]	*LCO ≠ LE*	4.165 (0.124)	*LCO ≠ LE*	1.444 (0.278)	*LCO ≠ LE*

* Rejection of the hypothesis at the 5% significance level.

** Rejection of the hypothesis at the 10% significance level.

Granger causality test based on VAR			
	χ2-stat	Decision	Null Hypothesis
UZ			
ΔLGDP	0.231 (0.890)	*LGDP ≠ LE*	LE does not Granger Cause LGDP
ΔLE	0.837 (0.657)	*LE ≠ LGDP*	LGDP does not Granger Cause LE
ΔLGDP	0.243 (0.885)	*LGDP ≠ LCO*	LCO does not Granger Cause LGDP
ΔCO	7.616* (0.022)	*LCO ←LGDP*	LGDP does not Granger Cause LCO
ΔLE	2.033 (0.361)	*LE ≠ LCO*	LCO does not Granger Cause LGDP
ΔCO	4.728** (0.094)	*LCO ← LE*	LGDP does not Granger Cause LCO

* Rejection of the hypothesis at the 5% significance level.

** Rejection of the hypothesis at the 10% significance level.

4. Conclusions

By applying multivariate co-integration and Granger causality based on VECM, in this study, a relationship between economic growth, CO_2 emissions and energy consumption is found. Examining the causalities among these variables can help guide decisions about how best to approach the problem of global warming. Kazakhstan, which has the largest coal reserves in Central Asia, and Tajikistan, which imports almost all of its primary energy, both have bi-directional causality for each pair variables. This is especially true in the long-run. This feedback effect should be carefully considered when making policy decisions about energy regulations. This is especially important because Kazakhstan and Tajikistan have energy-dependent economies. Therefore, an increase in energy consumption may affect economic growth positively, while the implementation of rigid energy conservation policies may affect economic growth negatively. In Kyrgyzstan, we only found a causal relationship between economic growth to CO_2 in the long run. Therefore the neutrality hypothesis is the best fit for this country as neither energy consumption nor CO_2 emissions affect economic growth. Turkmenistan, one of the energy powers of the region, is best described by the conservation hypothesis in the short-run because there is only a uni-directional causal relationship from economic growth to energy consumption. In the long-run, we found out that energy consumption Granger causes economic growth and that there is also uni-directional causality from CO_2 emissions to economic growth.

Overall, the results we obtained regarding Granger causality based on VAR model showed that CO_2 emissions Granger cause both economic growth and energy consumption. Since the effects of CO_2 emissions is clearly important fpr economic growth, countries which are considering regulations on CO_2 emissions in an attempt to curb global warming should also consider how those regulations will affect their economic growth.

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5. The Relationship between Energy and Economic Growth: An Empirical Evaluation on Central Asian Countries and Azerbaijan

SIDIKA BASCI, CUMHUR CICEKCI AND EMRAH OZ

Abstract

Many countries need energy for economic development and growth. Thus, it is vital to secure enough energy resources to sustain economic growth. In 1990 after the collapse of Soviet Union, the countries in Central Asia and Azerbaijan gained their new position in the international system as new independent states and they have gone into a new process with becoming integrated into global economy via international trade and energy channels. At the end of the separation process from Soviet Union, even though these countries had less industrial power, they had very rich energy resources that might be a pusher factor on their economic growth potential. Therefore, it is very important to investigate the effects of energy use on economic growth in these countries. In this study, firstly, general nature of energy industry in countries in Central Asia and Azerbaijan is reviewed under the subtitles of production, consumption, reserves and exportation categories. Furthermore, the effect of energy use on economic growth is analyzed for panel of these countries by using Neo-classical Aggregate Production Model where capital, labor and energy are treated as separate inputs. Moreover, cross-sectional dependencies of the countries are taken into consideration, as well. Although this dependency is very important and effects the results very much, previous panel data analysis for the region and also for most of other regions as well do not consider this dependency. Our empirical study indicates that the more energy use does not lead to more economic growth and the countries of the region still use the labor intensive techniques.

Keywords: Central Asia, Energy consumption, Economic growth, Panel data, Cross-sectional dependency

1. Introduction

As stated in Payne (2008) and Apergis and Payne (2009), there are four hypotheses of the relationship between energy consumption and economic growth. The first one is the "growth hypothesis". According to this hypothesis, energy is a direct input in the production process and also a complement to labor and capital inputs. Therefore, in the context of Granger-causality, if there is an increase in energy consumption, there should also be an increase in real Gross Domestic Product (GDP). However, as Squalli (2007) states, there may be the possibility of inefficient usage of energy. The consumption can be in relatively unproductive sectors of the economy. As stated in Apergis and Payne (2009), it is also a possibility that a growing economy may move towards less energy intensive sectors of the economy. Under these two situations the relationship may turn to be a negative one, contradicting to the growth hypothesis.

There are energy conservation policies such as reduction in greenhouse emissions, efficiency improvement measures and demand management policies. All of these policies are designed to reduce energy consumption and waste. The second hypothesis, named as "conservation hypothesis" states that such policies do not adversely affect real GDP so the hypothesis is supported if an increase in real GDP Granger-causes an increase in energy consumption. The third hypothesis is "neutrality hypothesis". It views energy consumption as a small component of real GDP. Therefore, there is absence of Granger-causality. Finally, the fourth hypothesis is "feedback hypothesis". Here, energy consumption and real GDP are interrelated and may serve as complements to each other so there is bi-directorial Granger-causality.

As can be noticed, the above stated four hypotheses are suggesting different types of relationship between energy consumption and economic growth. So, there is no clear consensus about the relationship. This lack of consensus makes empirical studies on the relationship more important in order to test the aforementioned hypothesis. This paper is also an empirical study where the effect of energy use on economic growth is analyzed for panel of Central Asian countries and Azerbaijan by using Neo-classical Aggregate Production Model where capital, labor and energy are treated as separate inputs. In fact, in the paper, we are testing the validity of the growth hypothesis.

Moreover, previous studies making panel data analysis do not take cross-sectional dependency into consideration. However, the existence of cross-sectional dependency is possible for the countries studied in this paper. Therefore, in the paper panel data analysis, which also considers cross-sectional dependency is used.

At this point a question can be asked about the reasons of the choice of this region. We can state two reasons. Firstly, as will be considered in the literature review part deeply, there are very few studies related to this region. This was due to lack of data but now time period started to be enough to make econometric analysis. That's one of the reasons why analysis related to this region is increasing.

Secondly, among the Central Asian countries and Azerbaijan there are very important countries as producers of oil and natural gas. The four biggest producers of oil and natural gas, Azerbaijan, Kazakhstan, Turkmenistan and Uzbekistan produced 3.5% of the total world oil production and 4.7% of total world natural gas production in 2012 (BP, 2013: 8). In terms of total energy production, the region produced 2.6% of total energy in the world in 2012 (World Bank).

Some part of this production is used in the domestic industrial sectors of the countries but it is important to note that this consumption is only 1.4% of the total consumption in the world (World Bank). This low rate indicates that industrial sectors in the region are weak because in fact these sectors for these countries are very much energy intensive. Cornillie and Fankhauser (2004) explain this fact by the impossibility of the provision of new and efficient capital inflows due to delayed privatization. Therefore, a structural change could not be possible to improve energy intensity.

On the other hand, the rest of the energy production is exported by the region countries. Two very important markets for the region are Europe and China. At the moment, the European Union (EU) is the second largest consumer of oil after the USA with a consumption rate of 14.8% of the world and it is expected that the natural gas demand and import dependence of the EU will increase very much within ten years. In fact the expectation is that energy dependence of the EU will be 70% in 2030. Coming to China, since the country is growing continuously, its energy demand is also growing continuously. In 2012, China's share in total consumption of oil was 11.7% and it was 4.3% for natural gas (BP, 2013: 23).

The Middle East, with 48.4% of total proved oil reserves and 43% of total natural gas reserves, is a very important region in terms of providing energy resources (BP, 2013: 20). However, regarding energy security, both the EU and China do not want totally to depend on the Middle East. Therefore, to diversify, energy resources of Central Asia and Azerbaijan became very important. Nevertheless, these countries are landlocked countries so at this point

construction of pipe lines becomes an important issue to be considered. At the moment, through the already existing pipelines, oil and natural gas of the region is being transported to Europe over Russia. However, once again for energy security reason, the EU wants to diversify these routes as well. For this aim, there are alternative pipe line projects which are passing especially through Turkey. Russia does not support these projects but Central Asian countries and Azerbaijan are close to the projects in order not to depend on Russia very much. There are pipeline projects to China as well.

The article continues as follows. In Section 2, there is a brief overview of production, consumption, reserves and exportation of energy together with economic growth for Central Asian countries and Azerbaijan. Section 3 outlines the related research in the literature. Section 4 discusses the methodology where theoretical framework, data and estimation technique takes its place. In Section 5, empirical results are reported and Section 6 concludes.

2. Brief Overview

When the recent economic histories of Central Asian countries and Azerbaijan after the collapse of communist regime and separation from the Soviet Union are considered, the period can be thought of in two parts. The first recession period part starts at the end of 1980's or the beginning of the 1990's and has a duration period between 5 to 9 years depending on the country (Table 5.1.). After the end of the recession, in the second part of the recent histories, the countries started to experience an expansionary period.

Table 5.1. **Recession Periods**

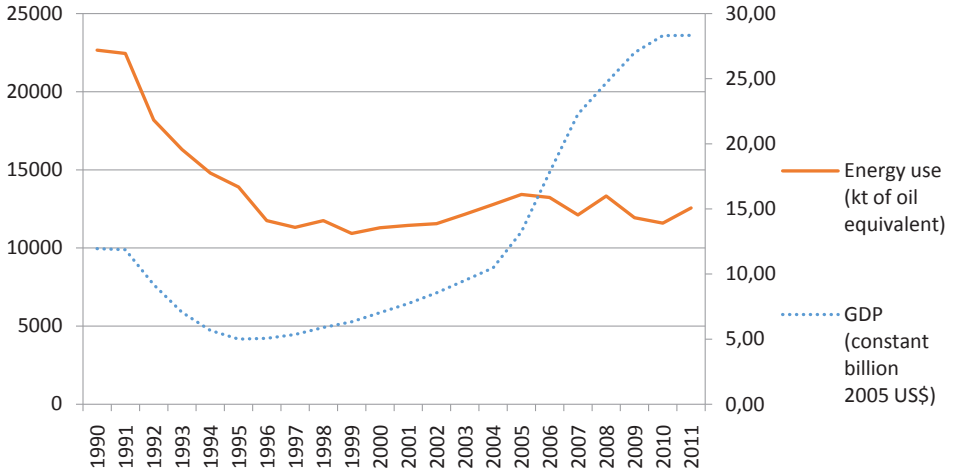
Country	Beginning of Recession	End of Recession	Duration of Recession
Azerbaijan	1989	1995	7
Kazakhstan	1989	1995	7
Kyrgyz Republic	1991	1995	5
Tajikistan	1989	1996	8
Turkmenistan	1989	1997	9
Uzbekistan	1991	1995	5

Source: Adapted from Mickiewicz (2005) page 21

Figures 5.1.-5.6. summarize the period in terms of energy use and Gross Domestic Product (GDP) for the countries. As can be noticed from the figures there is a downward trend for all of the countries except Uzbekistan for both

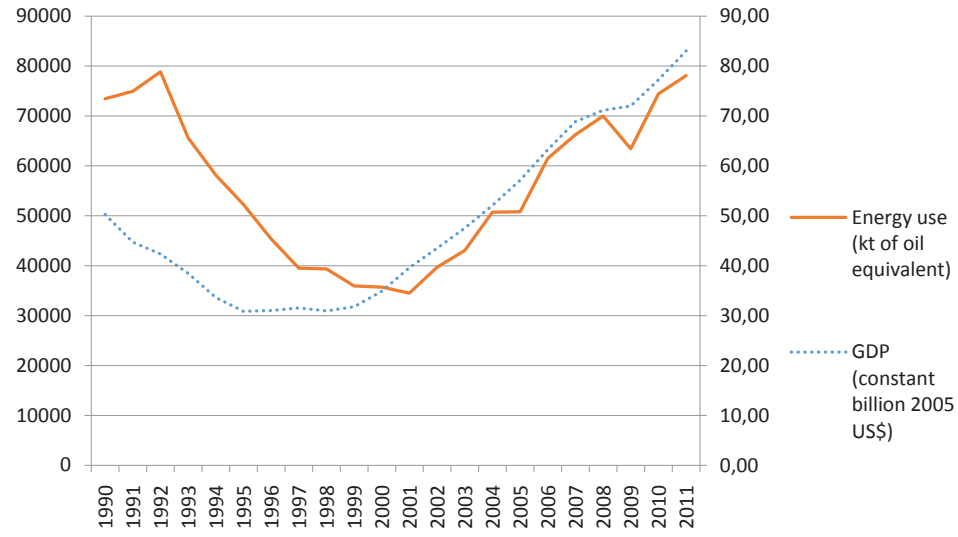
energy use and GDP till mid 1990's. Uzbekistan seems more stable for the period. After mid 1990's, with the end of recession, GDP starts to increase for all of the countries. Energy use increase is parallel to GDP increase in Kazakhstan and Turkmenistan but do not show the same trend for other countries. In Section 5, where empirical results are presented, this relation put intuitively in this section is analyzed in detail.

Figure 5.1. **Azerbaijan**



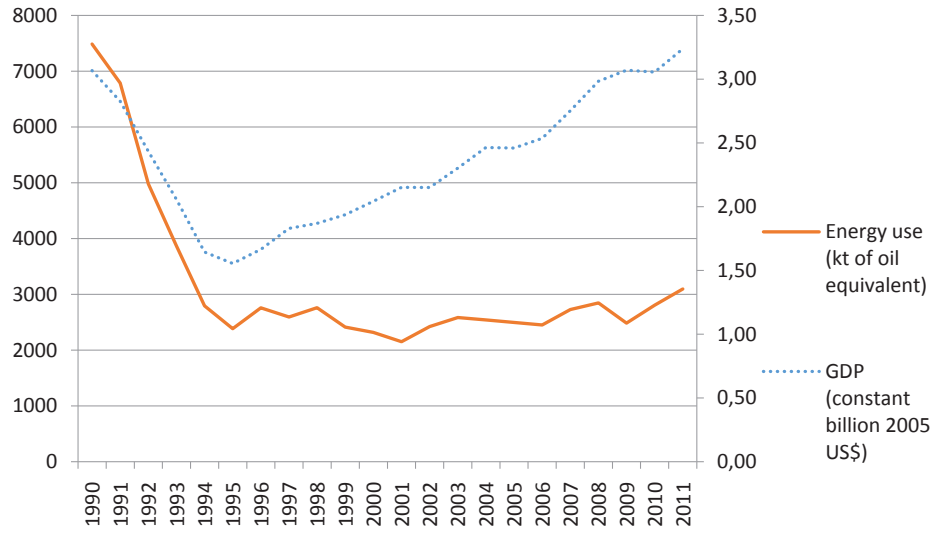
Source: Adapted from World Bank

Figure 5.2. **Kazakhstan**



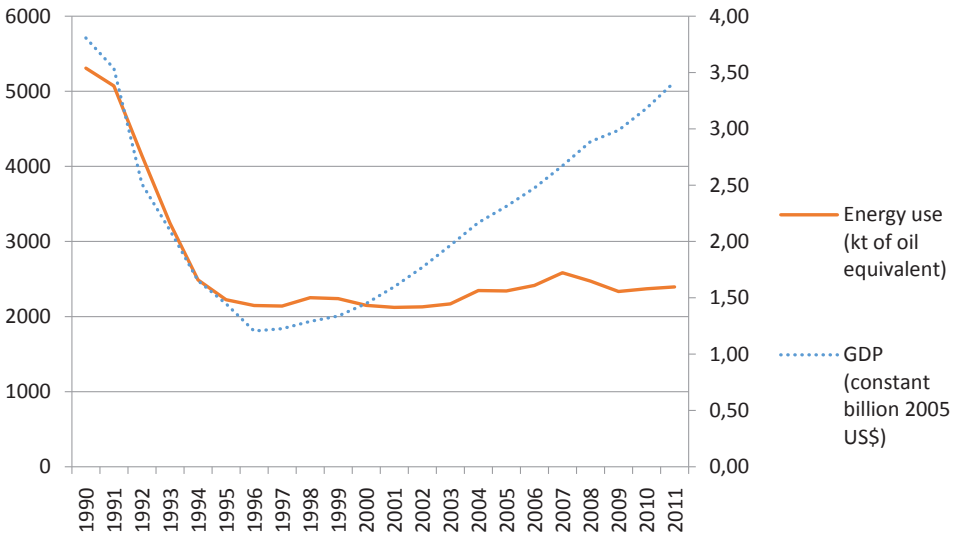
Source: Adapted from World Bank

Figure 5.3. **Kyrgyz Republic**



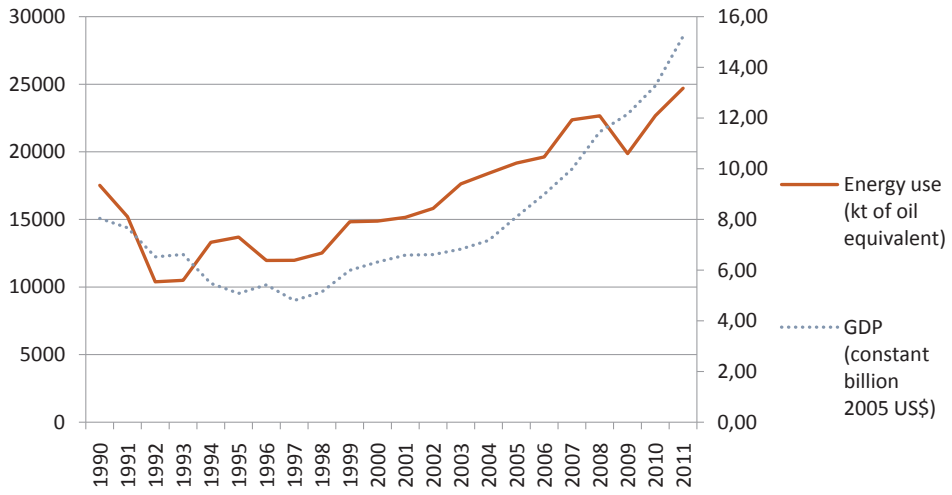
Source: Adapted from World Bank

Figure 5.4. **Tajikistan**



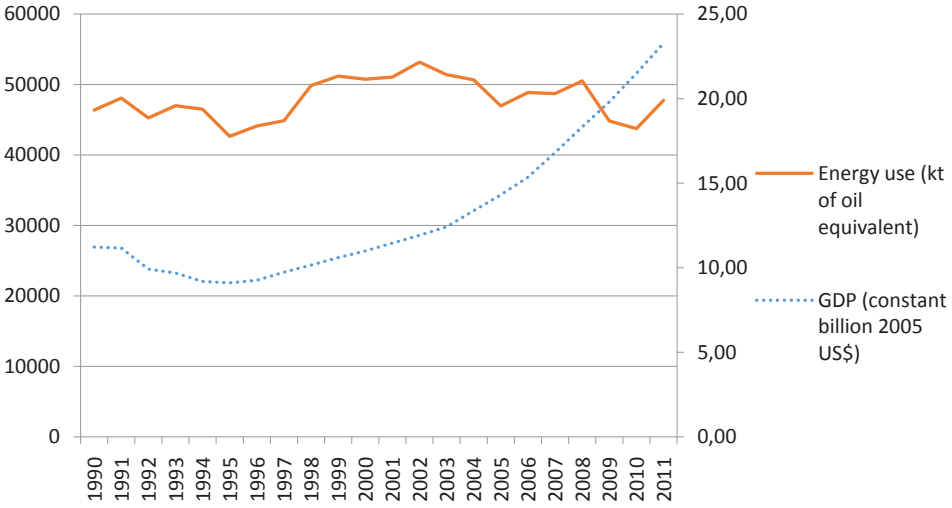
Source: Adapted from World Bank

Figure 5.5. **Turkmenistan**



Source: Adapted from World Bank

Figure 5.6. **Uzbekistan**



Source: Adapted from World Bank

It is also useful to overview the recent energy positions of the countries in terms of energy production, consumption, reserves and exports before going on with the econometrical analyzes. Table 5.2. summarizes all information. When proved oil reserves are considered, Kazakhstan is the richest country in the region, followed by Azerbaijan, Turkmenistan and Uzbekistan. In terms of proved natural gas reserves, the richest country in the region is Turkmenistan. Kazakhstan, Uzbekistan and Azerbaijan follow this country. Coming to proved coal reserves, Kazakhstan has a comparative advantage over other three countries (See Table 5.2.). These four countries together have the 3.6% of the World proved oil reserves and 11.1% of the World proved natural gas reserves. Moreover, the region together with Kyrgyz Republic and Tajikistan owns the 3.8% of the World proved coal reserves (BP, 2013).

On the other hand, the share of the region in the World in terms of primary energy consumption is only 1.4%. Kazakhstan was the only country from the region in 2009 which could take place in the first 30 highest primary energy consumption list of BP Statistical Review of World Energy at the 27th place. Among the countries, the highest primary energy consumption is realized in Kazakhstan followed by Uzbekistan, Turkmenistan and Azerbaijan. However, when energy efficiency is considered, Azerbaijan and Tajikistan takes the first two places (Table 5.2.). Therefore, the possibility of inefficient usage of energy suggested by Squalli (2007) and Apergis and Payne (2009) seems to be valid for Kazakhstan, Uzbekistan and Turkmenistan.

Table 5.2. **Overview of Energy Production, Consumption and Reserves (2011)**

	Azerbaijan	Kazakhstan	Kyrgyz Republic	Tajikistan	Turkmenistan	Uzbekistan
Energy Production (ktoe)	59958,32	160147,62	1619,49	1541,63	65244,70	57267,63
Primary Energy Consumption (ktoe)	12560,91	78101,19	3097,27	2395,21	24710,13	47754,95
Final Energy Consumption (ktoe)	7563,00	44312,00	2635,00	2088,00	16112,00	34884,00
Fossil fuel energy consumption (% of total)	97,86	98,94	68,38	42,90	100,00	98,17
Energy intensity of GDP at constant 2005 ppp (koe/$2005p)	0,155	0,407	0,264	0,167	0,581	0,560
Energy Efficiency (GDP per unit of energy use, constant 2005 PPP $ per kg of oil equivalent)	6,42	2,45	3,78	5,97	1,72	1,78
Energy imports, net (% of energy use)	-377,34	-105,05	47,71	35,64	-164,04	-19,92
Energy Self Sufficiency (%)	5,53	2,09	0,41	0,65	2,17	1,26
Oil Production (Thousand Barrels Per Day)	993,22	1638,40	0,84	0,21	222,91	106,16
Oil Consumption (Thousand Barrels Per Day)	85,00	216,00	34,00	14,00	110,00	98,00
Proved Oil Reserves (Billion Barrels)	7,00	30,00	0,04	0,01	0,60	0,59
Natural Gas Production (Billion Cubic Feet)	577,32	400,82	0,35	0,67	2337,85	2226,26
Natural Gas Consumption (Billion Cubic Feet)	335,78	436,14	14,12	7,02	709,83	1802,47
Proved Natural Gas Reserves (Trillion Cubic Feet)	30,00	85,00	0,20	0,20	265,00	65,00
Coal Production (Thousand Short Tons)	0,00	128607,00	931,00	220,00	0,00	3132,80
Coal Consumption (Thousand Short Tons)	0,00	92076,00	1553,00	226,00	0,00	3227,60
Proved Coal Reserves* (Million Short Tons)	na	37038,00	895,00	413,00	na	2094,00

Source: Data on oil, natural gas, coal and electricity are adapted from the Energy Information Agency (www.eia.doe.gov), data on energy production primary energy consumption, energy imports, fossil fuel energy consumption are adapted from World Bank Economic Indicators (www.worldbank.org) and final energy consumption and energy self-sufficiency are adapted from international energy agency (www.iea.org)

The above discussion about the proved reserves and primary energy consumption put forward the importance of the region for energy resource poor and dependent countries and shows the export potential of the region. However, for exports to increase, another important factor is the infrastructure necessary for transferring the energy resources to the import dependent countries, especially for landlocked countries like the Central Asian countries and Azerbaijan. There are several completed and ongoing pipeline projects which transfers or will transfer the energy resources of the region to Europe and China. One problematic country in the region in terms of building pipelines is Turkmenistan due to security problems in Afghanistan and Pakistan which have to be on the route.

Of course for trade potential, another important determinant is the production level in the countries. When oil production is considered, Kazakhstan has the highest production in the region followed by Azerbaijan, Turkmenistan and Uzbekistan. In terms of natural gas production, this time, the highest production is in Turkmenistan. Uzbekistan, Azerbaijan and Kazakhstan follow the country. Kazakhstan has a special situation in terms of natural gas because although the country has some comparative advantage of proved natural gas reserves, the production is not parallel to those reserves. Coming to coal production, Kazakhstan has a comparative advantage over other three countries (Table 5.2.).

Electricity is one of the most important inputs for industry. That's why its consumption level can be considered as an indicator which gives some idea about the industrialization of a country. We can see in Table 5.3. that it is highest for Kazakhstan and Uzbekistan. The sources of electricity production can differ from country to country. For Azerbaijan, Turkmenistan and Uzbekistan the main source is natural gas. In fact for Turkmenistan the only source is natural gas. While coal is the main source of electricity production for Kazakhstan, hydroelectric is very important for Tajikistan and Kyrgyz Republic. Oil is not an important source of electricity production for the region.

Table 5.3. **Overview of Electricity Production and Consumption (2011)**

	Azerbaijan	Kazakhstan	Kyrgyz Republic	Tajikistan	Turkmenistan	Uzbekistan
Electricity Production (Billion kWh)	20,29	86,58	15,15	16,21	17,22	52,40
% Oil	1,67	0,63	0,00	0,00	0,00	1,04
% Natural Gas	85,15	9,17	3,54	1,18	100,00	75,41
% Coal	0,00	81,10	3,18	0,00	0,00	4,08
%Hydroelectric	13,19	9,10	93,28	98,82	0,00	19,47
% Nuclear	0,00	0,00	0,00	0,00	0,00	0,00
Electricity Consumption (Billion kWh)	15,64	81,01	9,05	13,39	12,48	47,70
Electricity Consumption per capita (kWh)	1705,42	4892,91	1641,64	1713,78	2443,86	1625,97

Source: Adapted from World Bank Economic Indicators (www.worldbank.org)

3. Literature Review

In the past three decades after two major oil crises in the 1970s and early 1980s, numerous studies have been conducted to examine the relationship between energy consumption and economic growth. Among them may be the most important and influential one is the seminal work of Kraft and Kraft (1978) where they find evidence of a uni-directional causal relationship running from GNP to energy consumption in the US using data over the 1947–1974 period.

After this influential work, various different applications had been realized for different groups of countries and for different periods. The survey of Payne (2008) provides a very useful chronological list of these empirical studies where 101 studies exist. However, looking at that list one can only realize Reynolds and Kolodziej (2008) which is a study for former Soviet Union countries and so includes Central Asian Countries and Azerbaijan as well. Payne (2008) explains this situation by the lack of reliable data for the region.In Reynolds and Kolodziej (2008), a unidirectional causality from oil production to GDP and also a unidirectional causality from GDP to coal production and natural gas by using Granger-causality tests is observed.

After 2008, a few more studies can be realized for the region, for some of the countries of the region or for countries close to this region in terms of

geographical, political or economic distance. The first of them is Apergis and Payne (2009) where eleven countries of the Commonwealth of Independent States are investigated for the period 1991 – 2005. They use multivariate panel data approach and they find unidirectional causality from energy consumption to economic growth in the short-run and bidirectional causality between energy consumption and economic growth in the long-run. Later in 2010 , Apergis and Payne investigates the causal relationship between carbon dioxide emissions, energy consumption, and real output this time within a panel vector error correction model for the same group of countries and for the period 1992–2004. They find bidirectional causality between energy consumption and real output.

Acaravcı and Öztürk (2010) testes the long-run relationship and causality between electricity consumption and economic growth for 15 transition countries using the Pedroni panel cointegration method for the period 1990–2006. Empirical results do not suggest any evidence concerning cointegrating relationship between electricity consumption per capita and real GDP per capita.

Bildirici and Kayıkçı (2012) estimate the causal relationship between electricity use and economic growth for the Commonwealth Independent States countries in three groups of income levels. Empirical results indicate that there is a unidirectional causality from electricity use to GDP for all groups in the long run. However, effect of electricity consumption on the GDP is negative for the second group of countries which supports the energy conservation policies, while it is positive for the first and third groups of countries which support the growth hypothesis.

Özdemir et al. (2013) investigates the relationship between economic growth and energy consumption for Central Asian Countries over the period 1990-2010 using panel data analysis and they conclude that there is significant correlation between energy use and economic growth in these countries.

4. Methodology

4.1. The Theoretical Framework

Pokrovski (2003) indicated that energy can be admitted to be a driving force of production. In addition, he advocated that there is a strong correlation between output and input factors, and that the value of production has to be determined by productive energy, capital services provided by the capital stock, and labor.

From this viewpoint, Ghali and El-Sakka (2004) proposed a production function framework to study the relationship between different factors of produc-

tion (including energy) and output in Canada. By adopting a similar approach in which energy was regarded as an essential factor of production, Soytas and Sarı (2007) analyze the relationship between the growth rates of energy consumption and income for six developing countries, namely, Indonesia, Iran, Malaysia, Pakistan, Singapore, and Tunisia. In this paper we follow same framework for Central Asian countries and Azerbajian. Equation 1 states the multifactor neoclassical KLE production function.

$$Y_{it} = f(K_{it}, L_{it}, E_{it}) \tag{1}$$

where Y is the aggregate output or real GDP and, K, L, and E represent capital, labor and energy inputs, respectively, the subscript t denotes the time and subscript i denotes countries, respectively. When we take the log difference of the KLE production function we obtain the following growth equation:

$$\dot{Y}_{it} = a\dot{K}_{it} + b\dot{L}_{it} + c\dot{E}_{it} \tag{2}$$

where a dot on the top of a variable indicates that the variable is now in a growth rate form. The constant parameters a, b and c are the elasticities of output with respect to capital, labor and energy, respectively.

4.2. Data

The dataset comprises information on up to *Azerbaijan, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, Uzbekistan and Russia* over a time period of up to 22 years from 1990 to 2011. This period is chosen because the data for variables is not readily available for earlier periods. Russia is also included in the analysis for two reasons. One of them is that the countries of interest for this study are very much dependent on Russia and the other reason is that including Russia increases data size to improve the analysis. The data are taken from the EU KLEMS dataset for the production data and the World Bank for energy consumption data.

In this study, real GDP in millions of constant 2005 U.S. dollars are used as a proxy for economic output. Since capital stock data are not easy to measure, we used capital stock in millions of constant 2005 U.S. calculated based on the perpetual inventory method from EU KLEMS dataset. Data on total labor force in millions are used as a proxy for labor input. All the variables are converted into natural logarithms so that the parameter estimates of the model can be interpreted as elasticity estimates.

4.3. Estimation Technique

Most of the panel data models assume that disturbances in panel models are cross-sectionally independent. However, cross-section dependence may arise for several reasons often, because of spatial correlations, spillover effects, economic distance, omitted global variables and common unobserved shocks (Omay and Kan, 2010: 998). If the model has cross-sectional dependency, using common panel data unit root and cointegration tests may lead to spurious results. Therefore, we must use the tests which are designed for cross-sectional dependent models since cross-sectional dependency is a possibility due to the close relations of the countries under consideration.

In order to determine the presence of cross-sectional dependency, a cross-section dependency (CD) test proposed by Pesaran (2004) which uses the correlation coefficients between the time series for each panel member is applied. Denoting the estimated correlation between the time-series for region *i* and *j* as *ij*, the Pesaran CD statistic is given by:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right)$$

where *T* is the time and N is the cross-section dimension of the panel, respectively. Under the null of cross-section independence, the above statistic follows the standard normal distribution.

After that, we apply the Peseran (2007) panel unit root test to determine whether there is unit root or not. It allows for heterogeneity in the autoregressive coefficient of the Dickey-Fuller regression and a single unobserved common factor with heterogeneous factor loadings in the data. Therefore, it takes into account cross-section dependence. This test is found to have good size and power properties, even when *N* and *T* are relatively small (Benos and Karagiannis 2013:12). Pesaran (2007) unit root test allows a common factor to have different effects on each cross unit. It is based on the following cross-sectionally ADF (CADF) test regression(s):

$$\Delta y_{i,t} = \alpha_i + \delta_i t + \rho_i y_{i,t-1} + \gamma_i \bar{y}_{t-1} + \varsigma_i \Delta \bar{y}_t + \varepsilon_{i,t}$$

where Δy_t and the lagged cross-sectional averages of y_t serve as proxies for the effects of an unobserved common factor (Pesaran, 2006 and 2007).

After determining the order of integration of series, the existence of the long term cointegration relationship between variables is investigated by employing Westerlund (2007) panel cointegration tests which are four in number and named Group-α (G_α), Group $-$ t (G_t), Panel $-$ α $(P_\alpha)$and Panel $-$ t (P_t). All these tests use a bootstrap technique to eliminate the cross sectional dependency.

While two of the four tests are panel tests with the alternative hypothesis that the whole panel is cointegrated ${H_A}^P: \alpha_i = \alpha < 0 \; for \; all \; i$, the other two tests are group-mean tests which test against the alternative hypothesis that for at least one cross-section unit there is evidence of cointegration ${H_A}^G: \alpha_i = \alpha < 0 \; for \; at \; least \; one \; i$ where α is error correction coefficient. For the group-mean test statistics, the error correction coefficient is estimated for each cross-section unit individually, and then two average statistics denoted G_t , respectively G_a are calculated. In the pooled tests, the series of each cross-section unit are 'cleaned' first (of dynamic nuisance parameters, unit-specific intercepts and/or trends), before the conditional (or 'cleaned') panel error correction model is estimated to obtain a common α estimate, which is checked for significance (Hossfeld, 2010:18).

With panel data, in the presence of cross-section dependence and absence of cointegration, the one of the most commonly used model is Common Correlated Effects (CCE) model suggested by Pesaran (2006). It consists of approximating the linear combinations of the unobserved factors by cross section averages of the dependent and explanatory variables and then running standard panel regressions augmented with the cross section averages. An advantage of this approach is that it yields consistent estimates also when the regressors are correlated with the factors (Peseran and Tosetti, 2011:182). However, due to fact that we can use this model in the absence of cross section dependency problem in residuals, it is necessary to check residuals that are obtained from estimation of CCE model by applying Pesaran (2004) CD test.

5. Empirical Results

5.1. Cross-Section Dependence Tests

The results of Pesaran (2004) Cross-Section Dependence test are reported in Table 5.4. The test statistics imply decisive rejection of the cross-section independence hypothesis for all variables. Therefore, it provides strong evidence that cross-section dependence exists for them.

Table 5.4. **Pesaran (2004) Cross-Section Dependence Test Result**

	CD	p-value
lnY	19.38*	0.000
lnK	6.51*	0.000
lnL	11.78*	0.000
lnE	7.22*	0.000
ΔlnY	16.29*	0.000
ΔlnK	8.67*	0.000
ΔlnL	3.43*	0.001
ΔlnE	8.85*	0.000

* denote 1% significance level

5.2. Unit Root Tests

We use Pesaran (2007) panel unit root test for the existence of unit roots and identify the order of integration for each variable. The results of these tests are presented in Table 5.5.

Table 5.5. **Unit Root Test Results**

Pesaran Test Results† (Cross-section dependence is taken into consideration)			
lnY	1.638	ΔlnY	-4.503*
lnK	1.925	ΔlnK	2.663*
lnL	-0.725	ΔlnL	-7.036*
lnE	1.361	ΔlnE	-4.709**

† The values are t statistics, * denote %1 significance level, ** denote %5 significance level

For Pesaran test (t distribution), the calculated statistics for all variables are less than the critical values. Thus, the null unit roots hypothesis cannot be rejected, suggesting that all variables are nonstationary in their level forms. The results of the first differenced variables show that Pesaran test statistics for all variables are greater than critical values at 1% level except energy. It is greater than the critical value at 5% level. Therefore all variables are stationary after differenced, suggesting that all variables are integrated of order one, I(1), according to Pesaran test.

After examining stationarity properties of series, now the Westerlund (2007) cointegration tests can be applied. The results are reported in Table 5.6.

Table 5.6. **Westerlund Cointegration Tests**

	Value	Robust p-value
G_t	-2.358	0.853
G_a	-1.276	0.890
P_t	-4.263	0.992
P_a	-1.040	1.000

The results of the Westerlund cointegration tests, provided in Table 5.6., from G_t, G_a, P_t and P_a statistics indicate the absence of cointegration, implying that a long-run equilibrium relationship does not exists between GDP, capital, labor and energy consumption in selected countries.

Having established the order of integration of the variables, now the estimation of models in first differences can be made. In addition to CCE model, we also present the estimation result of CCE model with trend and Mean Group (MG) model with trend (Pesaran and Smith 1995) which relies on estimating N time-series regressions and averaging the coefficients with trend.

The results of model estimations are reported in Table 5.7.

Table 5.7. **Model Estimations**

Variables	MG	CCEMG	CCEMG
ΔlnKit	-0.964 (0.223)	0.105 (0.413)	0.284* (0.07)
ΔlnLit	1.375** (0.019)	0.799* (0.05)	0.821* (0.07)
ΔlnEit	0.337* (0.000)	0.063 (0.535)	0.084 (0.419)
Order of integration	I(0)	I(0)	I(0)
Country Trends	Included		Included
CD test	0.000	0.051	0.029

Estimators: MG: mean group, CCEMG: Pesaran (2006) common correlated effects MG. *p-values* in parentheses. CD test: Pesaran (2004) test for H_0 of cross-sectionally independent residuals (p-values). The order of integration of the residuals is determined using the Pesaran (2007) unit root test: I(0): stationary. * Significance at 1%, ** Significance at 5%.

The results of the CD tests that generated from residuals of models are provided at this stage to be able to select an appropriate method for estimating relationship between the variables in the two models. The Pesaran's test reject the null hypothesis of no cross-sectional dependence for MG, CCEMG with trend models and while confirms cross-section dependence independence for CCEMG model. Therefore, regarding to CD test result, CCEMG model is chosen as an appropriate model to investigate relation between variables. Estimation results show that only the coefficient of labor is statistically different than zero. The findings show that a 1% increase in labor enhances GDP by 0.799%. Capital and energy use are not effective on economic growth.

6. Conclusions

This paper analyses the effect of energy use on economic growth for the Central Asian countries and Azerbaijan taking into account the role of capital and labor in the growth process as well for the period 1990 - 2011. Although these countries are among the major countries in the world which have very rich energy resources, mainly oil and natural gas, there are a few studies related to these countries due to lack of data. This paper overcomes this problem by including Russia to the analysis as well and by using panel data analysis. Moreover, the panel data methodology used in the paper depends on the econometric literature where cross-section dependence is also considered. This is important because preliminary analysis reported in the paper about the cross-section dependency among the variables shows that there is cross-section dependency. Therefore, since this existence is considered during the econometric analysis of the relationship between energy use and economic growth the results differ from the results of the limited previous studies which do not consider cross-section dependency.

The empirical results are obtained by the technical method of common correlated effects mean group (Pesaran, 2006) which is used in the presence of cross-section dependency problem. The first finding is that there is a support to the neutrality hypothesis which states that energy consumption have little effect or no effect on economic growth. The coefficient of energy consumption in the model is insignificant. This result differs from most of the limited previous studies about the countries under consideration due to the fact that in this study cross-section dependence is taken into consideration. Secondly, results show that labor is the dominant factor in economic growth. This dominance of labor indicates that these countries are still dependent on labor intensive production and are not using their rich energy resources efficiently. Therefore, countries must apply energy policies which will improve effect of energy use on economic growth.

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6. Natural Resource Abundance, Institutional Quality and Economic Growth in CIS Countries

YESSENGALI OSKENBAYEV AND
NURGUL SATYBALDIYEVA

Abstract

The bottom line of the study is to show that the natural resource abundance is non-linear function of the institutional quality. Threshold point in the impact of different types of natural resources abundance on institutional quality implying that excessive or overabundant production of resources are crucial in explaining the resource curse. Interestingly, for instance, that diffuse resources such as agricultural resources over-abundant production bears positive externalities at higher levels of production, while at lower levels of production it could have negative impact on institutional quality. Another finding of the study is that Dutch disease impact is observed through its effect on institutional quality channel. The empirical research results show that point-source resource abundance has significant negative impact on agricultural sector value added growth contribution to income. Therefore, based on the results of the study, it is concluded that point-source natural resource abundant production, energy production in CIS countries case, is squeezzing out diffuse resource production activities, agricultural sector natural resources production which potentially has positive impact on economic growth via shaping better institutions.

Keywords: Natural resource curse, Commonwealth Independent States, Dutch disease

1. Introduction

Natural resources could be a significant driver of the economy, if it gives a big push needed for development. Rosenstein-Rodan (1943, 1961) and Murphy et al. (1989) suggest that a big-push is necessary to boost demand and expands the market, which provides better opportunities for enrepreneurs. This in turn should boost economic development. However, the recent studies of natural resource impact on economic growth evidence the adverse link between resource concentration and economic growth(Sachs and Warner, 1995, 1997).

Sachs and Warner (1999, 2001) particularly documented that the resource concentration is problematic for economic success. Auty (1990) and Gelb (1988) find that the resource concentration has adverse impact on economic growth. They provide the evidence of adverse link between resource concentration and economic growth based on cross country research. They suggest that Dutch disease effect is major explanation resource curse in countries specializing in natural resource exports (Sachs and Warner, 1999; 2001). The core idea of Dutch disease story is that natural resource concentration crowds out the resource from other sector which potentially have positive externalities on economic growth.

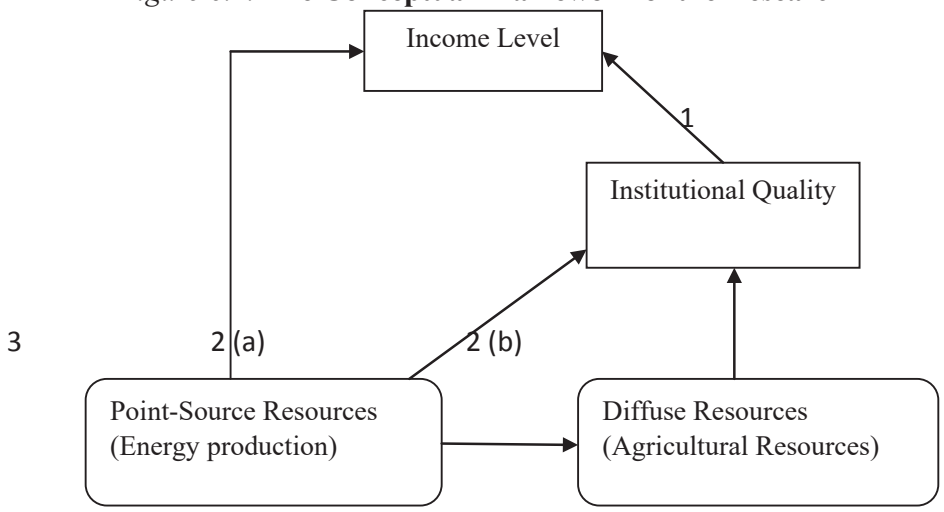
A broad literature concerning the adverse effect of natural resource concentration on economic performance provide explanation of resource curse via institutional quality. For instance, most recent studies (Mehlum et al., 2006) suggest that depending on the institutionalquality, whether the country has "grabber friendly" or "producer friendly" institutions, the natural resource concentration can be "curse" or "blessing." Boshini et al. (2007) confirm this suggestion that resource concentration associated with good institutions boost economic growth. Other studies show that it is type of the natural resources that the particular country is specialized is crucial in understanding resource curse impact(Auty, 1997; Woolcock et al., 200; Isham et al., 2005).

The punch line of this study is to link the seemingly different channels of natural resource curse effect: Dutch disease and institutional quality. Thus, it is hypothesized that resource abundance squeezes out agricultural resource production sector which has positive externalities effect on economic growth via shaping better institutions as a comparison to other types of resources. Isham et al. (2005) documented that point source resources by contrast to diffuse resources deteriorate institutional quality. This study claims that natural resource concentration deteriorates institutional quality directly and indirectly alike by driving out agricultural resource production which has positive impact on institutional quality.

2. The Research Hypothesis and Data

The main hypothesis of this study is that point-source natural resource abundance impact on institutional quality is via crowding-out effect on diffuse natural resource production. Unfortunately, the broad literature missing the unanimously accepted theory of natural resource curse. Most of them have been split into two major groups in explaining resource curse abundance. The first group of economists concentrate on the institutional quality dimension, suggesting that natural resources effect economic growth through instutional quality(Isham et al., 2005) or in association with institutional quality (Mehlum et al., 2006; Boschini et al., 2007; Brunnschweiler, 2007) in Figure 6.1., arrows 2(a) and 2 (b). The other group of scientists explain natural resource curse impact within the framework of Dutch disease problem. The essential idea behind Dutch disease lies crowding-out effect of resource concentration on some activity *x* (Figure 6.1., arrow 3). And this activity *x*, in turn, boosts economic growth. Sachs and Warner (1995, 1999, 2001) defines *x* as manufacturing sector activities.

Figure 6.1. **The Conceptual Framework of the Research**



The study integrates two major channels of natural resource curse effect: institutional quality impact and Dutch disease crowding-out impact. It is hypothised that natural resource abundance squeezzess out agricultural sector which has positive externalities impact on economic growth via institutional quality (depicted in Figure 6.1., arrow 3). For the purpose of examining the hypothesis resource abundance impact on economic growth, the empirical study employes panel VAR method and define the growth equation as follows:

$$y_{i,t} = \sum_{j=1}^{p} \alpha_j y_{t-j} + \beta'(L)RR_{i,t} + \gamma'(L)Inst_{i,t} + \delta'(L)RR * Inst_{i,t} + \eta_{i,t} + \varepsilon_{i,t}\ , \quad (1)$$

where $y_{i,t}$ is a real income per capita growth, $RR_{i,t}$ is a resource rents share in GDP, $Inst_{i,t}$ is institutional quality variable (CIM), $RR * Inst_{i,t}$ is interaction between resource abundance and institutional quality to examine the resource abundance impact on growth associated with institutioanl quality and finally $\eta_{i,t}$ represents unobserved country-specific and time-invariant effect with $\mathsf{E}(\eta_i) = \eta$ and $\mathsf{Var}(\eta_i) = \sigma_\eta^2$ In the same vein, the equation for institutional quality, using panel VAR, is constructed as follows:

$$Inst_{i,t} = \sum_{j=1}^{p} \alpha_j Inst_{t-j} + \beta'(L)RR_{i,t} + \gamma'(L)RR_{i,t}^2 + \delta'(L)AgriVA_{i,t} + \theta'(L)AgriVA_{i,t}^2 + \rho_{i,t} + v_{i,t}\ , \quad (2)$$

where $AgriVA_{i,t}$ is an agricultural resource production value added share in income and $\rho_{i,t}$ represents unobserved country-specific and time-invariant effect with $E(\rho_{i,t}) = \rho$ and $\mathsf{Var}(\rho_i) = \sigma_\rho^2$. The resource abundance variables split into two major groups: represents point-source natural resource abundance and $AgriVA_{i,t}$ agricultural resources production value added share in income in order to examine the whether the composition of natural resources is important in explaining resource curse for CIS countries. But the bottom line of the study is that the natural resource abundance variables are considered as nonlinear function of institutional quality and their squared terms are also included in the eqution (2). In this regard, coefficients for $\beta'$and γ' are expected to be negative as point-source resource abundance deteriaorates institutional quality by contrast to diffuse resources, while the coefficients for $\delta'$and $\theta'$to be positive to examine that the diffuse resources bear postive impact on institutional quality. Finally, the impact of resource rents on agricultural value added growth contribution to income is going to be tested to check the main hypothesis defined in this study earlier.

The study uses data on growth, resource abundance and institutional quality for 8 Commonwelth of Independent States (CIS) including Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Moldova, Russia and Ukraine. The panel data set is a balanced panel of 8 CIS countries followed over 18 years (1993-2010). The panel data is chosen as to include as many years as possible with a reasonable number of CIS countries. The general description and statistics of the data employed is shown in Table 6.1. All of these data are available from the World Bank World Development Indicators online database.

Table 6.1. **Data and Descriptive Statistics**

Variable	Abbrev.	Definition	Mean	Std. Dev.
GDP per capita growth (annual %)	*G*	Annual percentage growth rate of GDP per capita based on constant local currency. GDP per capita is gross domestic product divided by midyear population. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. *Indicator Code: NY.GDP.PCAP.KD.ZG*	3.48	9.48
Total Natural Resource Rents (% GDP)	*RR*	Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents. *Indicator Code: NY.GDP.TOTL.RT.ZS*	13.10	17.20
Agriculture, Value Added (% GDP)	*AgriVA*	Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator. *Indicator Code: NV.AGR.TOTL.ZS*	16.89	11.23
Institutional Quality, CIM	*Inst*	Contract-Intensive Money suggested by Clague et al. (1999)[1]	0.39	0.14
First component of institutional quality, CIM	M_2	Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This definition of money supply is frequently called M2; it corresponds to lines 34 and 35 in the International Monetary Fund's (IMF) International Financial Statistics (IFS). Data are in current local currency. *Indicator Code: FM.LBL.MQMY.CN*		
Second component of institutional quality, CIM	*C*	Money is the sum of currency outside banks and demand deposits other than those of central government. This series, frequently referred to as M1 is a narrower definition of money than M2. Data are in current local currency. *Indicator Code: FM.LBL.MONY.CN*		

1 Discussed in detail in the following sections.

3. Contract-intensive Money and Some CIS Countries Case Studies

The study uses Contract-Intensive Money (CIM) as a proxy for institutional quality suggested by Clague et al. (1999). They suggest that contract enforcement and property rights boosts entrepreneurial activities and trade which in turn increases potential gain of society from that activities and trade. Contract-intensive money, suggested by Clague et al. (1999), is defined in this study as follows:

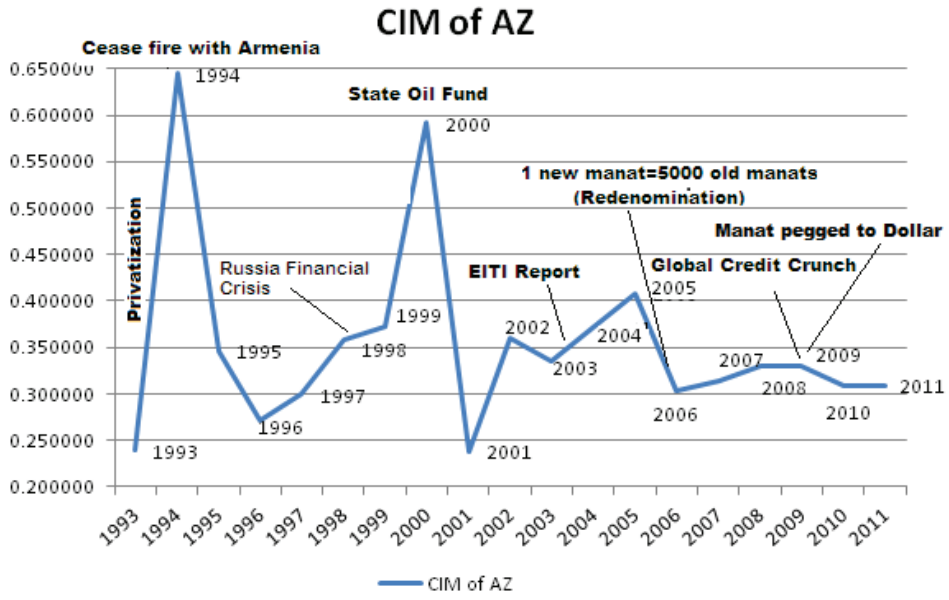
$$\text{CIM}= \frac{(M_2 - C)}{M_2},$$

where M_2 is a money supply including currency and deposits, C is a currency in circulation. If Contract-Intensive Money (CIM) is a good proxy for institutional quality, namely good proxy for property secutiry rights, political regime change then it should change as a response to those changes. In this study the natural resource abundant countries, especially the CIS countries concentrated on energy resources production, are considered. The data for CIM is available and are retrieved from the *World Bank World Development Indicators* online database (see Table 6.1).

3.1 Azerbaijan

Nagorno-Karabakh conflict between Azerbaijan and Armenia evoked in 1988 and lasted in subsequent years in 1991 and 1992. The war affected the whole Azerbaijan economy. The Cease-fire was reached between Azerbaijan and Armenia in 1994 (Yalowitz and Cornell, 2004). There was a substantial increase in CIM from 0.24 in 1993 to 0.64 in 1994 (Figure 6.2). In the beginning of the independence days strong capital inflows were common in transition economies, particularly in Azerbaijan with the end of the war. The foreign investments were particularly significant with large and promising natural resource sectors. A privatization law was also passed in 1993 and most of the enterprises have been privatized during that year. In 1994 Azerbaijan signed an oil contract worth $7.4 billion with a Western consortium (BBC News Europe, 2012).

Figure 6.2. **CIM versus Time in Azerbaijan, 1993-2010**



Early stages of reforms in Azerbaijan could be divided into two stages. First stage is period from 1991-1995 and second stage of reforms from 1996 onwards. The first stage of reforms brought about some failure in economic performance especially in 1995. The first stage economic reforms could be described briefly as follows: "One can easily note that feeble reformative efforts and cosmetic economic activities at the first stage of economic reforms produced a very negative impact upon Azerbaijan's economic performance(Cited from Heydar Aliyev's (the former President of Azerbaijan) Web-Portal)." Since the independence, that is from 1992 onwards, about 75 percent of producer and consumer prices were liberalized. The prices for some items such as bread and fuel remained controlled during 1993. But, in the end of 1993, state price control on bread and other consumer goods was abolished, and as follows prices increased. Inflation rate was 1788 percent in 1994. As a consequence of hyperinflation, the market was dollarized. These years can be seen in Figure 6.1. as a dramatic decline up to 1996. And, in turn these policies lead to sharp decrease in production and unemployment increase in Azerbaijan.

The second stage of reforms from 1996 onwards is known as macroeconomic stability and dynamic development period. Azerbaijan proceeded policies of fiscal and monetary austerity policies, first adopted under a three-year agreement with the IMF in 1996. As a result of the policies the inflation rate fell at the beginning of 1998. Azerbaijan's fiscal and monetary policies have also resulted in a stable currency (IMF, 1998). According to Figure 6.2., there was a jump in 1993 which was followed by a dramatic decline to 1996. There

was a slight recovery in 1997 and followed by an abrupt increase by 2000. In addition, State Oil Fund was established at the end of 1999, for the sake of efficient management of oil revenues which evidenced public trust in from 1999 to 2000.

However, effective in 2001 National Bank of Azerbaijan declared that it would require all payments made in domestic currency. In addition to this, they have introduced restrictive measures for importation of the foreign currency which was considered by IMF staff as inappropriate as it would lead to divergent cash and non-cash exchange rates (IMF, 2002). In fact, Azerbaijan faced high dollarization in 2001 (Feige, 2002). In Figure 6.2., CIM dramatically declined in 2001.

Azerbaijan joined the Extractive Industries Transparency Initiative (EITI) in 2003 in London by declaring its support of EITI and willingness to become a pilot country for its implementation. The EITI supports improved governance in resource-rich countries through the full publication and verification of company payments and government revenues from oil, gas and mining. Azerbaijan became the first oil producing country in the world to publish EITIreports examined by an independent audit firm in 2005. The Government of Azerbaijan made a substantial progress in economy (Hasanov, 2011). For instance, record growth was documented in the economy in 2006. In the beginning of 2006, the government has also presented the currency redenomination. A new manat was introduced at a value of 5,000 old manat.

During 2008 the Central Bank of Azerbaijan pegged manat's value to dollar, later following depreciation in dollar's value against euro it switched to the euro-dollar basket. Following the peak of financial crisis in October 2008, the the Central Bank of Azerbaijan effectively dropped euro from the basket and pegged its currency to dollar (BSTDB, 2011). The 2008 crisis indirectly affected Azerbaijan. Azerbaijan's economy was ready for an indirect impact and serious consequences. After the government intervention by the Central Bank of Azerbaijan and the State Oil Fund reserves, the financial situation of Azerbaijan became stable (ibid). In figure 6.2., there is a fairly constant level of CIM during 2006 to 2009 and then another mild decline to 2010.

3.2 Kazakhstan

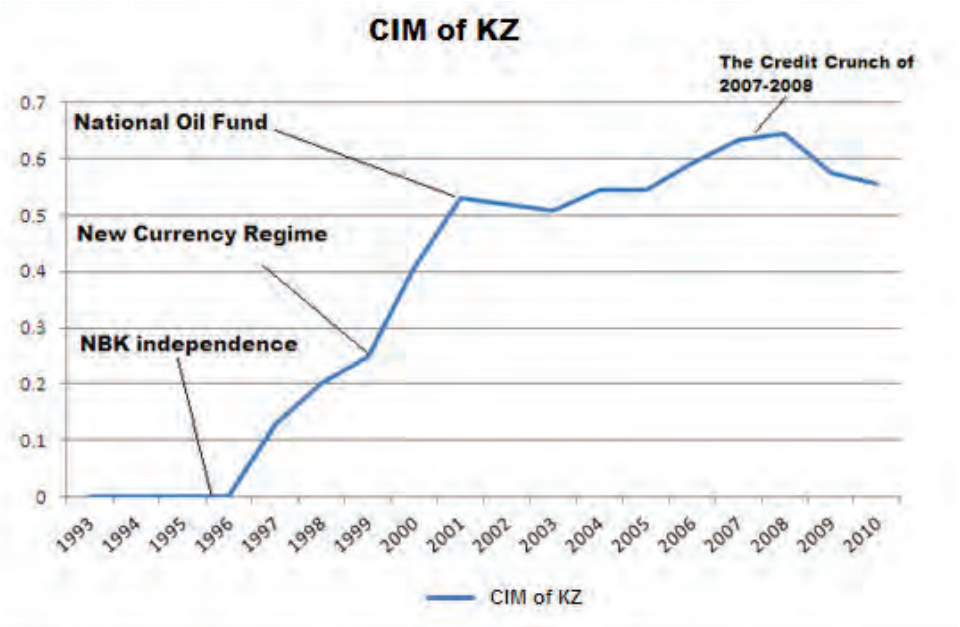
In the beginning of independence, economic reforms aimed at the development of market relations. Many reforms such as privatization processes, financial sector and reforms of the state finance and financial sector were carried

out in that period. The dramatic rise in CIM, testifies to the efficiency of those reforms after 1995 (Figure 6.3.). The new currency of Kazakhstan called Tenge was introduced in 1993 to replace the Soviet ruble by the National Bank of the Republic of Kazakhstan (NBK). The monetary policy of the NBK is one of the contents of the Kazakh economy's success. Inflation rate accounted for 2265 percent in 1993 and production output decreased by nearly 50 percent in 1991-1995 (Akishev, 2008). It is observed from Figure 6.3. that CIM remains perfectly flat indicating no change from 1993 to 1996. NBK independence was enforced in 1995 and NBK carried out policies independent from central government. As a result of tight monetary policy, for instance, NBK was able to combat inflation decreasing it from 2165 percent to 60 percent in 1993-1995 (ibid).

The NBK has pursued tight and strict monetary and fiscal policies. South-Eastern Asia and Russian financial crises accelerated the depreciation of tenge, domestic currency of Kazakhstan, and triggered severe exchange rate fluctuations in the segment of foreign exchange market. NBK has changed the currency regime shifting to a freely floating foreign currency exchange rate in 1999. In addition, financial liberalization program followed the introduction of floating exchange rate regime (Oskenbayev, 2002). Figure 6.3. shows a substantial increase in CIM between 1996 and 2001 followed by mild decrease in 2002 and 2003. CIM was very sensitive to the financial liberalization program which was carried out in this period.

Additionally, the National Fund of the Republic of Kazakhstan was created in 2000 as a stabilization and sustainable development fund established from hydrocarbon resource revenues (Kalyuzhnova, 2011). There was a slight recovery in CIM in 2004 which was gradually soaring until 2008. Kazakhstan's terms of trade increased by over 40 percent between 2003 and 2007 and then another mild decline in 2008 (IMF, 2010). The state policies to protect individuals' deposits and deposits of legal entities in banks helped the banking system to avoid the loss of clients and to preserve its sustainability (Akishev, 2008). In this year, broad money (M2) increased by 84% and currency in circulation (M0) increase by 73% according to previous years. Because of the new policies and government guarantee on deposits, there was an incredible rise in bank deposits in 2001-2004 (ibid). The data in Figure 6.3. showed a fairly constant level of CIM during 2001 to 2003.

Figure 6.3. **CIM versus Time in Kazakhstan, 1993-2010**



In period 2007-2009 crisis state declared moratorium plan on National Fund disbursement in order to maintain the level of "oil fund" before completely draining them. Thus, government could not boost the needed level of investment to provide sustainable development target employing the sources of "oil fund." Kazakhstan was one of the leading transition economies in capital formation accounting for 27% of GDP before crisis (Kalyuzhnova, 2011). The data indicates that there was a moderate decrease in CIM from in 2009 and 2010 according to Figure 6.3. On top of that, National Fund resources have been shifted from firm level to portfolio assets and in the short run directed to foreign assets rather than being domestic oriented (ibid). As a consequence Kazakhstan experienced poor economic performance, especially in 2009 demonstrating negative growth.

Real GDP growth declined from 6% in 2013 to 4.3% in 2014 as a consequence of low domestic demand. This came due to currency devaluation and increased inflation which in turn was fueled by global oil price. The effect was doubled by decreased demand from China and Russia. Oil prices decreased considerably and reduced revenues from natural resources as well as business confidence to invest in the domestic economy.

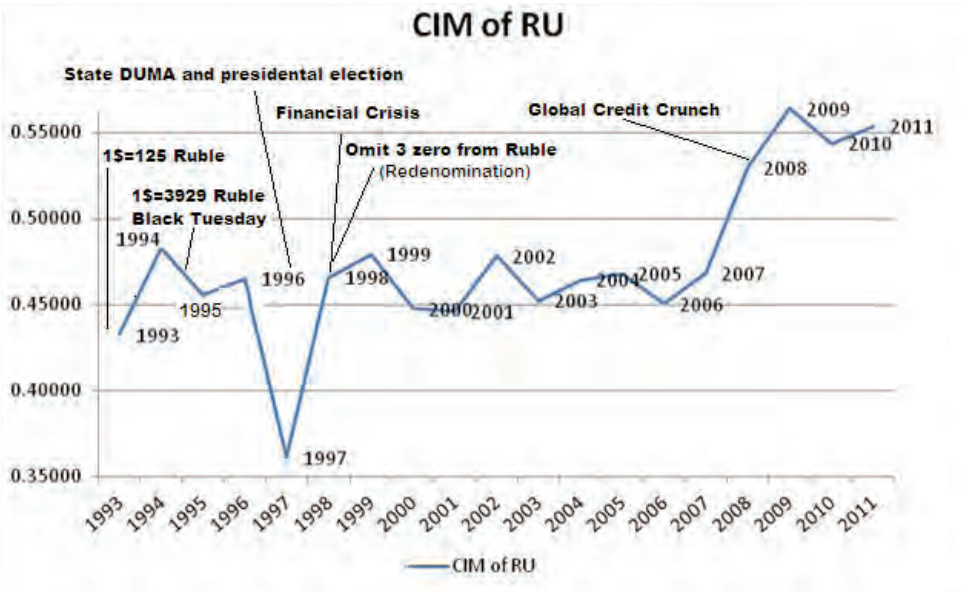
3.3 Russian Federation

After the dissolution of the Soviet Union, the government has launched new reforms lifting price controls on consumer and intermediate goods (Vincent and Steven, 1993). To encourage the development of the private sector, funda-

mental changes were made in the tax system. Large scale reforms, specifically tax reforms, were executed to maintain economic stability (Stepanyan, 2003). However, late 1993 and 1994 is considered as lost year for reforms. Yeltsin's dissolution of the parliament in October 1993, caused a major impediments to reforms launched after the breakup of Soviet Union. President Yeltsin blamed the parliament for it "wrong decisions," referring to the latest reforms in budget system, privatization and many other areas (Economist, 25 September 1993, p. 41). The new elections have been held accompanied followed by approval of a new constitution as a result of a referendum (Gould-Davies and Woods, 1999). As consequence of the delay in reforms and ignorance of monetary, budgetary policies, monthly rate of inflation rocketed up from 4% to 15% leading to a fall in domestic currency by 21% on "Black Tuesday" in October 1994 (ibid). Figure 6.4. shows a sharp decline in CIM from 1994 to 1995.

The real conflict between policymakers and oligarchs erupted in the early 1997 (Gould-Davies and Woods, 1999). In fact, it was successful period for Russia in terms of economic progress. However, the government set new strategies towards conducting institutional arrangements for long-term sustainable development with IMF staff collaboration. Because the macroeconomic stabilization achieved at that time would not provide sustainable development on its own. As oligarchs in Russia get stronger, the increasing concern of the state was avoidance of taxes by oligarchs and as follows a big pressure on revenue side of the budget. To that end, the newly appointed Nemtsov, the First Deputy Prime Minister of Russia in March 1997, initiated the set of reform programs targeting at oligarchs such as dealing with natural monopolists, abolishment of insider privatization and punishment of tax debtors. In the end the political instability was deteriorated in that period and it is observed that CIM tremendously declined in 1997 (Figure 6.4.).

Figure 6.4. **CIM versus Time in Russian Federation, 1993-2010**



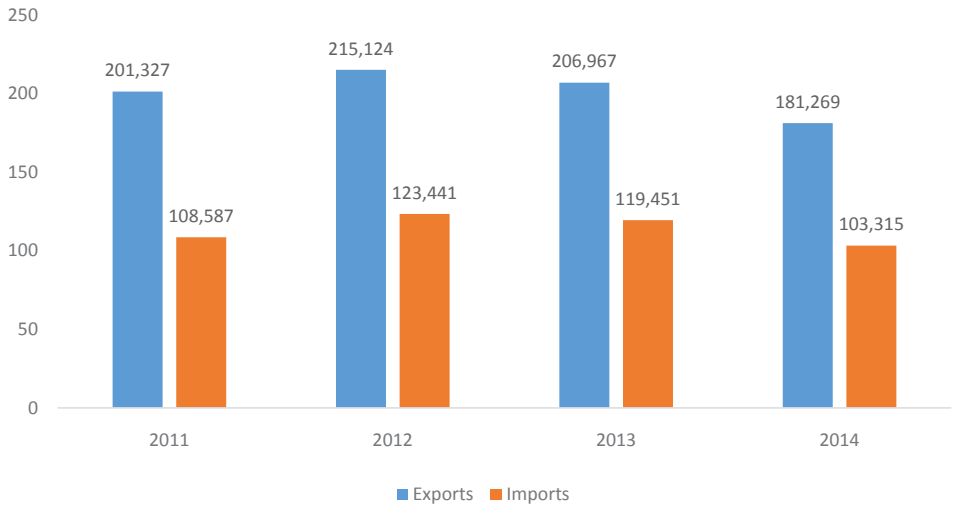
A new political scandal evoked during the financial crisis took place in 1998 and 1999 in many countries including Russia. The global recession of 1998 that started with the Asian-financial crisis in July 1997, exacerbated Russia's economic crisis. As a result of crisis and huge deficit in budget the government has undertaken measures leading to increase in taxes in 1999 which obviously increased the tensions among oligarchs as well. However, this decision of parliament was sustained, counteracting to constitutional norms, by a Presidential decree (Gould-Davies and Woods, 1999). Although, CIM did not decline abruptly as it had tremendously deteriorated in 1997, it decreased from 1999 to 2000 and 2001.

Nevertheless, tremendous change in CIM is not spotted until 2006, even though the Russian economic growth in real terms accounted for almost 40% from 2001 to 2006 (Astrov, 2007). World commodity price volatility, especially of energy resource products, exposed fiscal management to unexpected challenges (ibid.). Thus, the government made a decision to establish Oil Stabilization Fund (OSF) in early 2004 which aimed essentially economic stabilization, accentuating on use of fiscal and monetary policies (e.g. sterilization policy), by contrast to other CIS countries (IMF Country Report No. 06/430, 2006).[2] As a consequence, Russia achieved a high budget surplus of 7.5% and 8.6% in 2005 and in 2006 respectively (Astrov, 2007). The strategic decision was made to convert the assets of OSF into foreign assets and corporate bonds

2 For instance, Azerbaijan and Kazakhstan use of natural resources fund target investing into foreign assets.

in 2006, in order to hedge against the risk of oil price decrease and diversification of assets grounded on the fact that for some reason other countries would benefit from their domestic securities as a result of oil price decline. It is in line with Norway's experience that might bring fruits in the long-run. In Figure 6.4., CIM shows abrupt increase from 2006 onwards. The policies taken at the period had also helped to achieve stable growth in spite of oil price decrease (Astrov, 2007: 172).

Figure 6.5. **Russia, Trade with EU, Trade Flows by SITC Section 2011-2014**



Source: Adopted from European Comission, DG Trade, 2015, available athttp: //trade.ec.europa.eu/doclib/docs/2006/september/tradoc_113440.pdf

It is observed from Figure 6.5. that trade between two economies hiked until 2012, when the trend was reversed. Russia's exports to EU declined by 13% whereas imports to EU fell by approximately 12%. This is due to several factors including conflict in Ukraine, EU sanctions and recession in Russia. Capital outflows following economic crisis reflected the institutional weakness of the Russian economy (Kuboniwa, 2015). Indeed, according to a well-known indicator of institutional quality, Worldwide Governance Indicators (WGI) that is suggested by Kaufmann et al. (2010), it is documented that Russia has low level of worldwide governance (rule of law) and ranked at the 160th and 154th in 2013 and in 2014 respectively.

4. The Link of the Resource Abundance and Economic Growth in CIS Countries

Im, Pesaran and Shin (2003) and LLC (Levin et al., 2002) unit root test is examined and reported in Table 6.2. As it is observed the null hypothesis is rejected for almost all variables with only exception economic growth, *G*, which is non-stationary at levels with trend. However, LLC test indicates that the null hypothesis is rejected for all variables. As most of the studies prefer LLC to IPS (Breitung, 2000; Hlouskova and Wagner, 2006) as a more powerful test, it is concluded that the variables are stationary (Westerlund, 2010).

Table 6.2. **Results of the Unit Root Tests for the Full Sample**

Variable	IPS		LLC	
	Constant	Constant and Trend	Constant	Constant and Trend
G	-4.040***	-0.425	-4.65***	-2.33**
Inst	-4.459***	-4.319***	-3.57***	-4.16***
RR	-1.909**	-4.837***	-3.50***	-9.44***
AgriVA	-2.449***	-2.243**	-5.91***	-3.91***
G	-8.602***	-10.687***	-10.50***	-8.89***
Inst	-11.085***	-8.264***	-12.94***	-9.46***
RR	-8.916***	-7.495***	-7.99***	-8.65***
AgriVA	-10.840***	-10.400***	-11.03***	-10.80***

Numbers in parentheses are lag levels determined by the Schwarz Bayesian Criterion.
***Indicates significance at the 1% level.

Blundell–Bond system GMM method is used to find out the impact of the main predictors of economic growth in CIS countries. In Table 6.2., the impact of resource abundance, institutional quality and their interaction term is demonstrated. Coefficients of the growth predictors in BBGMM model have the expected signs and do not contradict the findings of the previous studies(Sachs and Warner, 1999, 2001). Moreover, it presents the impact of growth predictors allowing for change in time.[3] The significances of the variables using BB-GMM model with the robust standard errors addressing the heteroscedasticity and autocorrelation problems is disclosed in Table 6.2. (see Column 2).

Before estimating the regression it is important to determine the number of lag periods. The standard tests used to choose the optimal lag number under the VAR model in time series data is either SIC or AIC tests. However, in panel data VAR model the procedure applied to identify the number of lags is different. Two methods are known to determine the lags using panel data VAR model. One of the methods to determine the optimal number of lags used in the literature is

3 Allowing for more lags would violate AR1 and AR2 are Arellano and Bond (1991) tests for autocorrelation and thus, only two lags have been included in the model.

likelihood ratio test suggested by Holtz-Eakin et al. (1998). The other method of optimal lag selection is suggested by Arellano and Bond (1991) and it is based on the presence of no autocorrelation in the panel VAR residuals.[4]

Concerning the validity of the models the p-value of the test statistics of serial correlation (for AR1 and AR2 processes) show that there is no significant second-order autocorrelation in BB-GMM model, which is crucial for the validity of the instruments.[5] The Sargan test (Arellano and Bond, 1991) is a test for overidentifying restrictions to determine whether the residuals are correlated with instruments or not. And, it is concluded that the model or instruments may be miss-specified in case the null hypothesis is rejected. As follows, the p-value of the Sargan test statistic indicates that the null hypothesis that the overidentifying restrictions are valid is not rejected.

Table 6.3. **Regression of Economic Growth on Resource Abundance and Institutions, 1993-2010**

Variable	Dependent Variable: Growth, *G*	
	(1)	(2)[a]
G(-1)	0.411*** (0.0594)	0.411*** (0.0748)
RR	0.335* (0.179)	0.335*** (0.0739)
RR (-1)	0.0715 (0.186)	0.0715 (0.127)
RR(-2)	-0.187 (0.145)	-0.187** (0.0857)
Inst	-9.720 (8.958)	-9.720 (7.618)
Inst(-1)	-0.628 (9.173)	-0.628 (8.698)
Inst(-2)	12.66* (6.766)	12.66*** (4.448)
*RR*Inst*	-0.0741(0.356)	-0.0741 (0.156)
*RR*Inst(-1)*	-0.257 (0.326)	-0.257 (0.194)
*RR*Inst (-2)*	-0.0596 (0.281)	-0.0596 (0.157)
Constant	2.206 (2.889)	2.206 (3.879)
Sargan test (p-value)	118.16 (0.38)	118.16 (0.38)
AR1 (p-value)	-2.44 (0.01)	-2.44 (0.01)
AR2 (p-value)	-1.25 (0.21)	-1.25 (0.21)
Observations	128	128
Number of id	8	8

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.
(a) - Robust standard errors in parentheses. The regression coefficients are estimated using Arellano Bover (1995) and Blundell and Bond (1998) system GMM approach.[6] AR1 and AR2 are Arellano and Bond (1991) tests for autocorrelation.

4 The optimal number of lags is selected until the autocorrelation in panel VAR residuals not present. Thus, in general it is determined by including the lags in the panel VAR model until it is free of serial correlation.

5 The first differenced errors could be autocorrelated by construction when the regression errors are independent and identically distributed. Thus, GMM moment conditions may be invalid if there is autocorrelation in the first differenced errors higher than one.

6 Estimation employs *xtdpdsys* command in Stata. Standard instruments for the first differenced equation include first differences of *RR* and *Inst, interaction term* and their lags as well. GMM-type instruments for differenced and level equations are lagged variable of *Inst* and lagged difference respectively.

The direct effect of resource abundance on economic growth appears to be positive in current year while direct negative impact of resource abundance is observed in past values of resource abundance, *RR(-2)*, implying that the resource curse impact is not observed immediately. The direct resource curse impact is described in influential papers of Sachs and Warner (1995; 1997) (Sachs and Warner, 1999; 2001). On the other hand, other studies do not find the evidence of the direct resource curse impact based on researches conducted using cross-country data (Gelb, 1988; Auty, 1990). The negative direct association of resource abundance and economic growth is originally represented using Dutch Disease hypothesis. The punchline of the Dutch Disease impact is that the resource endowments drive away those sectors that have positive externalities for growth.

In the same vein, the positive impact of past values of the institutional quality variable, *Inst(-2)*, is interpreted. It is implication of that the positive effect of institutional quality on economic growth is time-consuming. It is argued that good institutions provide safe quality of confidence as to the enforceability of contracts, independent judiciary system and rule of law. The higher the institutional quality is the higher is the incentives of the firms to save and increase capital, invest into business and the faster the economic growth rate. On the other hand, the fruits of contract enforcement and property rights are enjoyed in trade and specialization and this process should be realized over the long run. It by no means imply that holding noncash money leads to better economic performance but rather the hypothesis is that the better institutions are and the higher the contract enforcement and property rights quality and more gains from trade and specialization process. In addition it should identically stir up noncurrency holdings (Clague et al., 1999). Differences in institutions there should imply differences in productivity and economic performance. The estimated coefficient of lagged institutional quality (12.66), *Inst (-2)*, implies that one standard deviation increase (0.14) in this variable leads to 0.189 percent increase in income per capita growth rate after two years in 8 CIS countries.[7] The long run coefficient of institutional quality impact is 21.49, implying that one standard deviation increase in the logged institutional quality variable , *Inst(-2)*, causes 0.32% increase in economic growth rate in the long run.[8]

7 Calculated as a product of the coefficient and standard deviation of explanatory variable (stdev. *Inst*=0.14*)* and then divided by standard deviation of the dependent variable (st. dev. *G*=9.48), so that the impact is estimated as follows: Coefficient * (stdev (Inst) / stdev (Growth))* Coefficient * (stdev (Inst) / stdev (Growth)) = 12.66* (0.14/9.48)

8 Long-run coefficient is obtained by dividing the short run coefficient (12.66) by one minus on the lagged variable of dependent variable.

5. The Link between Institutional Quality and Resource Abundance in CIS Countries

The relationship between resource abundance and institutional quality for 8 CIS countries including oil energy resource rich countries from 1993 to 2010 is presented in Figure 6.6. (from (a) to (h)). Oil resource rich countries including Azerbaijan, Kazakhstan and Russia are shown in Figure 6.6. part (f) – (h). Resource abundance share in income are presented in different scales for different CIS countries to observe the link between institutions and resource abundance.[9] The first country in the alphabetical order Armenia is among the CIS which have relatively less dependence on resource abundance comparing to other CIS countries. However, it is spotted that institutional quality is quite sensitive to changes in resources abundance. It is seen that the increase in resource rents share in income is associated with decline in institutional quality from 2000 onward. This adverse relationship between resource abundance and institutions is observed in period earlier from 1993-2000, for instance, from 1993 to 1995 the sharp increase in resource rents share in income increase is linked to low institutional quality. In 1997-1999 period, there is decline in resource abundance incorporated with increase in institutional quality.

The downward sloping trend in resource rents is associated with upward sloping institutional quality from 2000 onward in Belarus and from 1999 onward in Moldova. In 1993-1997 period, the rocketing up resource rents in Belarus is clearly related to decreasing quality of institutions, while sharp decline in resource abundance between 1997 and 1998 is associated with increasing quality of institutions.

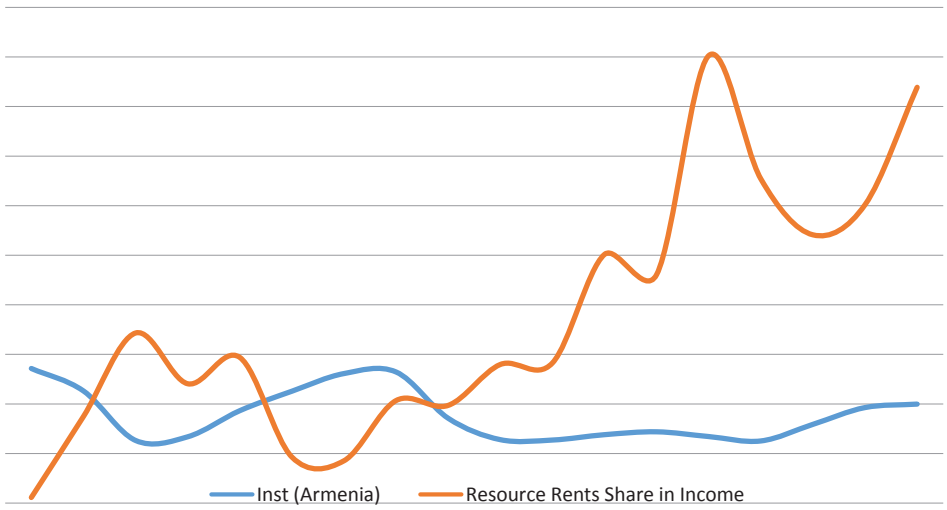
Georgia evidenced the sharp increase resource abundance in 1999-2000 and decrease in institutional quality in following year and faced huge decline in resource rents share in income immediately when the quality of institutions improved again. The case of Ukraine is interesting as well. Although, resource rents share in income is demonstrated in log form, the high volatility in resource rents share in income change is evident from Figure 6.6. (e). The immediate increase of resource abundance from 1993 to 1997 linked to decrease in institutional quality in associated period. The same pattern of relationship between the variables is documented in 1999-2000. From 2000 onward the trend of resource rents shows declining pattern which coincides with increasing trend of institutional quality.

9 Resource rents share in income as a percentage measure used for countries including Armenia, Belarus, Georgia and Moldova as they have relatively small share of resource rents in income. Log of resource rents share in income taken for Ukraine and resource rents share in income (as a share of GDP) for oil resource rich countries including Azerbaijan, Kazakhstan and Russia.

In the same vein, oil resource countries including Azerbaijan, Kazakhstan and Russia experienced the same relationship between resource rents share in income and institutional quality as it is observed in last three graphs of Figure 6.6. Azerbaijan, for instance, confronted the low institutional quality following sharp resource rents increase in 1998 and 1999, and these trend continued 2000 onwards as resource rents kept rising. The inverse relationship is observed in the preceding years as well. The share of resource rents in GDP increased from 33% to 47% in period 1993-1996 and is associated with substantial decrease in institutional quality from 64 to 27 which constitutes for a 2.64 standard deviation from mean. It started improving again as a consequence of resource rents decrease from 1996 to 1998.

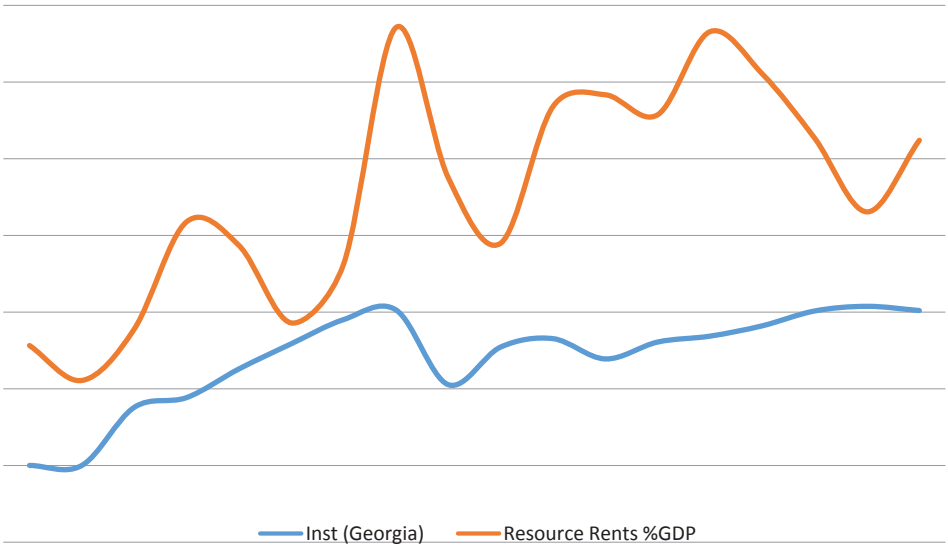
The same pattern is spotted in Kazakhstan and Russia especially in 2005 onwards in Kazakhstan and 2006 onwards in Russia when the decline in resource rents was accompanied by improvement in institutional quality. Thus, the inverse link between resource rents share in income and institutional quality is documented for 8 CIS countries between 1993 and 2010 implying potential existence of energy resources (point source resource) abundance, particularly oil resource extraction and exports, adverse impact on economic growth via institutions.

Figure 6.6. **Institutions and Resource Abundance in 8 CIS countries, 1993-2010**

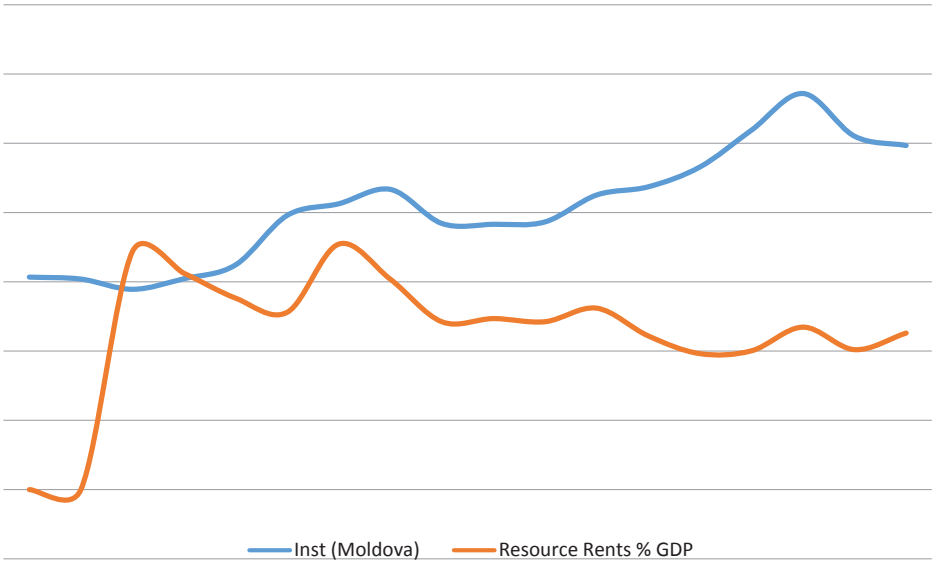


(a)Armenia (Inst=CIM, Resource Rents % GDP, as a percentage), 1993-2010

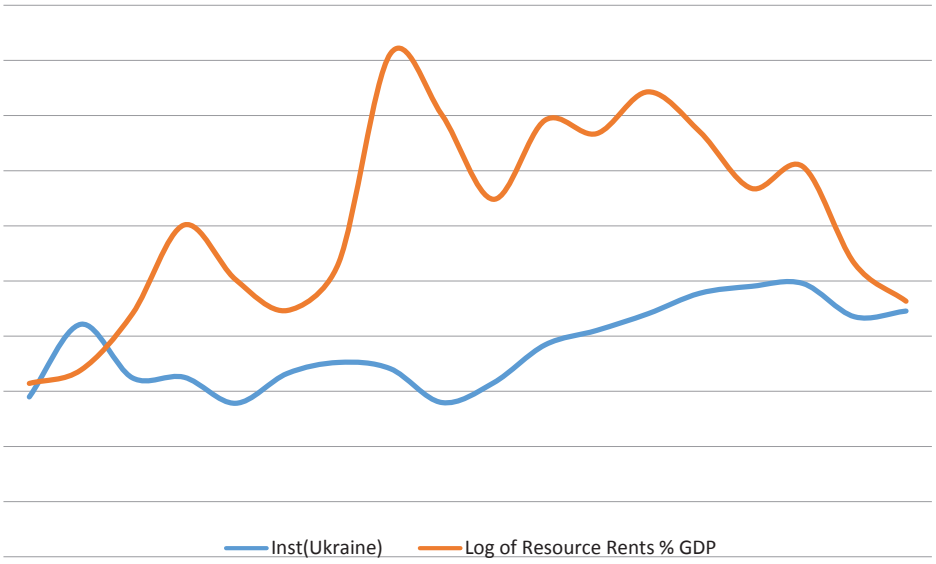
(b) Belarus (Inst=CIM, Resource Rents % GDP, as a percentage), 1993-2010



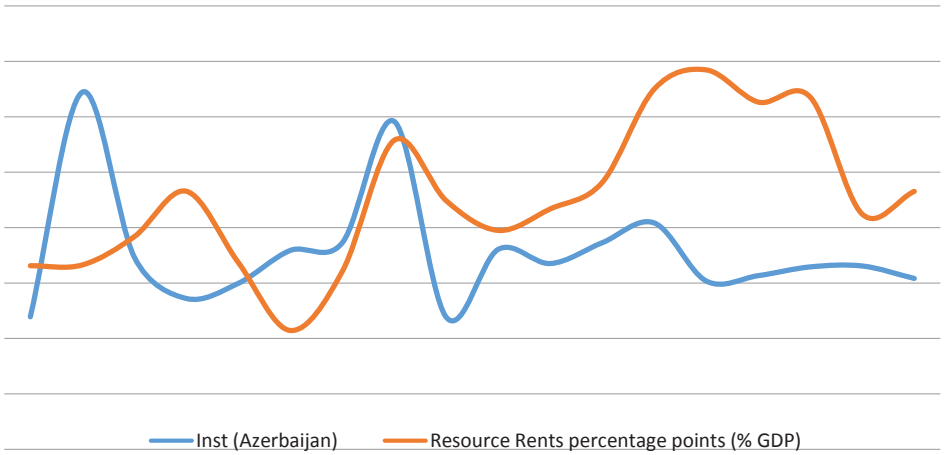
(c) Georgia (Inst=CIM, Resource Rents % GDP, as a percentage), 1993-2010



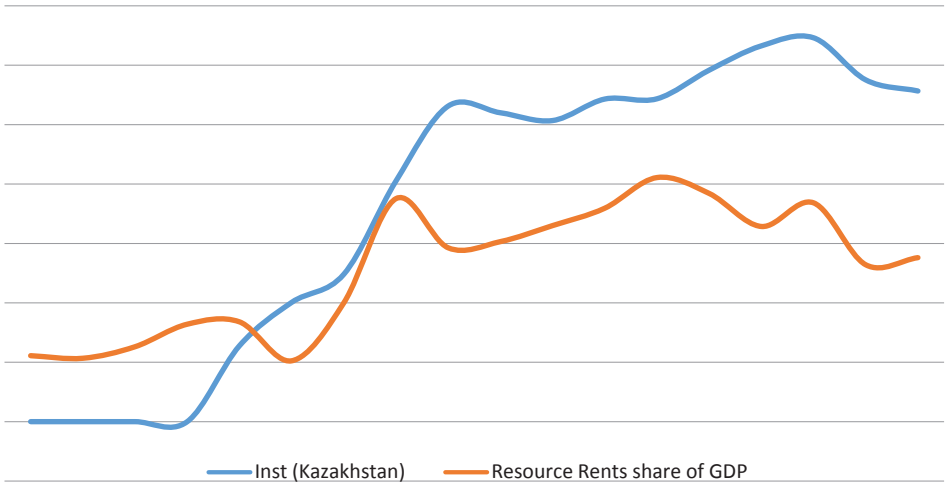
(d) Moldova (Inst=CIM, Resource Rents % GDP, as a percentage), 1993-2010



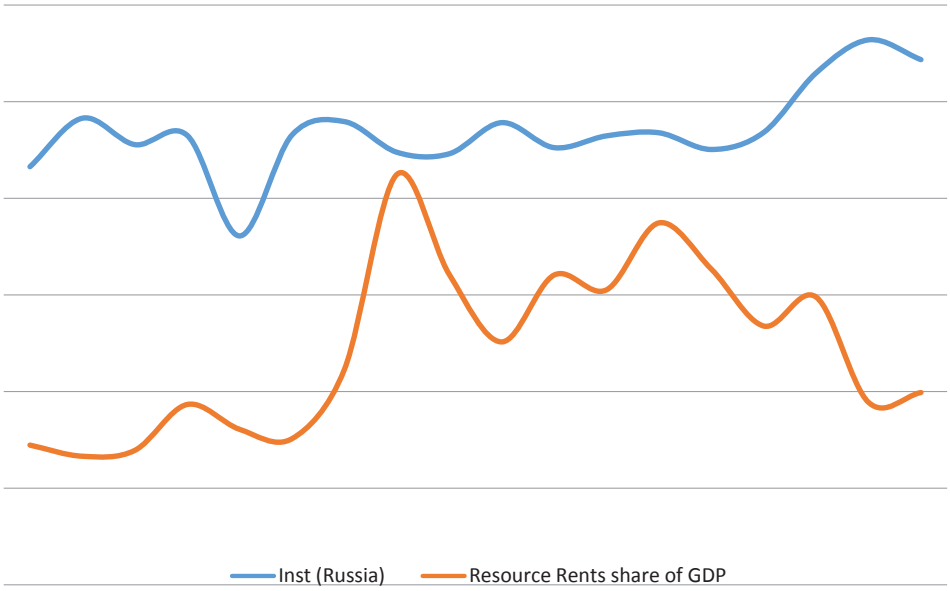
(e) Ukraine (Inst=CIM, Resource Rents % GDP, in logs), 1993-2010



(f) Azerbaijan (Inst=CIM, Resource Rents share of GDP), 1993-2010



(g) Kazakhstan (Inst=CIM, Resource Rents share of GDP), 1993-2010



(h)Russia (Inst=CIM, Resource Rents share of GDP), 1993-2010

In order to establish the link between institutional quality and resource abundance, BBGMM dynamic panel data model is applied using the panel data of 8 CIS countries between 1993 and 2010. The results of the regression model are presented in Table 6.4.[10] The variables used in the model are institutional quality variable, *Inst*,[11] and two explanatory variables of institutional quality such as resource rents share in GDP and agriculture sector value added share in GDP from 1993 to 2010. All of these data are retrieved from the World Bank World Development indicators online database. Two types of natural resources, total natural resource rents share in income representing point source resources and agriculture value added share in income representing diffuse resources,[12] are included in the model to examine whether the composition of resources are important for institutional quality in CIS region. The Arellano and Bond (1991) test for autocorrelation, AR1 and AR2, indicates the needed the optimal lag length in panel VAR model. Optimal lag length is confirmed as one by Arellano and Bond autocorrelation test.

10 The method applied to determine the optimal number of lags is the method suggested by Arellano and Bond (1991), i.e. the same that is employed in the model in the previous section discussed above.

11 Proxy used for institutional quality indicator, Contract-Intensive Money, is measured as follows: CIM= (M2-M0)/M2, where M2 is broad money, M0 is currency in circulation.

12 Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.

Table 6.4. **Institutional Quality (CIM) and Resource Abundance**

Dependent Variable: *Inst*		
VARIABLES	(1)	(2)
Inst (-1)	0.362*** (0.166)	0.330** (0.134)
RR(-1)	-0.0024*** (0.0009)	0.00211 (0.00249)
RR_sq(-1)		-6.88e-05** (2.84e-05)
AgriVA(-1)	-0.0045** (0.0018)	-0.0116*** (0.00304)
AgriVA_sq (-1)		0.000142*** (4.45e-05)
Constant	0.367*** (0.097)	0.416*** (0.0836)
Sargan test (p-value)	101.94 (0.80)	97.58 (0.88)
AR1 (p-value)	-2.269 (0.023)	-1.97 (0.05)
AR2 (p-value)	1.183 (0.237)	1.39 (0.16)
Observations Number of id	136 8	136 8

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05.
The regression coefficients are estimated using Arellano Bover (1995) and Blundell and Bond (1998) system GMM approach.
AR1 and AR2 are Arellano and Bond (1991) tests for autocorrelation.

Table 6.4. show the significant negative effect of lagged variables of resource rents and agricultural value added share in income as well on institutional qaulity in both models including the agriculture value added as a diffuse natual resources in CIS countries. However, the only difference in second specification (Column 2) is that it includes squared terms, and it indicates that the lagged squared term of agriculture value added share in income has positive impact on institutional quality. The model indicates that the composition of the resource is crucial in explaining the impact of natural resources on institutional quality(Auty, 1997; Woolcock et al., 2001; Isham et al., 2005).

Table 6.5. **Short-run and Long-run Coefficients Estimates from Table 6.3.**[13]

	Dependent Variable: *Inst*	
VARIABLES	(1)	(2)
	Short-run coefficients:	
RR(-1)	-0.0024	0.00211
RR_sq(-1)		-0.0000688
AgriVA(-1)	-0.0045	-0.0116
AgriVA_sq (-1)		0.000142
	Long-run coefficients:	
RR(-1)	-0.0038	0.003
RR_sq(-1)		-0.001
AgriVA(-1)	-0.007	-0.017
AgriVA_sq (-1)		0.002

Short-run and long-run coefficients are obtained using the panel dynamic model outcomes in Table 6.5. Lagged resource rents variable, *RR(-1)*, short-run coefficient in specification (1) equals to -0.0024, implies that one standard deviation of resource rents share in income (17.20) leads to decrease in institutional quality by 0.29[14] after a year which is relatively huge, while long-run coefficient (-0.0038) indicates that one standard deviation increase in resource rents share in income causes decline of institutional quality by 0.47. Thus, the long-run coeffieicent significantly larger than of short-run impact on institutional quality.

6. Dutch Desease Explanation of Natural Resource Curse

In this section whether the resource rents share in income increase impeded the contribution of the growth of agricultural value added to GDP. In order to examine this, we derive a measure of contribution of growth of agricultural sector value added to GDP. Contribution of agricultural sector to growth (vertical axess in Figure 6.6.) is given by growth rate of agriculture value added (*ga*) from 1993 to 2010 times agricultural value added share in income (*sa*) from 1993 to 2010, or by formula *ga*sa* in Figure 6.6. (a). Thus, in that sense it is a contribution of agricultural sector growth to GDP growth. Countries demonstrate negligible contribution of growth of agriculture value added to

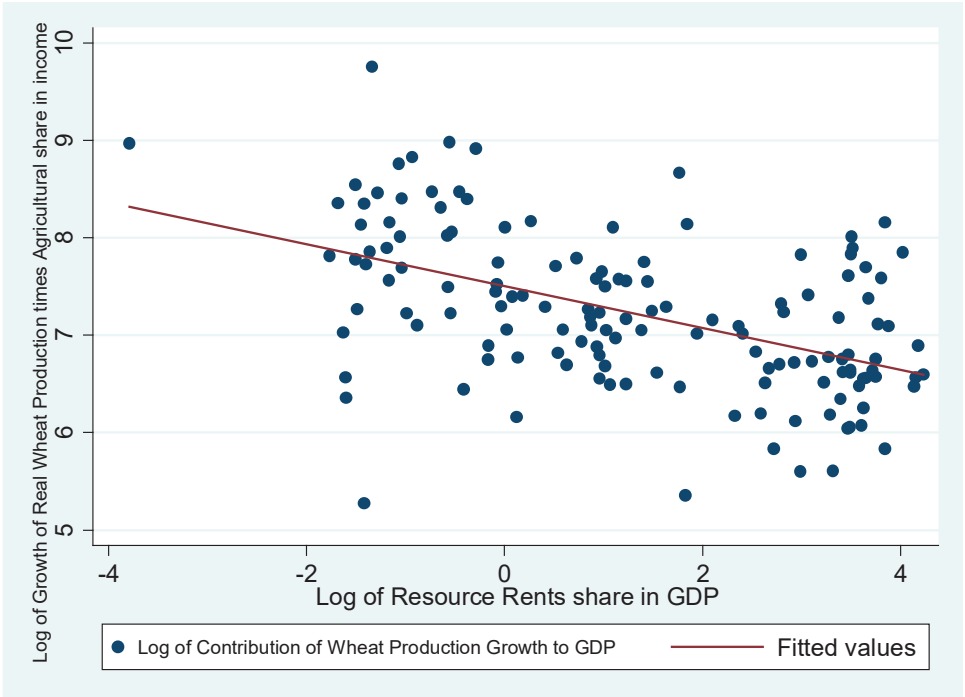
13 Short-run coefficients are obtained directly from the reported results in Table 3. Long-run coefficient is obtained by dividing the short run coefficients by one minus on the lagged variable of dependent variable.

14 Calculated as a product of the coefficient and standard deviation of explanatory variable (stdev. *RR*= 17.20*)* and then divided by standard deviation of the dependent variable (st. dev. *Inst*=0.14), so that the impact is estimated as follows: *Coefficient * (stdev (Log RR) / stdev (Inst))* *Coefficient * (stdev (Log RR) / stdev (Inst))* = -0.0024*(17.20/0.14)=-0.29

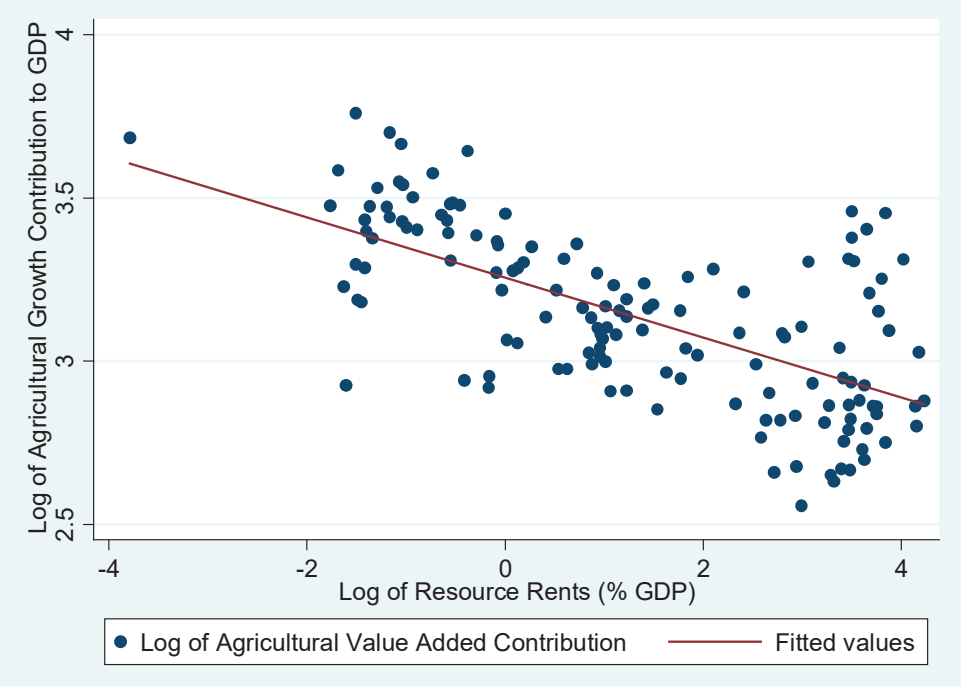
GDP growth if either there is agricultural value added growth decline or insignificant share of value added in GDP.

Contribution of wheat production growth to income (vertical axess in Figure 6.4.) is given by growth rate of wheat produciton growth in real terms (in 1000 MT – metric tons), i.e. *gw*, times agricultural value added share in income, that is *sa*, in Figure 6.7.(b). And this measure is a contribution of wheat sector growth to agricultural sector, given by formula as follows: *gw*sa*. Obviuosly the appropriate measure would be wheat sector share in income rather than agricultural sector value added. However, we use agricultural value added share in GDP as a proxy for wheat sector share in income because of the data availability. It is also observed that the log of resource rents share increase adverse impact on growth contribution measures is much more severe in the case wheat sector contribution to growth rather than the whole agricultural sector contribution.

Figure 6.7. **Log of Resource Rents share in Income and Log of Agricultural Growth Contribution to GDP**



(a) Log of Resource Rents share in Income and Log of Agricultural Growth Contribution to GDP



(b) Log of Resource Rents share in Income and Log of Wheat Sector Growth Contribution to GDP

In order to examine the resource abundance impact on economic growth via institutional quality, dynamic panel data model is performed and the results are presented in Table 6.6. below. The core explanation of Dutch disease is that the resource abundance drives away the resource from the sector that has positive externalities on economic growth. There is supportive evidence of that the countries with vast natural resources tend to have declining growth in manufacturing sector exports (Sachs and Warner, 1997, 1999). In this study it is hypothesized that resource abundance squeezes out agricultural sector growth, particularly wheat sector growth, which have positive externalities on economic growth directly or via institutional quality. The regression results in Table 6 supports the hypothesis declared in this study. It is spotted that log of resource rents share in income has significant negative impact on log of agricultural sector natural resources production, especially wheat sector production, growth contribution to GDP. In case the agricultural sector is crucial determinant of institutional quality, then the Dutch disease impact explains the negative association of resource abundance and bad institutional quality, and thus poor economic performance.

Table 6.6. **Crowding-out Effect of Resource Rents on Agricultural Production and Wheat Production Growth Kontribution to GDP**

	Log of agriculture growth contribution to income		Log of wheat sector growth contribution to income	
VARIABLES	(1)	(2)[1]	(3)	(4)[1]
	FE robust	BBGMM	FE robust	BBGMM
Contribution to growth (-1)		0.713***		-0.153***
		(0.050)		(0.032)
Resource Rents	-24.592**	-13.232**	-23.208**	-63.440**
	(8.506)	(5.184)	(8.612)	(29.281)
Constant	1981.28***	565.173***	2268.863***	3056.455***
	(111.43)	(127.577)	(112.817)	(434.207)
Observations	142	136	142	136
Number of id	8	8	8	8
Sargan test (p-value)		89.47 (0.96)		103.80 (0.76)
AR1 (p-value)		-1.94 (0.05)		-1.62 (0.11)
AR2 (p-value)		1.28 (0.20)		-0.57 (0.57)

Notes: Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1;
1 - The regression coefficients are estimated using Arellano Bover (1995) and Blundell and Bond (1998) system GMM approach; AR1 and AR2 are Arellano and Bond (1991) tests for autocorrelation.

As a further illustration of the importance of resource abundance in accounting for poor economic performance in eight CIS countries, the third column of Tables 6.6. and 6.8. is a product of the coefficients estimated in model specification described in Table 6 and resource rents average (median from 1991 to 2010) to capture the crowding out effect of resource abundance. Two facts deserve the close attention. One is that energy resources producing countries such as Azerbaijan, Kazakhstan and Russia have the highest crowding out effect of resource abundance. Secondly, crowding out impact in oil resource rich countries mentioned above has tremendously increased in a second decade from 2001 to 2010. For instance, crowding out impact has more than doubled in Kazakhstan and Russia, while increased by 1.5 in Azerbaijan in the second decade. Russia has the lowest average growth rate (6.13%) among 8 CIS countries covered in study (see Table 6.7.) in 2001-2010. The results indicate that the agriculture sector growth contribution to income was 3.99% lower due to natural resource abundance. The same pattern is documented in crowding out effect of natural resource abundance on wheat sector production.

Table 6.7. **Basic Data on Resource Rents and Economic Growth, 8 CIS Countries**

Countries	Period from 1991 to 2000			Period from 2001 to 2010		
	Resource Rents (% GDP)	Growth rates	Regression estimates of resource rents effect[1]	Resource Rents (% GDP)	Growth rates	Regression estimates of resource rents effect[1]
Armenia	0.0027	5.48	-0.0357	0.0104	11.72	-0.138
Azerbaijan	0.3319	-0.97	-4.3917	0.4736	9.51	-6.2665
Belarus	0.0277	0.95	-0.3665	0.0261	8.44	-0.3461
Georgia	0.0045	3.15	-0.0595	0.0088	6.15	-0.117
Kazakhstan	0.1301	-2.71	-1.7215	0.3293	8.78	-4.3567
Moldova	0.0027	-4.13	-0.0357	0.0023	7.05	-0.0305
Russia	0.1501	-4.53	-1.9861	0.3015	6.13	-3.9899
Ukraine	0.0278	-8.90	-0.3678	0.0548	7.14	-0.7246

Notes: 1 – The third column is the product of resource abundance and estimated regression coefficient on this variables from specification in Table 6.3. (= Column 2 *(-13.232)), indicating the impact of resource abundance on agricultural resource production growth contribution by countries.

Table 6.8. **Basic Data on Resource Rents and Economic Growth, 8 CIS Countries**

Countries	Period from 1991 to 2000			Period from 2001 to 2010		
	Resource Rents, (% GDP	Growth rates	Regression estimates of resource rents effect[1]	Resource Rents, (% GDP	Growth rates	Regression estimates of resource rents effect[1]
Armenia	0.0027	5.48	-0,1713	0.0104	11.72	-0,6598
Azerbaijan	0.3319	-0.97	-21,0557	0.4736	9.51	-30,0452
Belarus	0.0277	0.95	-1,7573	0.0261	8.44	-1,6558
Georgia	0.0045	3.15	-0,2855	0.0088	6.15	-0,5583
Kazakhstan	0.1301	-2.71	-8,2535	0.3293	8.78	-20,8908
Moldova	0.0027	-4.13	-0,1713	0.0023	7.05	-0,1459
Russia	0.1501	-4.53	-9,5223	0.3015	6.13	-19,1272
Ukraine	0.0278	-8.90	-1,7636	0.0548	7.14	-3,4765

Notes: 1 – The third column is the product of resource abundance and estimated regression coefficient on this variables from specification in Table 6.3. (= Column 4 *(-63.440)), indicating the impact of resource abundance on wheat production growth contribution to income by countries.

7. Conclusions

The literature of resource curse have determined two channels of natural resource abundance impact on economic growth. Some of the scholars suggested the resource curse impact via institutional qualuty, while others proposed the idea that natural resource curse effect undermines economic growth crowding out sectors that have positive externalities on economic growth. However, many of them, if not all, are based on cross-country and thus, needs to be complemeneted time series or panel data to study to examine the commodity booms impact on economic performance. It is potentially crucial point because it is still an open question wether the observed negative impact of resource curse is observed in the long term or just short term phenomenon stemming from commodity booms and associated uncertanties with it.

The lack of sufficient data on institutional quality more often restrained the scholars from conducting an investigation that would cover natural resource curse impact on economic growth in the long-run. Obviously, finding the appriapriate measure for institutional quality is a daunting task. The proxies used in the broad literature with a sufficient time span needed to conduct research are mostly unavailable. In this regard, the study suggests a new measure for institutional quality that could be exploited in resource curse study, initially pioneered in the influential paper by Clague et al. (1999). The measure has advantage over the others not only in data availabaility but also many other detailes discussed in the paper mentioned above.

The study findings show that the type of resources is crucial in explaining resource curse, which has been documented by Auty (1997), Woolcock et al. (2001) and Isham et al. (2005). It is rather not all but only some types of the resources are problematic for economic growth. Thus, the more appropriable are the resource to seize the control over them and capture the rents that are generated by producing natural resources the higher the possibility that this would lead to rent-seeking and inefficient activities. However, the bottom line of the study is to show that the natural resource abundance and their composition is nonlinear function of the institutional quality. It is believed that there is threshold point in the impact of different types of natural resources abundance on institutional quality implying that excessive or overabundant production of resources are crucial in explaining the resources curse. Interestingly, for instance, that diffuse resources such as agricultural resources production bears positive externalities at higher levels of production, while at lower levels of production it could have negative impact on institutional quality.

Another finding of the study is that Dutch disease impact is observed through its effect on institutional quality channel. The basic idea of Dutch disease effect is that resource abundance drives out resources from the activity or sector, for instance, manufacturing sector that potentially has positive impact on economic growth. The empirical research results show that point-source resource abundance has significant negative impact on agricultural sector value added growth contribution to income. Therefore, based on the results of the study, it is concluded that point-source natural resource abundant production, energy production in CIS countries case, is squeezzing out diffuse resource production activities, agricultural sector natural resources production which potentially has positive impact on economic growth via shaping better institutions.

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PART III

Political Aspects of Energy Policy in Central Asia and Caucasus

7. A Game of Central Asia Hold'em

ANCA-ELENA MIHALACHE

Abstract

The fall of the Soviet Union rendered the five states of Central Asia into a prize that many competitors sought to win. In a game of Texas Hold'Em in which the stakes would be the riches of these five states, Russia and China are now the two main players. Turkey, Iran and India, in their turn, played their best shots but so far failed to secure a winning hand. There are two other players: the United States and the European Union. The aim of this paper is to focus on the European Union and its engagement in Central Asia. After a critical analysis of what the EU has done so far, the paper offers the solution of further engagement through the actions of one of its newest member states, Romania, as it has long harbored good diplomatic relations with Central Asian states. Add to this its need to ensure energy diversification and its plan of transforming the Black Sea port of Constanţa into a Eurasian hub for freight and hydrocarbons and Romania now seems like a strategic asset in the geopolitical game of Central Asia Hold'Em.

Keywords: Central Asia, European Union, Partnership, Romania

1. Introduction

Imagine a game of poker. The Dealer was the Soviet Union (USSR) and the prize is the riches of what we now call Central Asia. Following the collapse of the USSR and especially in the past few years, Central Asia has become a key region in the entire Eurasian complex, most notably from an economic standpoint. The fact, which was already well known by the newly created state of Russia, now one of the big players in the game, was quickly understood by others as well.

So the U.S. and the European Union (EU) on the one hand, and China, Turkey or Iran on the other soon joined in. For some, as the U.S., the interest lay in gaining access to places like Afghanistan. For others, like China and Europe, it was about the black gold that states like Kazakhstan and Turkmenistan can plentifully supply. As for the others, thanks to their geographic proximity to the region, they saw the game as means of stepping out from the shades and playing in the big leagues in order to gain some strategic advances.

2. The Big Blinds[1]

The main player, **Russia,** predictably considered Central Asia a natural extension of the regions where it can manifest its national interests in a privileged manner – thus launching its doctrine of the "near abroad"[2] in 1992 that declared all former soviet regions part of its own sphere of political and economic interests.

Given Russia's geographic position and its tumultuous history, it is understandable why it feels the need for "buffer zones" to protect it from foreign powers.

> *"It counts no rivers, oceans, swamps or mountains marking its borders -- it relies solely on the relatively inhospitable climate and its forests for defense. Russian history is a chronicle of the agony of surviving invasion after invasion. Traditionally these invasions have come from two directions. The first is from the steppes -- wide open grasslands that connect Russia*

1 The blinds are forced bets posted by players to the left of the dealer button in flop-style poker games. The number of blinds is usually two, but it can range from none to three. The small blind is placed by the player to the left of the dealer button and the big blind is then posted by the next player to the left (according to http://en.wikipedia.org/wiki/Blind_%28poker%29).

2 The "near abroad" has generally been elevated to a concept of a Russian "sphere of influence" over and within the former Soviet states; also referred to as the "post-Soviet space." For more on the concept of "near abroad," see: Porter, Bruce and Carol Saivetz, "The Once and Future Empire: Russia and the Near Abroad." The Washington Quarterly 17 (1994), 75–90.

> *to Central Asia and beyond -- the path that the Mongols used. The second is from the North European Plain, which brought to Russia everything from the Teutonic Knights to the Nazi war machine."*(2012, http://www.stratfor.com/analysis/geopolitics-russia-permanent-struggle)

It is, therefore, long in the Russian DNA that Central Asia should fill the role of protector of the Russian core. Therefore, in order to make sure that its southern part is protected, Russia has long been the most hawkish player at the table. Its main advantage is that it was dealt a strong hand by the Soviet Union in the first place – in that it inherited a privileged connection with Central Asia and a comprehensive infrastructure that makes Russia irreplaceable.

Militarily, Russia has ensured its presence in the region through long term stationing of troops in military basis such as the Kant airbase and Anti-submarine Weapons Testing Center in Issyk-Kul Lake in Kyrgyzstan, 201 military base in Tajikistan (the largest Russian base abroad, comprising approximately 700 soldiers), Sary Shagan anti-ballistic missile testing range, Balkhash 9 Radar Station, Kastany military-transportation airbase in Kazakhstan etc. (Garibov and Ibrahimov, 2013).

It thus created dependency as well as deterrence in the republics, especially given the growing number of risks associated with the region after NATO's withdrawal from Afghanistan – ranging from drug trafficking to terrorist attacks.

The republics are now highly dependent on Russia for their security – especially those poorer states of Tajikistan and Kyrgyzstan, also the most prone to post-Afghanistan dangers – and, at the same time, they are also deterred from ever upsetting the balance imprinted by Russia in the region. We need look no further than the Feragana Valley (spread across the territory of three states, Uzbekistan, Kyrgyzstan and Tajikistan), constantly under the threat of ethnic unrest to understand just how fragile the balance in this region is and how Russia could use it in order to destabilize large swaths of Central Asia.

Economically, Russia has focused mostly on the energy sector. First, it made sure that it is part of almost all major transport corridors of hydrocarbons from Central Asia to Europe. Second, it revitalized the old Soviet infrastructure thus ensuring that most roads and railways towards the West go through its own territory. Third, it happily welcomed not only Central Asian products and resources to its market, but also people looking for work. In 2012 it was hosting

over 3.5 million workers from the region and the remittances they send home reached approximately 8 billion dollars every year – that's 46% of the GDP of Tajikistan and 20% of that of Kyrgyzstan (Kasymalieva and Marat, 2012).

Socially, Moscow has deepened ties with its Diaspora in the region (4.4 million Russians only in Kazakhstan as per the country's 1999 census)and, most notably, used the Russian language as a bridge with Central Asia – more than 16 million people in the region use it as their first language. It also took advantage of the fact that a large part of the local political and intelligence elite were once students of Soviet Moscow, which gives Russia the upper hand in collecting and distributing sensitive information. Moscow's other lever is the media, with Russian TV stations reaching a wide public in Central Asia. In Bishkek, for instance, there are more than ten available Russian channels. Even though some of the governments, such as the one of Turkmenistan, have attempted to restrict access, Russian televisions are still available, by satellite. This means that the population can easily fall prey to misinformation coming from Moscow (Nixey, 2012).

Other instruments that helped Russia maintain a foothold in Central Asia have been **collective organizations** such as the Collective Security Treaty Organization (CSTO), the Shanghai Cooperation Organization (SCO) and the Eurasian Customs Union. Within these formats Russia supplies its "partners" with support in military matters, it pardons their debts and offers them new credits, thus making sure its involvement will be necessary in the long run.

All signs, therefore, point to Russia having the upper hand in Central Asia. And given its strong tactics with territories of great importance, it is safe to assume that Russia is a player to be feared.

But the above mentioned SCO brought to the table the other important player in the region: **China**. In retrospect, the project initiated by both Russia and China in 2001 with the declared goal of fighting terrorism and separatism is in reality just the first step of what later became China's pivot towards Central Asia. From this perspective, it is likely that the Eurasian Customs Union was not an answer to the previously expansionist tendencies of the EU and NATO, but to those of China (Petersen, 2013).

However, unlike the geopolitical needs of Russia, those of China are of a **more pragmatic** kind – energy resources for its ever growing economy. There is a bigger stake, of course. China is desperately trying to secure access to resources and trade through **routes** other than maritime ones. Its fears of a hostile

Washington or Tokyo encroaching on its trade routes are most visible in its latest attempts to secure access to islands and sea lanes, which has cost it so far not only bad feelings from neighbors, but also an arbitration procedure in the UN.

China also fears that **separatist sentiments** could strengthen among its Uyghur population in Xinxiang – due to tight relations with the Uyghur Diaspora in Central Asia – and that Islamic radicalism could spread around the region and eventually end up hurting the Han Chinese – as shown by the two attacks preceding the Third Plenum of China's 18th Communist Party Congress.

The visit of president Xi to Central Asia in September 2013, prior to the SCO summit in Bishkek, and the long list of investments that received a blessing on this occasion are just the latest in a long series of levers that China is successfully using in the region under its comprehensive One Belt, One Road policy. These take the shape of energy projects developed in partnership with China National Petroleum Company, as well as large sums of money that Beijing landed in the region through its state-owned banks (4 billion dollars in 2004 and another 4.1 billion in 2011 to the government of Turkmenistan, 5 million dollars to the Kazakhstan Development Bank and KazMunaiGas each, 880 million dollars to Tajikistan, etc.). China is also successfully using its Confucius institutes and student exchange programs to enhance its cultural standing in the region.

But despite all this display of soft power, it is clear for now that Beijing is afraid of going all in against Russia – that means resorting to the military dimension. Still, even though right now the region is not important enough for China to anger Moscow, it could become so in the future. It is worth noting that China is slowly testing the waters by collaborating with Turkey on missile defense. It remains to be seen whether it will gradually start grooming Central Asia as well for weapons trade.

It's also worth looking at the crucial role that oil plays in **fighting modern wars**. A fact most likely well known by China is that fuel demand in a military conflict would be so large that it would seriously affect its supply. According to some estimates,

> *"In an air war against Taiwan alone, the People's Liberation Army Air Force would use up nearly half of China's indigenous jet fuel production" (*Kelanic, 2013).

So, even though for the moment China is successfully building long term relations on a bi and multilateral level based on its economic clout – which is more difficult to seize than the Russian actions that work on all levels of influence – its bet is not less important or less menacing.

3. The Small Blinds

The smaller players in the region have all given it their best shots as well. Firstly encouraged by the US, **Ankara** felt that its history, its religion and its ethnicity will make it a role model for the region (Garibov and Ibrahimov, 2013) and, implicitly, a point of attraction after the fall of the USSR. However, due to the fact that it was not yet economically strong enough to fully support the new republics, they soon became reluctant to change one elder brother for another, as Kazakh president Nazarbayev put it (Ibrahimov, 2010).

As a result, Turkey adopted just a **pragmatic approach** in the region, focusing on becoming a transport hub between the two continental blocs and satisfying its needs of hydrocarbons at affordable rates; and, of course, finding new markets for the products of its fast growing Anatolian tigers.

In order for Turkey to improve its chances of gaining better profits in Central Asia, Ankara could partner up with the EU, on condition that Brussels too seizes this opportunity. Ankara's privileged relation with Azerbaijan could be an asset.

However, the Syrian conflict has put any such projects on the backburner for now. It has added several layers of insecurity to an already volatile situation: the refugee crisis, the tense Russo-Turkish relations in the aftermath of Turkey's downing of a Russian airplane in November 2015, and the renewed efforts to contain PKK terrorist attacks in Turkey.

Both Turkey's relation with Russia and with the EU are, at the time of this writing, being re-thought. The refugee crisis has been turned into an opportunity to strengthen the previously somewhat fraught relations between Turkey and the EU, but it has yet to play out fully. It will take months or even years before actual results of the deals are clear. Turkey's future cooperation with Russia is also anyone's guess at this point – with pragmatism still possibly prevailing if both sides need each other enough.

Teheran has seen from the beginning Turkey's bet in the region as a threat to its own security and interests, especially given the American support that Ankara benefited from. Second, the pan-Turkism that it promoted risked inflaming nationalist feelings in Iran's backyard.

Its **greatest disadvantage**, however, was its Islamic identity, which raised fears in the five republics. Even if it may not have intended to export its religious beliefs, Iran acted in such a way that states like Tajikistan had good reason to fear its ambitions – Tehran maintained close ties to the Islamic Renaissance Party and indirectly participated in the fall of the Tajik government of Rakhmon Nabiev in 1992. It also supported several religious foundations in the region and distributed books or opened mosques and schools on the ground.

As a result, just like Turkey, Iran found it best to resort to **pragmatic and rational policies**, mostly to counter its international isolation. It prioritized transport infrastructure and trade, while using its geographical position to its advantage – by offering land routes to Turkey and maritime routes to the world market through the Indian Ocean.

However, its aggressive stance in the Caspian Basin delimitation process (demanding to increase its share of the sea from the current 13% to 20% at the expense of Turkmenistan and Kazakhstan) makes Teheran a **less desirable business partner** in the eyes of the five republics. Still, the 2015 nuclear deal with Iran shows promise of ushering in a renewed period of cooperation with the West. Political and business contacts have flourished immediately after the sanctions' lifting and talks of commercial deals have made headlines for months. Iran could thus use this favorable position to promote projects in and with the Central Asian republics, though it could take years before concrete results are clear.

New Delhi is the other natural player in the region, as India is now the fourth consumer of oil in the world. Unlike the others, however, **its economic interests are more diverse**, as it also aims to develop and improve its trade of agricultural, metals and IT industries. Its other stake in the region refers to security as it fears the "arch of instability" starting in the Feragana Valley, going through all of Afghanistan and the tribal regions of Pakistan and ending in its own Kashmir region(Garibov and Ibrahimov, 2013).

In 2012 India launched its **Connect Central Asia Policy** aiming to set up universities, hospitals and IT centers, joint business ventures as well as joined research partnerships in the field of security and defense. To ensure its infrastructure for these projects, and to ensure that this infrastructure bypasses Pakistan, India is developing the North South Transport Corridor linking it to Iran and Afghanistan, as well as Central Asia. India is also trying to develop the **Turkmenistan-Afghanistan-Pakistan-India (TAPI)** pipeline in order to reduce its dependence on energy imports from the Middle East.

All these show that even if India joined the game about two decades later than the other players, it seems quite determined to make its gains. And this, in turn, could prove useful for the other players that are in need of a partner in the region – especially the United States.

4. The Newcomers

Seen through the eyes of these five players, it is obvious that the past two decades have built Central Asia into a strategic prize. Therefore, without diminishing the role played until now by the U.S. and the EU in the region, it is worth noting that both actors seem to lack a long-term vision for their involvement in Central Asia, which has cleared the path for Russia and China to play their best hands.

The **American** lack of involvement is understandable for at least two reasons: on the one hand its retreat from Afghanistan leaves the Northern Distribution Network more or less useless to its own immediate purposes; on the other, it is likely for Washington to become less reliant on or even a major exporter of hydrocarbons thanks to its shale gas revolution. Therefore, given its lack of motivation, the US's involvement in the medium term is unlikely.

Nevertheless, for the sake of Afghanistan's economic development after 2014, the U.S. should take advantage of its good relations with India to promote trade in the region.

> *"Increased trade with India would offer diversification and needed balance in the region, helping avoid a Chinese monopoly. But sustained trade engagement between India and Central Asia and Afghanistan — which could potentially pave the way for long-term Afghan stabilization — requires a push and commitment from the US. The latest developments in the region, however, suggest that the players concerned are still far from reaching such cooperation."*(Hashimova, 2014)

However, the lack of vision of the **European Union**, whose stated purpose is to diversify from Russian energy resources, is questionable, to say the least. Its **weak hand** is reflected in the small sums of money allocated to its programs in the region. The TACIS (the European Commission's Technical Assistance to the Commonwealth of Independent States)[3] program, for instance, financed 62

3 The TACIS (Technical Assistance to the Commonwealth of Independent States) program is a technical assistance program launched by the European Commission in 1991 to aid members of the Commonwealth of Independent States in their transition towards democracy and market-oriented economies.

assistance projects worth a total of 105 million euro and 14 investment projects worth another 52 million euro. By comparison, the EU allocated 106 million dollars to the building of just one bridge inside its borders (between Romania and Bulgaria)(Akiner, Ibrahimov and Huseynov. 2013). This is just one example of how limited the financial motivation for the EU in the region is.

Nor has the Union done more through its 2007 "EU and Central Asia Strategy for a New Partnership". It has been perceived as rather inefficient as trade encompassed in this format has ensured that more European products go to the East than the other way around (Akiner, Ibrahimov and Huseynov. 2013:45). Add to this the fact that most of the imports that actually took place were of hydrocarbons and it becomes easy to see how Europe failed in creating sustainable partnerships in the region.

On the long term, lack of economic diversification along with poor allocation of funds and a one-way route for its goods will do nothing but take the EU out of the game.

5. I'll see that bet and raise you…

But all is not lost. The New Silk Road proposed by Hillary Clinton in 2011 represents a major opportunity for the EU. Europe is of course aware that the diversification of trade partners through a more efficient connection to Asian markets will most likely require a stable outpost in Central Asia – along with additional outposts in the South Caucasus and Eastern Europe. But for Europe to manage such a task, it needs to become more attractive and thus point out why it is the better alternative to Russia and China.

Traditionally the EU has bet on **values** to measure its clout, and this should not fundamentally change. However, it also should not stand in the way of doing business. For now, a safer bet for the EU in Central Asia is not on its values, but on two other things that China and Russia cannot offer simultaneously: **reliability and pragmatism**. Russia is indeed, reliable, but it is not pragmatic, as its stakes in the region are too high, as previously shown. China on the other hand is pragmatic, but the deals it offers might not always be reliable – the technology it brings might be cheaper but it's not state of the art, the investments it makes might be big, but they might also be subject to corruption.

The EU offers standards, it offers regulations, and these make it a predictable partner. The fact that its involvement is merely a business transaction with advantages on both sides can make it very attractive. In the end, the EU is the only one capable of **bringing Central Asia to the table not as a prize, but as a player.**

Even if the EU is the main player, it would be efficient to have one Member State create and build the link between the Union and the region. One of the European states that could play this role is **Romania**. Its strategic partnerships with two important neighbors of the region (Turkey and Azerbaijan), as well as its good bilateral relations with the five republics, its comparable experience in regard to Moscow prior to 1989 and its less judgmental stance on human rights issues (stemming from its understanding of difficulties associated with transition from a communist system) all add up to open up a clear path from Bucharest to Central Asia.

Romania has held quite **good diplomatic relations** with Central Asia, while making it an objective of its foreign policy to

> *"pay close attention to the strategic connections between the Black Sea and the Caspian Sea, via consolidating and diversifying bilateral relations with Central Asian states and via enhancing its role within the EU's initiatives for the region"*(Romanian Ministry of Foreign Affairs).

Romania is one of the few European countries to maintain more than one embassy in Central Asia and it has held bilateral diplomatic relations with all five Central Asian states for two decades now. Bucharest has a well-established diplomatic representation in the region: Romania set up an embassy in Kazakhstan in 1992, one in Turkmenistan in 1993 and one in Uzbekistan in 1995. Kyrgyzstan and Tajikistan are covered by the embassy in Astana. Only Kazakhstan and Turkmenistan have embassies in Romania, but Uzbekistan plans to open an embassy in Bucharest in the near future. In 2012, Romania held a series of events in Bucharest to commemorate 20 years of diplomatic relations with Kazakhstan and Turkmenistan (Marin, 2013).

Just like the EU, Romania is interested in promoting **security and stability** in the region and it supports and encourages democratization, dialogue and cooperation. Possible threats stemming from an unstable region include terrorism and illegal drug trade from Afghanistan. Therefore, Romania supports multilateral security initiatives, such as those undertaken by the EU, the OSCE and NATO, while some Romanian companies are involved in the provision of security systems in the region.

The main initiative that Romania promoted so far on a regional level is the **Black Sea Synergy** meant to build cooperation in the Black Sea region. It offers the guidelines for the implementation of concrete and pragmatic projects of cooperation between wider Black Sea region states and the EU, in ar-

eas such as: democracy, human rights, good governance, border management, protracted conflicts, energy, transports, environment, maritime policy, fishing, migration, education, research and development. The main arguments for the EU to adopt this initiative were linked to the Eastern Neighborhood and its strategic position, the importance of connections to Central Asia, the Middle East, as well as the Western Balkans.

Romania is also part of the **Black Sea Economic Cooperation (BSEC)** – a regional organization which seeks to develop and diversify bilateral and multilateral economic cooperation on the basis of international law. BSEC acts towards improving the business environment and promoting the individual and collective initiatives of the companies directly involved in the region.

All this shows that **Romania is able to promote regional initiatives** and that it has diverse economic interests that would be well served by further cooperation with Central Asia. For that matter, **energy security** is especially important to Romania, as Bucharest aims at diversification from Russian resources. At the same time, Central Asia represents an important market not only for Romanian industrial production but also for know-how in the field of hydrocarbons and drilling equipment.

Kazakhstan is by far Romania's most important trading partner in Central Asia. Romanian exports to Kazakhstan are mostly maritime transport vehicles, electro-mechanical equipment and chemicals. From Kazakhstan, Romania imports mostly oil which is then processed in its Petromidia refinery, part of the Rompetrol Group. Romania is one of Kazakhstan's top ten largest export markets. In 2007, Kazakh state oil Company KazMunaiGas purchased 75% of the shares of Romanian company Rompetrol for around $1.6 billion (€1.2 billion). Through the Kazakh ownership of Rompetrol, Kazakhstan is one of the main contributors to the Romanian state budget, providing revenues of €1.5 billion per year(Marin, 2013).

Regarding the social and academic dimension, Romania has also signed **education cooperation** agreements with Kazakhstan and Turkmenistan, granting scholarships every year to students who want to study in Romania. Furthermore, Romania and Kazakhstan have established a joint educational program at the Aktau University, in Kazakhstan. Constanţa Maritime University has opened a branch in Aktau, which trains naval officers and electrical engineers. The teaching staff is made up of Romanians, and graduates will receive both Romanian and Kazakh diplomas.

Some friendship associations and cultural initiatives exist as well(Marin, 2013), even though, for the moment, there is very little public awareness in Romania of these and of Central Asia in general.

In conclusion, Romania already seems aware of the importance that Central Asia has gained and it seems willing to join the game.

Therefore, the next step is for Bucharest to **take responsibility** for the role it can play. The establishment of the Romania-Kazakhstan Business Council, the scholarship programs and especially Romania's support for energy diversification projects are just tactical steps.

They could however, become part of a larger, long term strategy for the region. To complement them, Romania could also focus on **improving transport corridors** such as the one from the port of Turkmenbashi to the port of Constanţa – this way Central Asian goods could potentially enter Europe through Romania and could give Constanţa the hub status that it deserves.

Of course, given the economic discrepancies between the oil rich states and the now recovering Romanian economy, Bucharest needs to be very careful in playing its hand. It must project enough strength as to become a partner, but not the type of strength that would sound an alarm for Russia or China. It should always act as an **honest broker**, but one that is part of a bigger system, that of the European Union.

Romania now has the chance of becoming a **gateway** towards the European continent, linking the interests of the EU and those of the Central Asian countries, at the same time mediating between the different values of the players.

Romania is already involved in programs such as TRACECA (Transport Corridor Europe-Caucasus-Asia)[4] or INOGATE[5] and it could promote taking them even further – through more financial allocation, through more multilateral meetings, etc. To make itself more attractive to Central Asia Bucharest can also add its experience with maritime delimitation lawsuits in The Hague (which could prove useful in the delimitation of the Caspian Sea). Politically, Romania can contribute by promoting visa liberalization programs between the EU and Central Asian states.

But in order to do all this, Bucharest must first position itself as a **reliable and responsible partner** for both sides. It must show **long term vision and political will** as these, in turn, might finally give it a seat at the table.

4 TRACECA (Transport Corridor Europe-Caucasus-Asia) is atechnical assistance program launched in 1993 with the scope of developing a transport corridor between Europe and Asia.

5 INOGATE is an international energy co-operation program between the European Union, the littoral states of the Black and Caspian seas and their neighboring countries. The program is operational since 1996. INOGATE originated in 1995 as an EU support mechanism dealing with INterstate Oil and GAs Transportation to Europe.

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8. Regional Cooperation in the Caspian Sea Region in the Context of the Eurasian Integration

LIDIYA PARKHOMCHIK

Abstract

Nowadays, the dialogue between the countries of the Caspian Five could be characterized by new trends appeared as a result of overthinking strategical goals for further development of the Caspian region. The Caspian states feel the need for improving multilateral economic relations, so as strengthening security, cultural and environmental cooperation. The first step on this way is initiation of new joint projects, which could establish a background for strong economic cooperation between littoral partners and even for possible regional integration.

However, any attempts to implement large-scale projects in such spheres of economy as transportation or trade would face multiple challenges caused by the regional geopolitical shifts. There is a strong necessity to take into consideration the fact of establishing new form of interaction between Kazakhstan and Russia through the activity of the Eurasian Economic Union, the most recent territorial enlargement of which clearly demonstrates the necessity for detailed study on the issue of Eurasian integration and its influence on further development of the Caspian region.

Therefore, the paper touches upon the current backgrounds of the regional cooperation in the Caspian Sea region in the context of the Eurasian integration. Highlighting the political preconditions for strengthening regional collaboration in the Caspian region the author indicates possible forms of cooperation between the EAEU countries and the Caspian Five in such spheres as energy, economy and transportation.

Keywords: Caspian region, Eurasian Economic Union, Cooperation, Energy, Transport

1. Introduction

Nowadays, the dialogue between the countries of the Caspian Five could be characterized by new trends appeared as a result of overthinking strategic goals for further development of the Caspian region. For instance, it becomes more and more obvious that focusing simply on the mining industry development prevents the littoral states from strengthening other formats of intergovernmental interaction. Therefore, the Caspian states feel the need for improving multilateral economic relations, so as to strengthen security, cultural and environmental cooperation.

Despite this fact, there are still a number of geopolitical and geoeconomic issues, which steadily influence shaping of the landscape of regional collaboration. The Caspian Sea region possesses a vast amount of natural resources with an estimate of nearly 4% of the world oil and gas resources. Therefore, the energy potential of the region is consistently attracting foreign players, which directly or indirectly affect intra-regional activities. Under these circumstances, the countries of the Caspian Five have to be very cautious in order to avoid weakening of the mutual trust among regional players accomplished by the system of "checks and balances".

It should also be admitted that new trends in improving the level of interstate cooperation mentioned above are based on clear understanding that progressive socio-economic development of the Caspian Sea basin countries could eventually transform the attitude of the global powers toward the Caspian region which is mostly associated with an arena of context for energy resources. The first step on the way to reduction of external economic and political interference is initiation of new joint projects which could establish a background for strong economic cooperation between littoral partners and even for possible regional integration.

In this regard, any attempts to implement large-scale projects in such spheres of economy as transportation or trade would face multiple challenges caused by the regional geopolitical shifts. There is a strong necessity to take into consideration changes in the balance of power in the Caspian energy "solitaire", Ukrainian crisis, the process of breaking Iranian isolation regime and, finally, establishing new form of interaction between Kazakhstan and Russia through the activity of the Eurasian Economic Union. Launching a new model of regional cooperation in Eurasia on January 1, 2015, the Eurasian space moved to a new stage of its economic integration. The Eurasian Economic Union was established as an international body with a relevant legal personality (Eurasian Economic Com-

mission, 2015). The most recent territorial enlargement of the EAEU clearly demonstrates the necessity for detailed study on the issue of Eurasian integration and its influence on further development of the Caspian region.

The discussion paper touches upon the current backgrounds of the regional cooperation in the Caspian Sea region in the context of the Eurasian integration. The discussion paper consists of introduction, three chapters and conclusions. In the first chapter the author highlights the political preconditions for strengthening regional collaboration in the Caspian region. In the second chapter the author indicates possible forms of formants of cooperation between the EAEU countries and the Caspian Five in such spheres as energy, economy and transportation. Finally, in the the third chapter the author evaluats the prospects for economic cooperation in the Caspian Basin focusing on the current volumes of the foreign trade.

2. Political Preconditions for Strengthening Regional Collaboration in the Caspian Region

Nowadays, the countries of the Caspian Five are at the very early stage of the process of shaping their own unique format of regional cooperation. It should be admitted that the littoral states have not yet reached an appropriate level of development of the intergovernmental relations, which is necessary for the establishment of the full-fledged international economic collaboration in the region. However, despite this fact there are some signs detecting formation of an acceptable environment for weakening of mutual claims in the political sphere, which prevent the regional players from reaching an advanced level of economic partnership. It is primarily a question of establishing an updated version of the Caspian Sea legal regime, which is still under heavy discussion.

Since the moment that caused the appearance of the legal dispute over the Caspian Sea, namely, since 1992, the countries of the Caspian Five have held 45 meetings of the Special Working Group on drafting a Convention on the legal status of the Caspian Sea at the level of deputy foreign ministers. The last SWG meeting took place on June 8-10, 2016 in Moscow. The mentioned format of consultation was established as a result of the first meeting of the foreign ministers of the Caspian states held in Ashgabat in 1996, where the high-ranked officials agreed to intensify the negotiation process in order to solve the issue of the legal regime of the Caspian Sea in the five-sided format.

However, it should be noted that until recently the productivity of the SWG consultations had remained at a fairly low level. The substantial progress was

caused by direct interference of the heads of the littoral states into the Caspian talks. The most telling example is the IV Caspian Summit held in Astrakhan in 2014, during which leaders of the littoral states agreed to recognize a 15-nautical mile sovereignty space adjacent to each country's shoreline and the exclusive right for each country to fish an additional 10 nautical miles beyond the 15-mile zone. Besides, the five presidents of the Caspian states inked a political declaration, which reflected the fundamental principle for guaranteeing stability and security.

Moreover, the Caspian Sea countries entered a new phase of the Caspian Basin delimitation in the two-sided format. At the end of May 2015 Astana and Ashgabat signed a draft decree on ratification of the Agreement between Kazakhstan and Turkmenistan on delimitation of the Caspian Sea inked in November 2014. The mentioned Agreement on the delimitation of the adjacent sections of the Caspian Sea between Kazakhstan and Turkmenistan marked another step on the way towards defining the delimitation line of the national sectors[1] over the seabed and subsoil, within which the littoral states could have exclusive right on the development and on the use of bottom and subsoil resources.

Nowadays, two sectors of the Caspian Sea bed are officially marked. Kazakhstan and Russia have finished the process of demarcation of the national seabed sectors. As shown in Table 8.1., the Russian sector of the seabed has been marked under agreements between Kazakhstan, Russia and Azerbaijan signed in 1998-2003. Documents on final demarcation of the Kazakhstan's part of the Caspian Sea bed were inked in 2014 based on the relevant agreement signed with Turkmenistan. Implying the format of the delimitation talks, which was first developed by Russia, Kazakhstan and Azerbaijan, became more preferable for the Caspian Sea division with the engagement of Turkmenistan. It means that all the Caspian Five states, except Iran, have already agreed to use the method of the modified median line.[2]

1 The de facto official use of the term national sector of the Caspian Sea dates back to the period of the Soviet Union. The Ministry of Oil Industry of the USSR adopted a decision on the division of the Soviet part of the Caspian Sea into national sectors between the four littoral Soviet republics in 1970. The demarcation lines between national sectors were considered as both an administrative and territorial borders of the Caspian states.

2 Iranian officials are still emphasizing their desire to divide the Caspian Sea into 5 equal parts, 20% for each littoral state, and insists that the legal status of the Caspian Sea is still based on bilateral treaties between Iran and the USSR dated back to 1921 and 1940.

Table 8.1. **List of the new agreements on delimitation of the Caspian Sea**

Agreement	Countries	Year
Agreement on the delimitation of the northern part of the Caspian Sea in order to exercise sovereign rights for subsoil use	Russia & Kazakhstan	1998
Agreement on the delimitation of the Caspian Sea	Kazakhstan & Azerbaijan	2001
Protocol to the Agreement on the delimitation of the northern part of the Caspian Sea	Russia & Kazakhstan	2002
Agreement on the delimitation of adjacent sections of the northern Caspian Sea	Russia & Azerbaijan	2002
Protocol to the Agreement on the delimitation of the northern part of the Caspian Sea	Kazakhstan & Azerbaijan	2003
Agreement on the delimitation of adjacent sections of the Caspian Sea	Russia, Kazakhstan & Azerbaijan	2003
Agreement on the delimitation of the Caspian Sea	Kazakhstan & Turkmenistan	2014

Source: Author's Compilation

Therefore, it should be admitted that the littoral countries have intensified their cooperation on working out the convention on the legal status of the Caspian Sea hoping to achieve significant progress in drafting principals of the future legal status of the Caspian Sea at the forthcoming V Caspian Summit, which would be held in Kazakhstan in 2016. Moreover, in accordance with the most optimistic scenario, the parties could even manage to sign the final Convention on the legal status of the Caspian Sea. Such a statement was made by the Russia's special presidential envoy for the delimitation and demarcation of borders with the Caspian states, Igor Bratchikov, at the 40th SWG meeting on June 1, 2015 in Tehran (Tass, 2015). For instance, Russian and Kazakh governmental officials have already declared their intention to contribute to the efforts on finalizing the Convention on the legal status of the Caspian Sea.

It should be noted that without Iran's approval all bilateral and trilateral agreements between Azerbaijan, Kazakhstan, Russia and Turkmenistan should be classified as interim measures in regulation of the legal regime of the Caspian basin. However, the very fact of reaching of the mentioned agreements is a positive signal for the Caspian talks. Therefore, within the framework of political consultations, the littoral countries became closer in their approaches to further development of the region by shaping precondition for strengthening the regional cooperation.

3. Caspian Five and the Eurasian Integration Factor

Nowadays, the states of the Caspian Five involved in the processes of Eurasian integration have to face a new reality. Functioning as a bridge between the Caspian and the EAEU regions, Russia and Kazakhstan have an opportunity to establish a new background for the intra-regional collaboration. Currently the EAEU member states are located in the immediate vicinity of the Caspian Sea shore, namely, Western shore – Armenia, Northern shore – Russia and Belarus, Eastern shore – Kazakhstan and Kyrgyzstan. Therefore, the EAEU activities will surely cause middle and long-term impact on all spheres of economic co-operation among the Caspian states.

For instance, the "quintet" of the EAEU countries occupy over 20 million square km or 15% of the world land with the total population over 182.1 million people. According to the Eurasian Economic Commission report, the volume of the EAEU gross domestic product in 2015 amounted to $1.6 trillion, the volume of industrial production in January-September 2015 stood at $907.1 billion, and the volume of the foreign and internal trade turnover in 2015 amounted to $579.5 billion and $45.4 billion respectively (Eurasian Economic Commision, 2016). Despite the trend of reduction of the macroeconomic indicators in the EAEU members caused by the economic crisis and the dramatic fall in oil prices, there is still a possibility for improving an economic cooperation, especially, assuming there is a wide political support for further strenthening of the EAEU project.

3.1. Energy Issue

The Caspian Sea region is one of the oldest oil-producing areas in the world and is an increasingly important source of global energy production. The area has significant oil and natural gas reserves from both offshore deposits in the Caspian Sea itself and onshore fields in the Caspian basin (EAI, 2013). Therefore, there is a significant necessety to develop close cooperation with the EAEU in order to establish the mutually beneficial coordination mechanism within the Common Energy Market. The Concept of building a CEM was approved by the heads of the EAEU member states on May 8, 2015. In the next 10 years the EAEU member states will be actively engaged in the elimination of barriers to the efficient functioning of the CEM, which should be launched in 2025. It is planned that the Concept of establishing the Common gas market and the Concept of establishing the Common oil and petroleum product market will be submitted to the Supreme Eurasian Economic Council in December 2015. According to the designed schedule, which is shown in Table 8.2., the Program of establishing the Common Energy Market would be approved by July 1, 2016 (Mansurov, 2015).

Table 8.2. **Stages of the Common Energy Market Launching**

Market	Concept	Program	International Agreement
Electricity	approved by 01.07.2015	approved by 01.07.2016 completed by 01.07.2018	launched by 01.07.2019
Gas	approved by 01.01.2016	approved by 01.01.2018 completed by 01.01.2014	launched by 01.01.2025
Oil and Petroleum Products	approved by 01.01.2016	approved by 01.01.2018 completed by 01.01.2014	launched by 01.01.2025

Source: www.kazenergyforum.com

The mentioned changes would definitely affect the relationship dynamics between the states of the Caspian Five and the EAEU members. Therefore, Azerbaijan, Iran and Turkmenistan need at least to be timely informed about the progress of Kazakhstan and Russia on the unification of the barriers in the oil and gas sphere, and at most to have an opportunity to correlate national legislation with the newly established norms.

It also should be mentioned that after the establishment of the EAEU, the Caspian states possibly entered a new phase of launching joint energy projects. Primarily it is the Eurasia project, which should be conducted jointly by Kazakhstan and Russia. The project of an international oil consortium, the Eurasia, was presented in October 2013. The project is focused on exploration of deep horizons of the Pre-Caspian basin, which lies to the north of the Caspian Sea partially within Russia and partially within Kazakhstan with its southern margin beneath the North Caspian. The Eurasia project assumes carrying out exploration works in the Pre-Caspian Basin by drilling of a super deep key-parametric well with a depth of 14-15 kilometers[3]. According to the geologist, there are six or seven explored sub-salt structures with recoverable reserves of more than 200 million tons of oil and with the net cost of $20 per barrel in the central part of the Pre-Caspian basin, namely, between Atyrau and Uralsk. Moreover, according to the independent research institutions of Russia, the unexplored subsoil depths in the Pre-Caspian basin could contain up to 40 billion tons of oil (Makhmutov, 2014).

3 Eurasia project will be divided into three major stage. At the first stage, the works will be carried out on gathering, treatment and reinterpretation of regional geological exploration and parametric wells, drilled during the Soviet era. The second stage will include a large-scale geophysical research on selected new regional profiles. And only at the third stage, it is planned to ensure the drilling of a new key well – Caspian-1.

Since the exploration works are expected to take place in the Caspian Depression, which is under the jurisdiction of both Kazakhstan and Russia, the established International Council on the Eurasia project will focus on harmonization of joint action strategy of the partners. According to preliminary estimates, the drilling of the Caspian-1 ultra-deep well should begin three years after the establishment of the International Consortium on the Eurasia project. The approximate cost of exploration works including the use of complex and high-tech methods and software products, as well as interpretation of geophysical data, will be around $500 million (KAZENERGY, 2015).

Consequently, the Eurasia project should be primarily seen as an attempt to ensure long-term access to natural resources. However, the complexity of the project could make it even more expensive and questionable than the Kashagan oil field project. For instance, the deepest key parametric well in Kazakhstan was drilled in Biikzhal area within the framework of the Soviet research programs. The depth of the drilled well is over 6.7 kilometers. Moreover, the depth of the deepest well in Russia, namely, the Kola Superdeep Borehole, is over 12 kilometers. Therefore, nowadays, neither Russian or Kazakhstan has innovative technologies for ultra-deep drilling.

Since the Eurasia project could be classified as a project with complex geological conditions, which require large investments, Astana and Moscow could concentrate on developing small and medium-sized projects with easy recoverable oil and gas. Within the process of settling the legal issue of the Caspian Sea regime, Kazakhstan and Russia concluded their own bilateral agreements and decided to jointly develop three oil fields in the north-western part of the Caspian Sea, namely, Kurmangazy, Tsentralnoe and Khvalynskoe. Actually, it was a pragmatic and mutually beneficial solution to the challenges of border delineation and to the division of income from the oil fields in the disputed sectors. With the aim of overcoming the obstacles to exploration activities on the Caspian offshore deposits, the parties even signed an additional Protocol on amendments to the Agreement on delimitation of the northern part of the Caspian Sea in order to exercise sovereign rights for subsoil use dated July 6, 1998.[4]

As of today, the parties have eliminated main legislative barriers opening access for mining companies to get license for exploration of the mentioned oil fields, namely, the Tsentralnaya oil field. For instance, Russia decided to make

4 During official visit of the head of Russia to Astanaon October 15-16, 2015, the President of Russia, Vladimir Putin, and the President of Kazakhstan, Nursultan Nazarbayev, signed the Protocol on amendments.

an exception for the Caspian oil and gas deposits, which were under the regulation of the Federal Law on the Continental Shelf of Russian Federation. According to the Federal Law, only companies with more than 50% state ownership and more than five years of experience in the industry are permitted to drill the continental shelf. As a result, Russia's largest private oil producer, Lukoil, could not get a permission from the Ministry of Natural Resources of Russia to prolong the exploration license expired in 2009. Since the Lukoil is acting as the main oil and gas field operator on the Caspian shelf from the Russian side the inked Protocol should provide legal assistance to overcome bureaucratic hurdles.

However, it should be admitted that to date the companies, which showed their interest in the exploration of hydrocarbons from the northern part of the Caspian Sea, namely, Gazprom, Lukoil and KazMunaiGas, still have no opportunity to form the Production Sharing Agreement as it was planned according to the intergovernmental agreement. Therefore, without the PSA it is impossible to start an active phase of hydrocarbon production.

Under these circumstances, the cooperation in the development of promising oil and gas fields located particularly in the Kazakh or Russian sector of the Caspian Sea could be an alternative to partnership on the base of 50%-50% sharing at the cross-border deposits. For instance, according to the State Program of Development of the Kazakhstan's sector of the Caspian Sea in 2003-2015, over 400 different structures were identified in the KSCS, including 120 prospective ones, with the forecasted resources of 8 billion tons of oil equivalent, including 4.5 billion tons of oil. This is comparable with the total reserves of all the onshore fields in Kazakhstan. According to the Gaffney, Cline & Associates, the KSCS resources amount to 2.3 billion tons of oil, even excluding the reserves of the North-Caspian project (Kashagan, Aktoty, Kayran and Kalamkas Sea). The most promising Caspian fields in the KSCS are the Kalamkas Sea (67.6 million tons of recoverable oil reserves), the Khazar field (31 million tons of recoverable oil reserves), the Zhambyl project (30 million tons of recoverable oil reserves), the Satpayev field (250 million tons of recoverable oil reserves), the Nursultan project (270 million tons of recoverable oil reserves) and Abai project (760 million tons of possible oil resources) (Nigay, 2014). Therefore, even without the Kashagan project Kazakhstan could start exploration of the so-called Big Caspian Oil, which would be dispersed among the small and medium-sized oil structures in the KSCS.

3.2. Economic Issue

It is quite obvious that significant gross of mutual trade turnover and development of trade and economic relations with foreign participants, as well as economic collaboration with other regions are main issues for the EAEU members. Therefore, the EAEU started the process of searching for new economic partners. The first feedback was from Vietnam, which agreed to boost cooperation with the EAEU members within the framework of the free trade zone. The signing ceremony of a free trade agreement was held in April, 2015 and it was the first-of-its-kind agreement with foreign countries for the EAEU. The Agreement will provide for the tariff liberalization of trade in goods between the member states of the EAEU and Vietnam by reducing import duties on most goods or by removing them on certain types of goods.

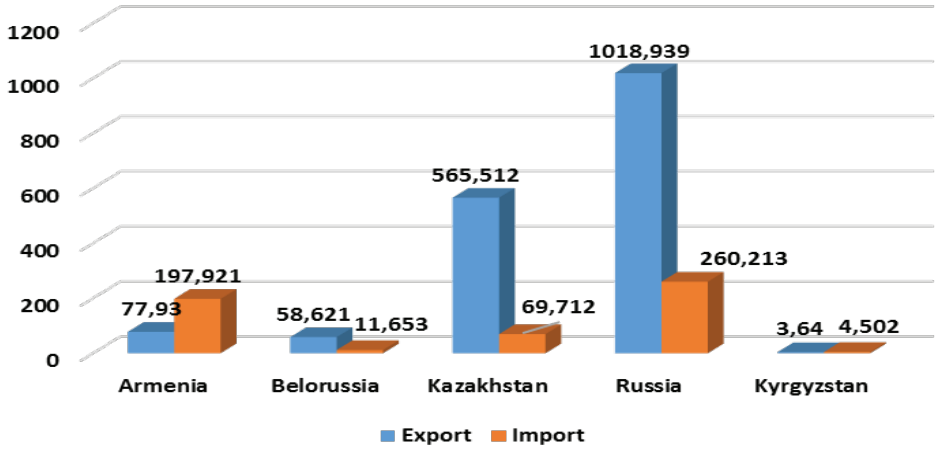
The mentioned example inspired other countries, namely, India, Israel, Egypt and Iran, to submit request for launching formal negotiations on establishing a free trade zone with the Eurasian Economic Union. As part of the Caspian Five and a strategic partner of Russia, Iran have a good chance to launch the talks on a free trade zone with the EAEU. As it is shown in Figure 8.1., Russia is the top trading partner for Iran among the EAEU countries.

According to the EEC report, in January - December of 2015 the total amount of export of the EAEU countries to Iran is estimated at $1.724 billion and the total amount of import of the EAEU countries from Iran was estimated at $544 million. The EEC noted the reduction in export and import amounts by 28.4% and 19.9% respectively compared to the same period of 2014. It should be admitted that there is a constant trend for the reduction of the foreign trade turnover between the EAEU countries and Iran. Namely, the foreign trade turnover has decreased from $4.9 billion in 2011 to $2.8 billion in 2014.

However, it should be noted that lifting economic sanctions related to Iran's nuclear program will have a significant impact on regional trade. Iran expects relief of the sanctions during the first half of 2016. Therefore, the negotiations for establishing a free trade zone could be launched as soon as the Joint Comprehensive Plan of Action on Iranian nuclear program or so-called Geneva agreement is officially put into force. Moreover, there is no doubt that the Russian authorities will provide all possible support for the Iranian request for a variety of reasons. Firstly, through the strengthening of trade relations with Tehran, which became a major strategic partner of Moscow in the Middle East in recent years, Russia will attempt to increase its influence over the region. Secondly, Russia is interested in intensification of trade relations with Iran in

the frameworks of the Caspian region in order to enlist the support of Iranian officials for various forms of regional cooperation initiatives, namely, creation of the Caspian Economic Cooperation Organization.

Figure 8.1. **Export and Import of Goods between the EAEU States and Iran in 2015 (million dollars)**



Source: www.eurasiancommission.org

The idea of the establishment of the CECO was put forward for consideration of the Caspian Five in 1992. It can be said without exaggeration that the CECO project was the very first regional integrational initiative proposed by the littoral states. For instance, the former President of Iran, Akbar Hashemi Rafsanjani, announced the CECO project during the intergovernmental conference organized in Tehran (Salygin & Safaryan, 2005). Two years later Russian government even prepered a draft agreement on the issue of regional cooperation between the Caspian countries which was presented at the official meeting of the Caspian Five representatives in Moscow. However, at this period the coastal states just begun the process of shaping national strategies towards the Caspian region development focusing mostly on attracting foreign investments in the mining sector. Therefore, there was no intention to form close collaboration between the newly independent states of the Caspian region.

Nevertheless, up until now Russia shows its readiness to realize the economic potential of the region through the CECO project. The reason behind Russia's perseverance can be found in its desire to ensure dominance over the decision-making process in the possible economic institution established at the supranational level. Under these circumstance, Iran started to express concern about the fact that the CECO project could be dominated by Russia. As the author of the project Iran expected that the CECO's headquarter would be located

in Tehran (Webeconomy, 2010). Despite these facts, Azerbaijan and Kazakhstan mostly support the Russian vision of the CECO project while Turkmenistan's position is not clearly defined yet.

Practical experience shows, especially examples of regional organizations such as the Organization of the Baltic region and the Black Sea Economic Cooperation, that the Caspian Economic Cooperation Organization can really boost mutual trade. However, it is necessary to take into account that the Caspian Five states are still shaping their strategies over the regional economic integration.

There is a possibility that the Caspian states will use an alternative way for strengthening economic ties, namely, creation of the Caspian free trade zone. The President of Kazakhstan, Nursultan Nazarbayev, suggested the mentioned proposal during the IV Caspian Summit in Astrakhan in 2014. It should be noted that the coastal countries already have a positive experience in setting up special economic zones over the Caspian shores. For instance, there are the Aktau Seaport SEZ in Kazakhstan and the Bandar Anzali SEZ in Iran. Russia and Azerbaijan are also planning to establish special economic zones, which should be located at the Astrakhan port and the Baku port (branch in the Alyat village) respectively. Therefore, in the middle-term the Caspian Five could manage to create a network of special economic zones, which would encircle the Caspian Sea creating conditions for possible interaction within the framework of the Caspian free trade zone.

3.3. Transportation Issue

The EAEU countries pay special attention to the development of transport infrastructure. In order to step up the transport security the leaders of the Eurasian Economic Union agreed to link the EAEU integration project with the Chinese strategic initiative, the Silk Road Economic Belt. The decision on conjugating two integrational formats was motivated by the necessity to improve infrastructural facilities among the former Soviet republics, which were suffering from weakening of the transportation network. The first official document on this issue was signed between the President of Russia, Vladimir Putin, and the President of China, Xi Jinping, on May 8, 2015.

Since the SREB is a project of creating the transport and trade corridor between Asia and Europe, there will be a strong necessity for using the transportation facilities of the Caspian region. Actually, Kazakhstan already has a program on deepening transport cooperation with China. For instance, Kazakhstan is plan-

ning to complete transportation and logistics project with a total investment of $36.3 billion by 2020 (Kazakhstan Temir Zholy, 2015). The major task of the program is to expand the transport links between special economic zones Khorgos - Eastern Gate and Aktau Seaport - Western Gate in order to speed up the implementation of transport and transit potential of the state.

It should be noted that to date the EAEU and China have not inked official Road Map for the implementation of the SREB. This indicates that the Chinese government prefers to hold bilateral talks on the issue of projects launching within the Silk Road Economic Belt.

The Caspian region is also a part of the International North-South Transport Corridor proposed by Russia and launched in 2000. Nowadays, all of the littoral states are involved in the project, which gives impetus to the regional trade. Currently, the participants of the INSTC could manage to launch the so-called Trans-Caspian and Eastern routes, which provide maritime and inland transportation of goods respectively. It should be highlighted that all foreign trade turnover between Iran and Russia that amounted to $1.27 billion in 2015 goes through the Trans-Caspian route, which passes through the Russian ports of Astrakhan, Olya and Makhachkala, as well as the Iranian ports of Anzali, Amirabad and Nowshehr.

The eastern branch of the INSTC, namely, the Eastern route, was launched in December 2014. It was put into operation when Kazakhstan-Turkmenistan and Iran finished construction of the Uzen-Bereket-Etrek-Gorgan railway line. The first cargo from Kazakhstan including 45 railcars entered Iran at the beginning of June 2015. The parties expect that in the next 5 years the annual railway transit capacity would be about 10 million tons of goods. The parties have reached an agreement on establishing uniform rates across Kazakhstan, Turkmenistan and Iran for container trains running from China to Iran starting from October 15, 2015. This measure will help to attract maritime freight traffic and to increase attractiveness of the land transcontinental corridors. The sides have also agreed on preferential tariff conditions in the territories of the parties for transportation of grain, ferrous metals, aluminum and ferroalloys from Kazakhstan to Iran and further to the port of Bandar Abbas (Kazinform, 2015). Therefore, Astana, Ashgabat and Tehran have already finished the legal process of tariffs unification and lifting non-tariff restrictions.

However, the situation with the western branch of the corridor is still unclear. The Western route would be launched by putting into operation a direct railway communication through the territory of Azerbaijan with further access to

the railway network of the Iran's border crossing Astara (Azerbaijan)-Astara (Iran). According to preliminary estimates, its capacity will be 1.4 million passengers and 5-7 million metric tons of cargo annually with a possible increase up to 15-20 million metric tons annually. Currently, the Azerbaijani-Iranian working group on the Qazvin-Rasht-Astara-Astara project announced acceleration of the work on the Astara-Astara section of the railway line. According to the working group officials, the construction would begin till the end of 2015. However, the financial problems still prevent the parties from launching the construction works at the Rasht-Astara section.

Therefore, the Caspian region has already become a part of the row of the multi-modal transit transport and energy projects aimed at strengthening the economic collaboration among the Eurasian countries.

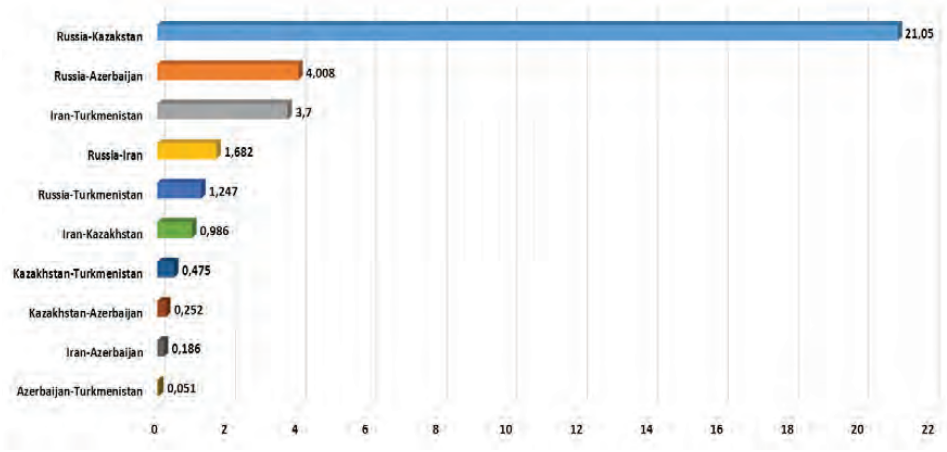
4. Prospects for Economic Cooperation in the Caspian Basin

There is no doubt that the Caspian region is playing a strategic role in a wide number of energy production and transportation projects, so as transport and logistics projects. However, in order to get a complete picture, including the level of the Caspian states economic interaction, there should be given some prospects for the regional development. For instance, it is important to consider the intensity of international trade between duos of the Caspian countries evaluating the significance of relevant trading partners for the regional economy.

Figure 8.2. shows the contribution of bilateral trade relations between the littoral countries in the overall volume of foreign trade among the Caspian region in 2014. It is obvious that the foreign trade between Kazakhstan and Russia constitutes the lion's share of overall volume of foreign trade in the region. It should be noted that the Kazakh-Russian share of trade did not exceed 60-68% in 2002-2009 and it even fell to 50% in 2010. It has grown to 75% in 2012 and decreased to 63% in 2014 (Kusainov, 2013).

The next largest trade partners are Russia & Azerbaijan and Iran & Turkmenistan with 12% and 11% of foreign trade share, respectively. Therefore, the overall share of Russia in the Caspian foreign trade turnover was 83% in 2014, which is 10% less than that in 2013. The aforementioned figures show that economic sanctions and fall in the crude oil price cause the reduction of the Russian presence in the economic activities in the region. However, the share of Russia in the regional trade turnover is still high and it is expected that Russia will save the leading position in the regional economy in 2015.

Figure 8.2. **The volume of Bilateral Trade between the Caspian Countries in 2014 (billion dollars)**



Source: Adopted from Agencies of Statistics of the Caspian Five

Consequently, in 2014 the total foreign trade turnover of the Caspian Five was estimated at $33,637 billion which does not reflect the economic potential of the region. Moreover, there is a threat of stagnation of the foreign trade in case if both most advanced regional economies, namely, Russian and Iranian will continue to be under the pressure of the Western economic sanctions. Besides, due to objective reasons the Caspian Five countries, excluding Russia and Kazakhstan, are looking into boosting the trade relations with partners outside of the region. However, the situation could be positively changed, especially, if the coastal states concentrate on launching jointly developed integrational project.

5. Conclusions

The influence of the Eurasian integration on the Caspian Sea region could be specified as the following issues:

- Since the Caspian Five states have similar economic structure oriented at the development of the oil and gas sector, there is a necessity to increase productivity of the non-oil sectors in order to widen the range of export and import products. It should be noted that as a result of proposed actions the littoral states will cause the substantial increase in the foreign trade turnover taking one step closer to shaping a common strategic vision for further development of the region;
- Since Russia and Kazakhstan represent both the EAEU members and the Caspian Five states, they will be responsible for maintaining high-level

relations between the two groups of countries. Russian-Kazakh economic activities in such spheres as energy, transportation and trade could be considered as a driving force for both the Eurasian and the Caspian integration. Therefore, there is a strong necessity to prevent weakening of the economic interaction between the partners, especially, during the period of sustained low oil prices;

- Since the Caspian Sea Basin has both favorable geopolitical position and geopolitical location, the regional states have already been involved into implementation of wide range of Eurasian integrational initiatives. However, there is only one project, namely, the International North-South Transport Corridor, which includes all countries of the Caspian Five and at the same time proposed by the members of the EAEU. All other projects are focused on bilateral cooperation and could not guarantee the contribution of its participants in the improvement of the intra-regional economic relations. Moreover, in some cases, such kind of projects could even cause entering the new phase of competition between the littoral states. First of all, it concerns the transit and transportation projects aimed to attract the significant flow of goods from China.

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9. The Conflict over the Energy Issue in the Caspian Sea Region

MUZAFFER ERCAN YILMAZ

Abstract

This paper provides an analytical discussion on the energy dimension of international conflict among the Caspian states with respect to the Caspian Sea and its surrounding region. The Caspian region is believed to cover fields containing 200 billion barrels of crude oil and 600,000 billion cubic meters of natural gas. Since the dissolution of the Soviet Union in 1991, the region has become the focus of much international attention due to such huge oil and gas reserves. Prior to 1991, only two countries, the Soviet Union and Iran, bordered the Caspian Sea, and the legal status of the Sea was governed by the 1921 and 1940 bilateral treaties. With the collapse of the Soviet Union and the emergence of Kazakhstan, Turkmenistan, and Azerbaijan as independent states, however, ownership and development rights in the Sea have been called into question. In order for the Caspian Sea region to realize its full oil and gas potential, the littoral states must first agree on the legal status of the Sea. Currently, there is no agreed-upon convention that delineates the littoral states' ownership of the Sea's resources or their development rights. As a result, several conflicts have arisen over mutual claims to different regions of the Sea. In addition, the fact that the newly-independent gas and oil producing countries in the region need new pipelines to reach new markets causes another problem with respect to the direction of pipelines. The study concludes that if the Caspian states are able to solve their problems, this will provide an economic boost to them, thereby bringing peace and prosperity to the troubled Caucasus and Caspian regions as well. If not, greater instability, even international conflict, is likely to be expected.

Keywords: Caspian Sea, Energy Conflict, Caspian States, Caspian Region, International conflict on energy

1. Introduction

The end of the Cold War in the early 1990s has had a dual impact on Central Asia and Caucasus. On the one hand, the disintegration of the Soviet Union and Soviet military withdrawal allowed democratization to proceed in the states in Central Asia and Caucasus previously ruled by Marxist dictatorships. The reduction in East-West tension also resulted in a great decrease in inter-state conflicts in these regions, some of which occurred due to the superpower ideological rivalry during the Cold War (Yılmaz 2009). On the other hand, however, competition on energy resources, sometimes along with historic enmities that are suppressed by the imperial center, has begun to show up (Bissel 1996). Especially the Caspian Sea basin was opened up to the outside world after having been contained within the Soviet imperial order for nearly a century. In spite of the collapse of the Soviet Union, the Russian Federation still aspires to a dominant role in the region. Yet Russia must now have to compete with the independent states of the Caspian. Moreover, with the end of the Cold War, the Caspian States entered the world and, in a way, the world has entered them as well, with consequences hard to predict. Yet one of the clearest aspects of this scene is increasing energy competition, maybe an overt conflict, in the Caspian Sea region. This study attempts to provide an analytical discussion on this issue through addressing the main actors and their interests in the region.

2. The Caspian Sea Region as a Great Energy Area

The Caspian Sea is the largest enclosed inland body of water on Earth by area, approximately the size of Japan, variously classed as the world's largest lake or a full-fledged sea. The sea has a surface area of 371,000 km^2 and a volume of 78,200 km^3. Over 130 rivers provide inflow to the Caspian, with the Volga River being the largest. The Caspian also has several small islands; they are primarily located in the North and have a collective land area of roughly 2,000 km^2. It is in an endorheic basin and is bounded to the northwest by Russia, to the west by Azerbaijan, to the south by Iran, to the southeast by Turkmenistan, and to the northeast by Kazakhstan.

The Caspian is believed to cover fields containing 200 billion barrels of crude oil and 600,000 billion cubic meters of gas (Winstone and Young 2005: 3). Since the dissolution of the Soviet Union in 1991, the Caspian Sea and the region surrounding it have become the focus of much international attention due to their huge oil and gas reserves (Bilgin 2005, 2010). The Sea itself contains six separate hydrocarbon basins, and most of the oil and gas reserves in the Caspian Sea region have not been developed yet. Although the littoral states

of the Caspian Sea are already major energy producers, many areas of the Sea still remain unexplored.

The prospect of potentially enormous hydrocarbon reserves is part of the allure of the Caspian region, including Azerbaijan, Kazakhstan, Turkmenistan, and the regions of Iran and Russia that are near the Caspian Sea. That aside, the 18-34 billion barrels currently proven, the region's possible oil reserves could yield another 235 billion barrels of oil. This is roughly equivalent to a quarter of the Middle East's total proven reserves. Possible gas reserves in the Caspian region, are as large as the region's proven gas reserves, and could yield another 328 trillion cubic feet of gas (http://www.eia.gov February 13, 2014).

Most of Azerbaijan's oil resources are located offshore, and probably 30% - 40% of the total oil resources of Kazakhstan and Turkmenistan are offshore as well. Proven oil reserves for the entire Caspian Sea region (total country reserves, not just for the Caspian Sea itself) are estimated at 18-34 billion barrels, comparable to those in the United States (22 billion barrels) and the North Sea (17 billion barrels). Natural gas reserves are even larger, accounting for almost two-thirds of the hydrocarbon reserves (proved plus possible) in the Caspian Sea region. Based upon proven reserves, Kazakhstan and Turkmenistan, each rank among the world's 20 largest natural gas countries. Overall, proven gas reserves in the Caspian region are estimated at 243-248 trillion cubic feet, comparable to North American reserves of 25 trillion cubic feet (http://www.eia.gov February 13, 2014).

3. Conflict and Competition among the Caspian States

Since they became independent in 1991, Azerbaijan, Kazakhstan, and Turkmenistan have sought to develop their national oil and gas industries further. Although the Soviet Union attempted to exploit each of these republic's oil and gas reserves, a lack of investment, deteriorating infrastructure, and out-dated technology resulted in declining rates of production at the time of the Soviet Union's collapse in 1991. In the last 20 years, however, especially Azerbaijan and Kazakhstan have experienced rapidly increasing levels of foreign investment in their oil and gas sectors. With additional investment, the application of Western technology, and the development of new export outlets, oil and natural gas production in the Caspian region could multiply.

3.1. Legal Status of the Caspian Sea

Nevertheless, in order for the Caspian Sea region to realize its full oil and gas potential, the littoral states must first agree on the legal status of the Sea. Prior

to 1991, only two countries, the Soviet Union and Iran, bordered the Caspian Sea, and the legal status of the Sea was governed by the 1921 and 1940 bilateral treaties. With the collapse of the Soviet Union and the emergence of Kazakhstan, Turkmenistan, and Azerbaijan as independent states, however, ownership and development rights in the Sea have been called into question. Currently, there is no agreed-upon convention that delineates the littoral states' ownership of the Sea's resources or their development rights (Koçgündüz 2010: 491-492).

As a result, several conflicts have arisen over mutual claims with respect to different regions of the Sea. Turkmenistan and Azerbaijan have remained locked in a dispute over the Serdar/Kyapaz field, while Azerbaijan has objected to Iran's decision to award Royal Dutch/Shell and Lasmo a license to conduct seismic surveys in a region that Azerbaijan considers to fall in its territory. In addition, Turkmenistan claims that the portions of the Azeri and Chirag fields, which Ashgabat calls Khazar and Osman, respectively, lie within its territorial waters rather than Azerbaijan's. Turkmenistan has insisted that work at the Azeri and Chirag fields, which is being carried out by the Azerbaijan International Operating Company (AIOC), be stopped (Diba 2010).

The continuing unresolved status of the Caspian Sea has hindered further development of the Sea's oil and gas resources, as well as the construction of potential export pipelines from the region. Negotiations between the littoral states have made slow progress in overcoming the problems and differences between the countries. So far, Russia, Azerbaijan, and Kazakhstan have agreed on dividing the Sea by a "modified median" principle. By contract, Iran insists on an equal division of the Sea. Turkmenistan's position, on the other hand, is not clear. It seems that its position is continuing to evolve.

Meanwhile, so many meetings among the Caspian countries have been realized by far. The littoral countries held four summits of the Caspian states leaders and more than thirty meetings on ministry level. More recently, the legal status of the Caspian Sea has been discussed during the IV. Caspian Summit in Astrakhan on September 29, 2014. Yet, no legal solution has been found so far.

3.2 Export Problems

In addition to the unresolved status of the Caspian Sea, how to export growing oil and gas supplies constitutes another serious problem. That is, as increasing exploration and development in the Caspian Sea region leads to increased production, the countries of the region will have additional oil and gas supplies available for export. As of the end of 2013, oil exports in Kazakhstan totaled

roughly 500,000 oil barrel/daily (bbl/d) while Azerbaijan had 160,000 bbl/d. Overall, Caspian Sea region oil exports in 2013 amounted to about 800,000 bbl/d (of the 1.3 million bbl/d produced). Because of various oil projects in the region slated to boost production in the years to come, the region's net exports could increase to over 3 million bbl/d in 2020, and possibly another 2 million bbl/d on top of that by 2030 (Bahgat 2004: 116).

With regard to natural gas, Caspian Sea region natural gas exports reached roughly 2 trillion cubic feet in 2013 (of 5.3 trillion cubic feet produced). With Azerbaijan's *Shah Deniz* field in development, along with increased investment to develop infrastructure and markets for the region's natural gas, Caspian natural gas exports could increase by another 2-3 trillion cubic feet by 2020 (Bahgat 2004: 117).

Yet in order to boost oil and gas exports from the Caspian Sea region, a number of problems need to be addressed first. All of the oil and gas pipelines in the Caspian Sea region (aside from those in northern Iran) that were completed prior to 1997 were designed to link the Soviet Union internally and were routed through Russia. With the collapse of the Soviet Union in 1991, the republics that had been customers for Caspian gas often have been unable to pay world market prices for gas supplies due to the economic transition process. Besides, gas exports to other newly independent states have been limited because the pipelines pass through Russia and require agreements with Gazprom, the Russian gas company that owns the pipelines and that has been a competitor with Caspian gas in the past (Bahgat 2003).

Hence, with a lack of export options, in order to export any gas at all, the region's gas producers have had two options: either sell their gas to Russia at below market prices or pay Gazprom a transit fee. For example, Turkmenistan's economy, which is concentrated mainly in oil and gas, experienced a huge 25% drop in GDP in the 1990s when Gazprom denied Turkmenistan access to its pipeline network due to a payment dispute. Although Gazprom and Turkmenistan resolved the dispute in 1998, in order to reach its full gas export potential, Turkmenistan and other Caspian region gas producers must solve the fundamental problem of getting their gas to international markets and getting paid in hard currency (Bahgat 2004: 121). Consequently, the Caspian region's relative isolation from world markets, as well as the lack of export options, has, thus, far stifled exports outside of the former Soviet republics.

In order to bring much-needed hard currency into their economies, Caspian region oil and gas producers are seeking to diversify their export options to

reach new markets. With new productions expecting to come as well, new transportation routes are certainly necessary to carry Caspian oil and gas to world markets. To handle the entire region's oil and gas slated for export, several export pipelines are under consideration, such as South Energy Corridor, Trans-Caspian Pipeline, and South Stream.

The South Energy Corridor, also known as the Southern Gas Corridor, is an initiative of the European Commission for the gas supply from the Caspian and Middle East regions to Europe. The initiative was proposed in the European Commission's Energy Security and Solidarity Action Plan in 2008 (Chaffin 2008). The European Union has identified a number of partner countries for this initiative, such as Azerbaijan, Turkey, Georgia, Turkmenistan, Kazakhstan, Iraq, Egypt, as well as Mashreq countries. Yet no serious progress has been made so far, partly due to some recent developments, such as the Arab Spring, making the Middle Eastern part of the project more unstable. Moreover, many transit countries, especially Iraq, Egypt, and Mashreq countries, have suffered from chronic ethnic and religious insurgencies, which could undermine stability in the area and thus, complicate pipeline development.

Figure 9.1. **The South Energy Corridor Project**

The Trans-Caspian Pipeline, on the other hand, is a proposed submarine pipeline between Turkmenistan and Azerbaijan. If it is built, the project would transport natural gas from Turkmenistan to central Europe, circumventing both Russia and Iran. However, the project has been heavily criticized by Russia and Iran, current transit countries for Turkmen gas. According to the Russian Natural Resources Ministry, any gas or oil pipelines across the floor of the

Caspian Sea would be environmentally unacceptable. Russia has also taken the legal position that a potential pipeline project, regardless of the route it takes on the seabed, would require the consent of all five Caspian littoral states in order to proceed. Iran has also pointed out that treaties signed by Iran and the Soviet Union in 1921 and 1940 are still in force and that any action taken without the consent of all the littoral states would be illegal (Fitzpatrick 2014).

Figure 9.2. **The Trans-Caspian Pipeline Project**

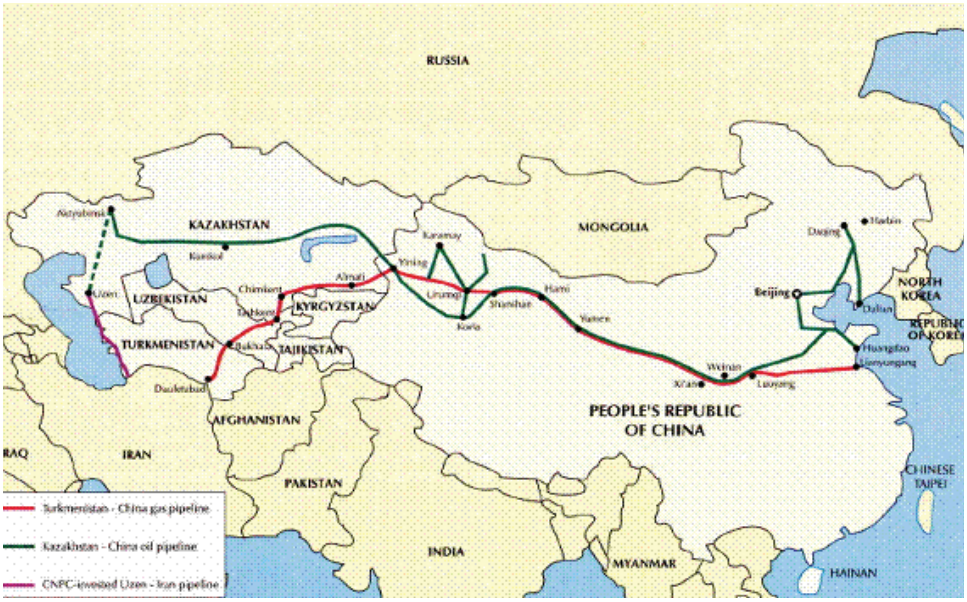
The South Stream is also a pipeline project to transport natural gas of the Russian Federation through the Black Sea to Bulgaria and through Serbia, Hungary, and Slovenia further to Austria. Indeed, the construction of the Russian onshore facilities for the pipeline started in December 2012. However, the original project was dropped in December 2014, following the Russian invasion of Crimea and the subsequent imposition of European sanctions on Russia (Schwarz 2014). Afterwards, Russia devised a new deal with Turkey to bypass the "non-constructive approach of the European Commission", to use Putin's words. Russia still wanted to build a pipeline under the Black Sea, but to avoid Ukraine's exclusive economic zone, the pipeline was planned to be re-routed through Turkish waters.

So the South Stream was replaced by the "Turkish Stream". The scrapping of the South Stream was coupled with the signing in Ankara of a historic December 2014 deal between presidents Recep Tayyip Erdoğan and Vladimir Putin. However, a recent crisis resulted in the abandonment of this project as well. A Russian Su-24 war plane was shot down by Turkey on November 24, 2015. Turkey insists that the jet, from the Russian air contingent deployed in

Syria in support of Bashar al-Assad, ignored warnings to leave its airspace. Russia, on the other hand, says that the plane was shot down within Syrian airspace. President Vladimir Putin described Turkey's action as a "stab in the back" committed by "accomplices of terrorists" (http://www.bbc.com/news/world-europe-35154651 December 21, 2015).Since then, Ankara and Moscow have traded barbs, introduced retaliatory measures and made calculated threats at one another, leading, by extension, not only to a potential crisis in the supply of natural gas to the European Union, but also a major blow to Russia's national economy, which depends heavily on the energy sector.

Aside from these projects, some oil or gas export pipelines have recently been built up successfully. The Kazakhstan-China oil pipeline is one of them. This pipeline is China's first direct oil import pipeline allowing oil import from Central Asia. It runs from Kazakhstan's Caspian shore to Xinjiang in China. The pipeline is owned by the China National Petroleum Corporation and the Kazakh oil company KazMunayGas.

Figure 9.3. **The Kazakhstan-China Oil Pipeline**



Likewise, the Central Asia-China gas pipeline, also known as the Turkmenistan-China gas pipeline, is a natural gas pipeline system from Central Asia to Xinjiang in China. It was inaugurated in December 2009 and on June 13, 2010, China and Kazakhstan signed an agreement on a branch line from Western Kazakhstan (Yodogawa and Peterson 2013). The second line was completed by the end of 2010. The construction of the third line began in 2012 and it became operational in June 2014. The construction of a fourth line of the pipeline is expected to be launched in early 2015.

In effect, the Turkmenistan China gas pipeline has broken Russia's monopoly over gas export routes from Central Asia. Moscow will not be able anymore to buy large quantities of Turkmen gas at a low price for domestic consumption and then sell its own at market prices. However, a Russian construction company, Stroytransgaz, helped build the Turkmen-Chinese pipeline. That means that Moscow preferred Turkmen gas to go east than west, where it would have competed against Russian gas in its primary European market.

Figure 9.4. **The Turkmenistan-China Gas Pipeline**

So as the above summaries attest, although there is no lack of export options or proposals, at least, despite some unresolved difficulties, questions still remain as to where the exports should mainly go. There are, for instance, some questions as to whether Europe is the right destination for Caspian oil and gas. Oil demand over the next 10-15 years in Europe is expected to grow by little more than 1 million bbl/d. Oil exports eastward, on the other hand, could serve Asian markets, where demand for oil is expected to grow by 10 million bbl/d over the next 10-15 years (Cooper 2013). To feed this Asian demand, however, it seems necessary to build some many more pipelines. Geographical considerations would force these pipelines to head north of the impassable mountains of Kyrgyzstan and Tajikistan across the vast, desolate Kazakh steppe, thereby adding even more length, and hence cost, to any eastward pipelines.

An additional way for Caspian region exporters to supply Asian demand would be to pipe oil and gas south. This would mean sending oil and gas through either Afghanistan or Iran. The Afghanistan option, which Turkmenistan has been supporting, would entail building oil and gas pipelines across the war-torn Afghan

territory to reach markets in Pakistan and possibly India. The Iranian route for gas would pipe Caspian region gas from Azerbaijan, Uzbekistan, and Turkmenistan to Iran's southern coast, then eastward to Pakistan, while the oil route would take oil to the Persian Gulf, then load it onto tankers for further trans-shipment (http://www.eia.gov/emeu/cabs/caspian.html March 27, 2014). Yet any significant investment in Iran would be risky under the Iran Sanctions Act that imposes sanctions on non-U.S. companies investing in the Iranian oil and gas sectors. U.S. companies, on the other hand, are already prohibited from conducting business with Iran under the U.S. law. Then what about north or northwest?

For its part, Russia itself has proposed multiple pipeline routes that utilize Russian export pipelines that transport oil to new export outlets being developed on the Baltic and Mediterranean Seas (http://www.eia.gov/emeu/cabs/caspian.htlm March 27, 2014). However, there are political and security questions as to whether the newly independent states of the former Soviet Union should rely on Russia, or any other country, as their sole export outlet, and Caspian region producers have expressed their desire to diversify their export options. Additionally, most of the existing Russian oil export pipelines terminate at the Russian Black Sea port of Novorossiysk, requiring tankers to transit the Black Sea and pass through the Bosporus Straits in order to gain access to the Mediterranean and world markets. Yet with respect to this direction, Turkey has already raised concerns about the ability of the Bosporus Straits to handle additional tanker traffic (http://www.bosphorusstrait.com March 25, 2014).

So in almost any direction, Caspian region export pipelines may be subject to regional conflict. As competition grows for increasingly scarce but vital resources, the strategic calculations of major and minor countries alike place more prominent emphasis on the transport of petroleum products and gas. Besides, there are also some other problems. For instance, it is a constant problem for Caspian states to find additional resources for the diversification of export routes. Especially the sharp oil price fall from $100 last summer to about $50 in just six months puts an additional economic pressure on the oil producer Caspian states. In fact, if the oil price falls too far, these countries' recent boom may even come to an end.

Furthermore, the Azerbaijan-Armenia war over Nagorno-Karabakh has not yet been resolved (Yılmaz 2010). Separatist conflicts in Abkhazia and Ossetia in Georgia are still going on, and the conflict between Russia and Chechnya has basically remained unresolved, devastating the region around Grozny in southern Russia (Winstone and Young 2005: 27). Under these conditions, international cooperation that is certainly required to solve the disagreements over energy issues is hard to be realized.

4. Conclusions

To sum up, one significant geopolitical and geo-economic consequence of the collapse of the Soviet Union was the rise of an intense political and commercial competition for control of energy resources of the Caspian Region. Both international players, states and oil companies, became involved in a serious competition in the fields of oil, gas, and pipelines. Of course, this competition does not necessarily lead to an international conflict. However, it is also true, even hypothetically speaking, that if these problems are not dealt with in a constructive way, requiring much international cooperation, serious crises, even conflicts are likely to come into being. To fully develop the Caspian region's reserves, some major obstacles should be overcome. The nations in the region do not possess the economic resources necessary to develop their reserves. Therefore, the attraction of foreign investments will continue to be a central issue of the Caspian governments. Secondly, a reasonable level of stability must be achieved so as to attract the support of foreign investors. Having such stability will require the resolution of long-standing ethnic, religious, and other types of local conflicts. Finally, and perhaps more important, the legal status of the Caspian Sea itself must be resolved. Failure to reach a consensus in the short run will slow resource development and threaten future projects.

As a result, the management of resources can support peace and prosperity, as well as conflict. If the Caspian states are able to solve their problems, this will provide an economic boost to them, thereby bringing peace and prosperity to the troubled Caucasus and Caspian regions as well, or else, greater instability, even international conflict, is likely to be expected.

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10. Comparative Analysis of Russian and Ukrainian Gas Transit Powers

FARKHOD AMINJONOV

Abstract

With increasing demand for natural gas, pipeline infrastructure started playing even more important role for transit countries in the Eurasian gas supply chain. High degrees of interdependence that pipelines entail succeeded to prevent long-term gas supply disruptions in the region. It, however, could not discourage energy actors from causing short-term supply cuts to influence the decision making of other players. Using energy as a weapon too frequently forced gas producers to invest in alternative pipeline projects to diversify their dependence on a single transit country. As a result, both Russia as a transit country for Central Asian natural gas and Ukraine as a transit country for Russian energy resources started gradually loosing their transit leverage. This paper aims to analyze changing dynamics of the Russian and Ukrainian gas transit powers over the last two decades.

Keywords: Pipeline politics, Transit leverage, Energy security, Interdependence, Bargaining power

1. Introduction

Energy crises in the Eurasian region demonstrate complex intermixes of political and economic components in the negotiation and bargaining processes. In this paper, I present a comparative analysis of Ukrainian and Russian transit powers both as a political instrument and as a form of economic leverage. Changing dynamics of transit powers are analyzed within the context of gas pipeline network infrastructure, energy interdependency and dependency diversification policies as well as transit countries' price bargaining power.

Due to its landlocked geographical location the most feasible way for Central Asian producers to transport hydrocarbons to distant markets is through pipeline networks. Natural gas carries much less energy per unit volume than oil. Thus, even if it is compressed or liquefied using complex and expensive technology, it will still make road and rail gas transport for a long distances economically inefficient. In this regard, a comparatively cheap way to transport natural gas is through large-diameter pipelines. However, building a pipeline transportation system is expensive and the tyranny of distance that requires comparatively big upfront investments in the construction of gas pipelines make it difficult and uneconomic to duplicate. High degrees of interdependence provide certain leverage not only to gas producers and consuming countries, but also to transit states leading either to beneficial cooperation or gas supply disruptions in the Eurasian energy system.

Although the Soviet political and economic system disintegrated, the gas pipeline networks remained in place. Russia emerged as a central player in the regional gas supply system by owning transport infrastructure. Even though Central Asian gas producing countries gained control over their own resources, they remained dependent on Russian pipelines to reach European customers. But the Russian absolute control over energy infrastructures was also challenged by the fact that Russian gas had to cross several independent countries, such as Ukraine, Poland, Belarus, Slovakia, Czech Republic etc. Although gas exports from Russia to Western Europe went smoothly through most of the transit territories, relations with Ukraine turned sour. Within complex interdependent Eurasian gas supply relations Russia used coercive power to influence the outcome of negotiations on export and transit of natural resources. Ukraine, on the other hand, gained leverage from its infrastructural power. At the same time, Russian status in energy relations with Central Asian producers changes from exporting into importing and transit country. Having possessed infrastructural leverage to transport Central Asian resources, Russia itself quite effectively used its structural power. However, over the last two decades both

Russia and Central Asian states succeeded to diversify their dependence on Ukrainian and Russian gas infrastructures, thus reducing the transit powers of the former.

2. Theoretical Framework

2.1 Complex Interdependence Theory

A broad definition of transit power can be derived from general description of power in the complex interdependence theory developed by Robert O. Keohane and Joseph S. Nye Jr (Keohane and Joseph, 1998:81). Power is defined as a capacity of one country to direct the decisions and actions of another state or states (Freeman, 1997:2). In this sense, power derives from strength, which is the ability to coerce or in the case of interdependence encourage another country to change its policy if it threatens stability of energy supplies. So the transit power can be defined first, as an ability of transit country to use its pipeline-based structural leverage to redirect the decisions of another country and second, as a tool to generate high revenues from gas transit relations. Robert Larson argues that there were several cases when Russia tried to use its leverage in the gas supply sector to put pressure on Ukraine, Belarus and some Central Asian countries (Larson, 2006:202). Some of them were successful, some not. Within the complex interdependence theory interaction between states will most likely increase leading to cooperation, while the role of the power balance will diminish but still remain important. Excessive dependence of producing countries on a particular gas-exporting route made both sides vulnerable to a long-term energy supply disruptions. That is why, gas supply relations within the Eurasian region up until recently have been characterized as relatively stable. However, such dependence could not discourage energy actors from causing short-term supply cuts to gain economic and political leverage. With decreasing dependence of exporting states on Russian and Ukrainian transit infrastructures vulnerability of long-term supply disruptions was replaced by simply a sensitivity to supply cuts, which could be sacrificed for higher goals. The fact that pipelines had to cross the territory of a sovereign country or countries, which in practice has the capacity, although not the right, to unilaterally abrogate any agreement on energy supply, made the situation even more complicated.

What matters the most is that to what extent, being asymmetrically interdependent, transit countries can use their power and react to the existing or possible alternatives. Complex interdependence theory imply that the less dependent state in gas transit relations is the one for which the termination

or drastic alteration of the relationship in gas supply chain costs least. Thus, in this context of energy supply interactions, it is not so much about who is stronger and who is weaker, but rather about the different types of power that interacting parties possess. In the Russia-Ukraine gas transit relations, Ukraine as a transit country up until recently tried to use its structural power to keep the present path of gas to Europe through its territory. Russian dependence on the Ukrainian infrastructure was the source of political and economic leverage of the latter. Besides, Ukraine financially benefited from high transit fees for the Russian gas. Russia, on the other hand, as an exporting country wanted to diversify its transit routes to decrease its dependence on Ukraine. Interestingly though, being a transit country for Central Asian gas, Russia tried hard to keep Central Asian gas producers dependent on it and did its best to prevent building alternative pipeline routes bypassing Russian territory.

2.2 Cooperative Game Theory and Bargaining Power

From the economic perspective transit countries use their favorable position as a bargaining power, which is the capacity to generate intended negotiation outcomes (Freeman, 1997). Bargaining is both a cooperative and a conflictive decision-making mode (Schneider, 2005:670). Bargaining is cooperative because all parties involved can improve their initial status quo situation by means of coordinating their behavior. It can also be conflictive because every participant would take part in negotiations with their own expectations of gains and would like to profit from the interaction as much as possible (Schneider, 2005:670). Franz Hubert and Svetlana Ikonnikova, apply cooperative game theory for multilateral negotiations in order to derive the bargaining power of different players endogenously from the architecture of the transport system and its possible extensions. This theory allows quantifying the strategic importance of any alternative option to extend the network by means of calculations depending on how it changes the distribution of the profit. It is important though that pipelines are evaluated in the context of the whole network (Hubert, 2007:79).

According to the theory, the power of a country is determined by its control of existing transport capacities. But in order to obtain a comprehensive assessment of countries' relative bargaining power, alternative pipelines and the possibility to extend existing ones should also be taken into account (Hubert, 2007:64). For transit countries the share of the profit is reflected in transit fees. Since it is often difficult to use "objective" or "fair" way of setting transit fees, the outcome in the form of transit agreements depends upon relative bargaining power (Stevens, 2009:11).

3. "Good" or "Bad" Transit Country

Producers, consumers and transit countries may mutually benefit from being interdependent, if they cooperate and coordinate their actions. Robert Jackson and Georg Sørensen argue that the increasing interdependence between producers and transit countries may produce incentives to avoid conflicts and compel states to engage in more intensive forms of cooperation (Jackson, 2008:24). The role of a so called "good transit country," which tends to produce predictable conditions for the most cost-efficient way to transport energy with minimal disruptions while enjoying internal security and stable government, is crucial (Stevens, 2009:15). This is an issue of confidence on which to build partnership in gas supply relations. However, actors do not always act in a predictable way and refrain from using energy as a weapon. "Bad transit country" may produce disorder in which cost-inefficient economic transportation methods and routes are chosen. It is usually a common practice in states with unstable government and bad security conditions(Stevens, 2009:11). The overall relationships between states also affect stability of energy supplies over the territory of another country. For instance, a country with friendly attitude to another state might not consider 30% energy dependency as a security challenge and would further develop joint cooperation, while two states with relatively opposed relations might perceive even 10% of dependence as quite a serious obstacle (Palonkorpi, 2008:5) .

4. Inherited Gas Transport Infrastructure as a Main Source of Transit Power

The Eurasian elaborate pipeline systems, which transport Central Asian and Russian gas to and through the Russian territory then through Ukraine and Belarus to Europe was largely established in the 1960s, 1970s and early 1980s (Erickson, 2009:30). The former Soviet space had a complete gas extraction and distribution system, which was broken economically and politically into pieces after disintegration of the Soviet Union. However, due to the importance of existing gas transport pipeline networks for the economies of both former Soviet republics and European consumers, it had to be put back together very quickly. In the middle of 2000s 25% of the European energy consumption came from natural gas (Hubert, 2007:65) and about 57% of this was imported (Kohen, 2007). Not surprisingly though that 50% of gas imports came from and via Russia (Hubert, 2007:65). Even though this amount has decreased down to 30% in 2013, it is still significant (Institute for Energy Research, 2014). The Eurasian gas supply system can be technically divided into two parts: first, gas transport network from Central Asian producers (mainly Turkmenistan,

Uzbekistan and Kazakhstan) to Russia; second, the network that transports Russian and to some extent Central Asian gas to the Ukrainian as well as Central and West European customers.

5. Russia – Ukraine – Europe Gas Pipeline Networks

The former Soviet Union first started to supply gas to Western Europe in the late 1960s, through eastern Ukraine and Czechoslovakia to Austria and Germany. This pipeline network is part of what is called the Southern System(Hubert, 2007:65). Ukraine remained the only gas transit country to Europe until 1990s (Ikonnikova, 2005:6). However, after the collapse of the Soviet Union the map of gas supply routes has been gradually changing. After the collapse, although technically pipeline networks remained almost the same, now Russia found itself in a relatively uncomfortable position that its only supply chain to Western Europe passed through several newly independent states and Russia had to purchase/barter and transport Central Asian gas to which it previously had free access. Within newly established mechanism of export profits distribution, Ukraine started bargaining over its share. The fact that the only transit route to Europe was in Ukraine's disposal gave it a very strong bargaining leverage.

In order to avoid high dependence on Ukraine, Russia decided to diversify its transit routes. Russia proposed building alternative pipelines bypassing Ukraine. The first of such alternatives, put into operation in 1998, run through Belarus and Poland and brought the Russian gas to Germany. The pipeline capacity of the newly built Yamal 1 (28 bcm/y) was put against 70 bcm/y Ukold pipeline network (Ikonnikova, 2005:7). To further decrease its dependence on the Ukrainian gas transit infrastructure Russia started considering to build Yamal 2 additional bypass pipeline. However, when Yamal 1 started the transmission of gas, Belarus initiated renegotiations over a payment for the transit. Tension on transit price negotiations deterred Russia from increasing the capacity of Yamal track.

In 2003 Russia promised to invest in upgrading pipelines running through Ukraine in exchange of control over transit capacities. The upgrade project aimed to raise the capacity of existing system by 15 bcm/y, which is still the cheapest option to increase the capacity of the existing gas transport networks (Ikonnikova, 2005:7). However, Ukraine refused to sign a long-term contract with Russia concerning its control over Ukrainian transit infrastructure. Strained relations with Belarus on price negotiations made the Russian side choose extreme measures and build a pipeline avoiding any transit country on

its way to the European market. Of all alternatives to extend the transit capacity of gas supply network, in 2005 Russia decided to choose the most expensive option but at the same time politically the most secure one. North European Gas Pipeline started moving Russian gas (Nord Stream – capacity 55 bcm – 2 pipelines: 27,5 bcm each) (Kari, 2009:133) to Germany through the Baltic Sea, avoiding any transit country in 2011.

In the 1990s Ukraine enjoyed the status of the only transit country for Russian gas. When Yamal 1 started operating Ukraine's transit leverage decreased down to 80%. Two pipelines of the Nord Stream network halved Ukraine's transit power. With projected implementation of either South Stream or Southern Gas Corridor, Russia will barely need Ukraine transit network.

6. Pipeline Infrastructure to Transport Central Asian Gas to External Markets

The conflict over gas supply between Russia as a producer, on the one hand, and Ukraine and Belarus as transit countries, on the other, forced the Central Asian gas-producing countries to search for alternative ways to export their resources. Five main streams of the Central Asia – Center (CAC) and two main runs of the Bukhara – Ural pipeline to and via Russia transported most of the Central Asian gas. Four of the Central Asia – Center pipelines run from Turkmenistan via Uzbekistan and Kazakhstan to Russia, while one of them goes along the coast of the Caspian Sea via Kazakhstan to Russia. There are also two branches of the Bukhara – Ural line running from Uzbekistan through Kazakhstan to Russia. Although the projected maximum capacity of all the arterial gas pipelines running into or via Russia is 100,5 – 122,8 bcm, over the years lack of investments reduced the capacity down to 63 – 77 bcm (Paramanov, 2008:7).

In 2007, the total net export of Central Asian natural gas accounted for 71,3 bcm (Turkmenistan 54,3 bcm, Uzbekistan 14,7 bcm and Kazakhstan 2,3 bcm). Most of this gas went to or through Russia (60 bcm: around 48,1 bcm from Turkmenistan and 10,5 from Uzbekistan, the remainder from Kazakhstan) to the European market (International Energy Agency Working Paper Series, 2008:10). Having benefited a lot from re-exporting Central Asian resources Russia used its political and transit leverage to block projects designed to diversify energy export dependence of the former. To sustain Central Asian countries' dependence on Russian infrastructure Russia proposed to upgrade four runs of the Central Asia-Center pipeline system from current 60 bcm/y capacity to 90 bcm/y and complete the Caspian Coastal Pipeline with the capac-

ity of 20 bcm/y to transport gas from western Turkmenistan, Uzbekistan and Kazakhstan (International Energy Agency Working Paper Series, 2008:18). Russia could not imagine, at that time, that the overall gas import from Central Asian region would decrease more than twofold with most of the resources moving towards Chinese direction in less than five years.

7.The Source of Ukrainian Gas Transit Power

Ukraine's resource potential, strategic location and existing infrastructure used to be the main source of its transit and bargaining power. However, being too dependent on Russian energy resources Ukraine could not afford losing gas supply for a long period. Ukraine consumes between approximately 60 and 75 bcm of gas annually, which is far beyond the proportion to the size of its economy and current 20 bcm/y gas production (Chow and Elkind, 2009:81).

Analysis of the gas transit pipeline network illustrates that until South Stream/ Southern Gas Corridor starts operating Ukraine will remain a major transit country with the capacity to transport the largest (around 50%) portion of the Russian gas to Europe. Around 80% of the Russian gas exports to Europe had previously passed through Ukraine (Stern, 2006:2). In addition, Ukraine has a comparatively large gas storage capacity. The country can store up to 35 bcm of gas in underground gas storage systems, mainly located in the west of the country – an ideal location for serving West European gas customers (Chow and Elkind, 2009:81). The location of the Ukrainian gas storages in the West of the country, has both economic (gas transportation require fuel gas to push natural gas through pipelines for a long distance, thus it can be easily and cheaply transported to Europe) and security significance (the gas crisis in Ukraine proved it risky to store strategically important resources in the eastern part of the country with dominant Russian population(Stratfor Galobal Intellegence, 2008)) for the current Ukrainian government. Ukraine could always open storages and use that energy to compensate insufficient gas supplies from Russia. In light of the gas crises between Russia and Ukraine having such storage capacities proved to be useful. Besides, Ukraine has its own gas production facilities. Gas production capacity of the country accounts for 20 bcm/y (peak of Ukraine gas production was almost 70 bcm in 1975, more than the total consumption of Germany, Italy, and the United Kingdom at that time) (Chow and Elkind, 2009:79). These unique facilities (storage and production) provide Ukraine certain leverage to sustain short-term supply cuts. But the gas storage capacity is for the most part a season long energy security guarantee. Afterwards when the storage is empty 20 bcm of domestic production will not save it from energy crisis.

8. Short–term Gas Supply Cuts in the Gas Transit Relations between Russia and Ukraine

As a legacy of the Soviet Union, Russia inherited control over the integrated system of the Eurasian gas supply network. However, newly independent republics started challenging Russian interests in the gas supply chain. Russian authorities also actively used its power to influence the decision-making of the Ukrainian government. In 1993, Russia cut 25% of Ukraine's gas supply, officially due to non-payments, a week before an important meeting during which the two sides would discuss a Russian ultimatum on the surrender of nuclear weapons and the Black Sea Fleet. Next attempt by Russia to use energy diplomacy appeared in 1995, when Russia raised its export price on gas for Ukraine while proposing that Ukraine join the Commonwealth of Independent States Customs Union. Both attempts to use energy as a foreign-policy instrument brought no result (Fredholm, 2005:17). Since then energy relations have been developed on Russia's frequent accusations of Ukraine of siphoning off gas bound for Europe, while Ukraine used its gas transit power to resist Russia's attempts to influence its foreign policy. Regular disputes with Russia over the debt amount and pricing contracts have worsened relations between two states. The most notorious disagreement over gas price subsidies took place in late 2005 and early 2006, when Gazprom chose to unexpectedly cut off gas to Ukraine for four days (Imblum, 2008:14). However, supplies were never completely cut off during this conflict and causing most countries a little more than minor inconvenience. In less then three years disagreements between Russia and Ukraine have led to another conflict. Ukraine and Russia failed to agree on a price for the Russian gas supply to Ukraine and a tariff for the transit of Russian gas to Europe before the previous agreements expired on December 31, 2008. Russian exports to Ukraine were cut off on January 1, 2009. Exports to 16 European Union member states were drastically reduced on January 6 and cut off completely from January 7, which restarted only January 20 (Pirani, 2009:4). Fourteen days of complete gas supply cut off had more serious consequences both for European consumers' economy and Russia-Ukraine's image of reliable gas supply countries.

According to some estimations the number of incidents in the Eurasian gas supply sector, such as cut-offs, explicit threats, coercive pricing policy and certain take-overs exceeded 55 in the period between 1991 and 2006 (Larson,2006:262). But, the gas crisis of 2014 is incomparable to previous crises in terms of its impact on the Ukrainian, Russian and European countries' economy and energy security. Russia demands 485 dollars per thousand cubic meters, while Ukraine claimed willingness to buy it for 269 dollars per thou-

sand cubic meters (tcm). Russian gas supplies to Ukraine were cut for over a six months period. What is more important, this overall instability is pushing Russian government to take the last measure to diversify its dependence on Ukrainian infrastructure by building either South Stream pipeline or extend the Russia-Turkey pipeline to reach European borders avoiding Ukrainian territory.

9. Spillover Effect of the Ukrainian Gas Crisis on Central Asia-Russia Gas Transit Relations

The Russia-Ukraine gas crisis had much greater impact for the Eurasian gas supply system than Russia assessed in the beginning. As a result of the crisis Russia lost its almost absolute transit power over the Central Asian natural gas. On the one hand, Central Asian gas was complementary for the Russian economy, from which it benefited a lot in terms of profits from reselling it. On the other hand, the amount of gas imported from the Central Asian region helped Russia to fulfill its obligations to the European consumers. Inherited gas pipeline network, sufficient gas reserves to meet growing European demand, complementary network system of gas transit routes and high revenues to the budget were hypothetically supposed to ensure cooperative dynamics in energy export/import and transit relations between Russia and Central Asian producers. However, Russian energy interest over the Central Asian natural resources was connected to the demand coming from the European markets. And Russia-Ukraine gas crisis negatively impacted this demand.

The amount of Central Asian gas arriving at the Russian border has increased from a mere 2.3 bcm in 1998, and 38,1 bcm in 2000, to 63,5 bcm in 2006 (Sagers, 2007:659). Up until 2007 Russia remained a major importer and transit country for the Central Asian gas. Russia - Central Asia gas transit relations have been relatively stable for a long period, although not always fair towards Central Asian energy actors in terms of discriminatory pricing policy. The first major supply disruption occurred when the Russian company Gazprom cut 90% of gas imports from Turkmenistan by in 2008 (Jarosiewicz and Strachota, 2009:5). It was the first time when Central Asian countries realized how vulnerable they are in energy relations with Russia.

Gas disruption was a serious strike to Turkmenistan's economy, which at that time was highly dependent on revenues generated from gas exports to Russia. Even though officially supply cut was a result of explosion on one of the CAC pipelines, the fact that it lasted for so long can be justified only by Russia's inability to profit from re-selling Turkmen gas. A year earlier, not to allow

diversification of gas export routes avoiding Russia, Gazprom signed an agreement according to which it was obliged to buy Turkmen gas in an amount of 50 bcm/y for 350 dollars per tcm (*NEWSru.com, Economica* (2009).plus 20 dollars price for transit facilities (Socor, 2009:125). Due to the Russia – Ukraine gas crisis, it was unable to pay for and import the entire contracted volumes of Central Asian gas and an accident in the system of the main provider was a convenient way to get rid of its obligations as a buyer. Having engaged in short-term price bargaining disputes Russia had no idea that this gas supply cut would have far more serious consequences than expected. In 2012 gas export to Iran and China exceeded the volume of export to Russia. Turkmenistan exported 42.48 bcm of natural gas in 2012, 52% of which went to China, 24% to Russia and 22% to Iran. However, since Europe remains the highest paying and the most reliable energy market, Central Asian countries will continue to be interested in the Russian gas transit infrastructure.

10. Ukraine's Changing Bargaining Power under Proposed Alternative Gas Supply Networks

Pricing policy in Russia-Ukraine gas transit relations was determined by a number of factors. Prices for gas and gas transit fees had been frequently used as a stick or a carrot to achieve certain goals both by Russia and Ukraine. Political changes in Ukraine's internal affairs, which resulted in new pro-Western governments, have led to active use of discriminatory pricing policy for natural gas by Russia. Ukraine, in its turn, during the previous gas crisis was counting on its almost monopolistic transit power to reduce transit fees and gas price set by Russia for its gas. In an attempt to decrease its dependence on Ukraine, Russia implemented the Nord Stream pipeline project, thus reducing its dependence twofold.

Ukraine's ability to turn off the gas tap has always been one of the most important tools capable to keep Russian policy in check. The model developed by Franz Hubert and Svetlana Ikonnikova that is based on cooperative game theory suggested that in the status quo situation a grand coalition, which consists of Russia, Ukraine, Belarus as the main players, would maximize its profit by using the existing capacity of South System, which is 70 bcm/y and Yamal 1 with the capacity of 28 bcm/y. Building new pipelines or/and upgrading existing ones required additional investment. If an increase of gas supply was necessary, then the most feasible and cheapest option, up to a limit of 15 bcm/y, would be upgrading of the South System. To increase energy export beyond that amount new pipeline had to be added. Investing in building Yamal 2 pipeline in addition to Yamal 1 was more efficient than considering bypass exten-

sions in the south. Economically the most expensive pipeline project was Nord Stream, which requires at least yet another doubling of capital expenditures per unit of capacity (Hubert, 2007:71). However, economically less efficient the Nord Stream pipeline played very important strategic role. Russia put in place the Nord Stream pipeline in 2011.

Franz Huber (2009) and Svetlana Ikonnikova (2009) calculated the relative bargaining power of the Eurasian gas network players, in which Russia is a producing country and Ukraine, Belarus, and some other countries are transit states for the Russian gas. They measured the power of a country by its share in total profit from the gas export business. According to the calculations, since currently demand for Russian gas and production cost is compatible, there would be no need (commercial interest) to increase capacity beyond South and Yamal 1. However, some countries receive their "share," and bargaining power not in the form of economic revenues, but as political concessions on other issues.

In the beginning of 1990s Ukraine enjoyed 100% gas transit leverage over the Russian gas exports. When the Yamal 1 was put into operation Ukraine still remained quite an important transit country since almost 80% of the Russian natural gas exports to Europe passed through its territory. With the construction of the Nord Stream pipeline, which directly links Russia with Germany under the Baltic Sea, Ukrainian transit power decreased down to 50%, because from that time on half of the Russian exported gas has reached European market avoiding Ukrainian territory. Russia supplied only 30% of the Europe's gas consumption with only 16% through Ukraine (Institution for Energy Research, 2014) With the South Stream pipeline, Ukraine may lose its strategic importance as a transit country for Russia, resulting in significant economic loss that was previously earned from transit fees and cheaper energy resources. Complications with gaining the permission from the Romanian government to let the South Stream Pipeline pass its territory forced President Vladimir Putin to make an announcement regarding its withdrawal from this Project. He offered Turkey a discounted gas price for its consent to extend the Blue Stream pipeline from Ankara to the borders of Italy within the framework of the Southern Gas Corridor initiative. In any of these two cases, Russian gas will reach European market avoiding Ukrainian territory and decreasing the transit power of the latter down to 0%.

Unstable gas supply relations force European countries to consider alternative pipeline routes avoiding Russia as well. In this sense, Ukraine as an important transit country can lose its significance, unless this diversification applies only to bypass Russia and retain Ukraine as a transit country. Thus, Ukraine pro-

posed a new option to transport Caspian gas bypassing Russia, the so-called "White Stream". This network will retain Ukraine as a major transit state for Central Asian gas export. Ukrainian officials during the energy conference in Vienna proposed it in 2007, where Ukrainian Prime Minister Yulia Timoshenko asked the European Union to consider participating in it (Erickson, 2009:47). However, this project is still under consideration.

11. Russia's Gas Pricing Policy towards Ukraine

When the Soviet energy system collapsed, Russia traded goods for the Central Asian energy resources. In the beginning of 2000s both sides agreed to introduce pricing policy for the energy resources. Gazprom purchased gas from Turkmenistan for less than 100 dollars per tcm, and sold it for 230 dollars per tcm to RosUkrEnergo, which resold it to Ukraine for 95 dollars per tcm and presumably the rest to Europe for 250 dollars per tcm (Jarosiewicz and Strachota 2009:6) someone was obviously making money out of it. It is difficult to say for sure, whether such positive discriminatory pricing policy was the result of Ukraine's bargaining power, or Russia's attempt to influence Ukrainian foreign policy by means of carrots, or both of them simultaneously. However, it was pretty clear that gas-pricing variations were used for political purposes by both transit and gas exporting countries.

Unstable gas pricing policies were often a source of disagreements between Russia and Ukraine. There were price consequences for Ukraine for taking more gas than agreed in the contract during the gas crisis of 2009. For siphoning gas the country was charged at 150% of the contract price in the period of April-September, and 300% during October-March (Pirani, 2009:26). Ukraine was often unable to pay even the reduced price for its gas and delayed payments.

Russia positions itself as an economic actor, arguing that in pursuit of economic leverage it will not provide energy without getting paid. However, market mechanism does not always prevail when it comes to gas export-import relations. This is clearly illustrated by giving price concession on gas to relatively poor and friendly states such as Belarus, high prices to relatively poor and unfriendly states such as Georgia and high prices to rich and friendly European states. South Ossetia and Abkhazia, for instance, receive gas for free, which is hardly a market mechanism (Larson, 2006:211).

One of the sources of conflict between Russia and Ukraine is the gas pricing mechanism upon which countries often fail to agree. Current Russia-Ukraine gas crisis is not an exception. Russia demands payment in an amount of 485 dollars per tcm according to the agreement signed between Putin and Tymoshenko in 2009. Having accumulated more than 5.5 billion dollars debt,

Russia demands prepayment for future gas supplies to Ukraine. To accelerate the process of negotiations the Russian government proposed a discounted price of 385 dollars for tcm. However, Ukraine says it is ready to pay 269 dollars per tcm with the condition that the debt is recalculated according to this price (Mercouris, 2014). Even though gas supplies in the amount of 1 bcm was restored, the overall conflict has not been resolved yet.

12. Russia's Bargaining Power in the Context of Existing and Planned Gas Pipeline Networks

By using its transit power Russia developed policies that gave it an upper hand in price negotiations with the Central Asian producers. Russia imported Central Asian natural gas at a low price and exported it for a much higher price. Turkmenistan's land-locked geographical location limited the space for maneuvering to diversify its dependence. Moreover, the fact that Turkmenistan's exports had to pass through Russia or Iran, the two countries with the biggest proven natural gas reserves in the world and practically Turkmenistan's main competitors further complicated energy relationships. In the absence of extensive energy security interests in importing Turkmen gas Russia could easily sacrifice stable gas supplies for certain political and economic gains. Despite their excessive vulnerability, Central Asian states never seriously attempted to achieve "independence" from Russia. All they wanted is to restructure commercial relationships in order to achieve a more politically acceptable framework of economic gains and energy led sustainable development.

With increasing interest of external potential customers for the region' natural gas, Central Asian states started demanding fair pricing policy and an ability to sign direct contracts with European consumers keeping Russia as a transit country only. Russia refused to agree on the second term, but increased the price for Central Asian gas up to the European level. Central Asian counterparts were ensured that there was no difference to change trader to sell gas to Europe, and if they want to sell additional gas they can sell it to China, but not Europe (Azarov, 2009). Central Asian countries accepted this condition hoping for a long and stable export of natural gas to Russia for the best possible price. After all this is what they wanted. However, an extensive dependence of Central Asian producers on solely Russian infrastructure proved to be quite risky in the end.

13. Russia's Exercise of Transit Power towards Central Asian Countries: Discriminatory Pricing Policy

The importance of alternative gas pipelines and the possibility to bypass monopolist Russian gas transit network should have never been underestimated. Alternative routes significantly affected price negotiation outcomes for the

countries involved in gas transit relations. For a long period, Russia enjoyed its favorable position as a single gas transit network owner to transport Central Asian gas to Europe. Using its bargaining power, Russia established a payment system, which was far below that of average world prices. Up until the beginning of 2000s Central Asian countries received goods in barter for their energy. Pricing mechanism was later introduced, but it was far from being fair towards Central Asian exporters. In 2006 Gazprom was buying natural gas from Turkmenistan for 60 dollars per tcm and selling it to Ukraine for 95 dollars per tcm, while the average price in Europe was about 260 dollars per tcm(Jarosiewicz and Strachota, 2007:3).

With increasing interest for the Central Asian natural gas by other regional and global customers, Turkmenistan, Uzbekistan and Kazakhstan started demanding fair prices for their resources. Alternative pipeline options significantly raised Central Asian producers' bargaining power. In an attempt to keep Central Asian region under its sphere of influence Russia agreed on terms of gas import from which it could no longer benefit. According to the agreement, Gazprom had to pay, on average 350 dollars per tcm of Central Asian gas in 2009, while Russia sold the same amount of gas to Ukraine for 230 dollars per tcm and to Europe for 280 dollars per tcm. Russia acknowledged losing money from the Central Asian contracts but expected to recover the loss when increasing demand is restored (Kramer, 2009).

However, Russia and Turkmenistan conducted an agreement on a "take or pay" basis, which implied that Russia was obliged to pay for Turkmen gas whether it physically received it or not as long as Turkmenistan kept sending the gas. According to the agreement Russia had to purchase gas in the amount of 50 bcm/y for 350 dollars per tcm*(NEWSru.com*, Economica, 2009) and itself cover 20 dollars transit fees (Socor, 2009), which meant Gazprom could not any longer profit from re-sales or swaps of Turkmen gas to Europe. Moreover, Russia started trading against its economic interests. Pricing policies for Central Asian gas, which was subject for change due to consideration of alternative pipelines, resulted in increasing bargaining power of Central Asian counties and diminishing of Russian transit power. China signed gas agreements with Central Asian producers to import up to 80 bcm of gas annually by 2018. With current level of gas export capacity Central Asian states will have to redirect all their gas towards Chinese direction leaving Russia with no power to influence regional exporters' decision-making on the basis of its transit leverage.

14. Conclusion

Due to Central Asian countries' land-locked geographical location pipelines turned to be the most cost efficient way to transport natural gas. However,

once installed, gas transport networks generate large quasi-rents and at the same time become quite inflexible. Transportation of natural gas requires large upfront investments in transport facilities with relatively long lifetime and low operating cost. The analysis of Russia-Ukraine and Central Asia-Russia gas transit relations proved the fact that conditions for operating such pipelines can be relatively unstable due to frequent gas supply disruptions, threats of supply cuts, discriminatory pricing policies.

The following conclusions were generated from the comparative analysis of the Russian and Ukrainian gas transit powers. First, the inherited Eurasian gas transit network infrastructure allowed Russia and Ukraine to use its transit leverage to either strengthen cooperation or generate short-term gas conflicts to promote its political and economic interests. Second, the gas transit strategy of both Ukraine and Russia has frequently been driven by political motivations and used as a foreign policy instrument against neighboring countries. Third, the Eurasian gas supply network was characterized by high level of interdependence. Although energy dependence could lead to cooperation and high level of energy security, gas transit disruptions show that interdependence could not ensure stable and reliable supply of energy resources. Interdependence was just a barrier against long-term gas supply disruptions. Fourth, the higher transit power of the transit country is the more favorable transit tariff this country enjoyed. However, due to the complexity of relationships between gas producers and transit countries, sometimes actors received their "share" and bargaining power not in the form of economic revenues, but as political concessions on other issues. Fifth, Russia or Ukraine threatened to use their transit power to punish or reward political behavior of other countries too frequently, which caused a reaction, countermeasure (for instance, investment in cost inefficient alternative pipeline projects bypass transit country) to render further use of that leverage ineffective. Due to frequent gas supply disruptions Russia decided to diversify its dependence on Ukraine as a transit country by choosing economically inefficient, but politically more secure options – the Nord Stream pipeline and potentially, the South Stream pipeline. Moreover, Russia-Ukraine gas crises had a spillover affect on Russia-Central Asian energy relations allowing China to enter and take over the significant part of the Central Asian energy market. As a result, both Russian and Ukrainian gas transit powers have significantly decreased over the recent years. If Russia builds South Stream, Ukraine will completely lose the possibility to use its transit power. Russia's attempt to restore its influence over the Central Asian natural gas producers may lead to a direct competition and conflict with China.

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11. The Project of the Present-Day Silk Road: TRACECA and Turkey's Role

HASAN SAYILAN

Abstract

Transport Corridor Europe Caucasus Asia project (TRACECA) is a line of transportation which links Asia and Europe. The project was established to enhance the economic relations, trade and transportation links along the corridor. Starting from the East Europe the corridor passes through Turkey, and over the Black Sea it reaches the Georgian ports. The corridor connects the region with Turkey via high way adding richness to the transportation networks of the South Caucasus. Additionally, this project has a feature of an important trade route that enables the commercial linkages of the Central Asia countries with Far East.

Initially, Turkey was not incorporated in to the project, but in 2002 it became one of the partners along with Romania and Bulgaria. Located on the corridors of the international transportation and energy, Turkey is directly affected by the TRACECA project due to its privileged geographical position which joins three continents. The Turkish Republics in Caucasusand Central Asia will be able to open up to the Europe and Mediterranean countries through Turkey by means of that project.

In this study, I aimed to present the historical progress, objectives and significance of the TRACECA Project. I dealt with Turkey's key role, investments and technical aids partaking in the Project. I mentioned the international trade routes and which strategies of transportation Turkey must refer within the scope of the Project.

Keywords: Turkey, Transport corridor, TRACECA, Railway, Highway, Central Asia

1. Introduction

The Transport Corridor Europe Caucasus Asia (TRACECA) project which is called modern Silk Road project is a transportation line connecting Asia to Europe. The project was developed to improve the economic relationships, trade and transportation connections along the corridor. The corridor starts from Eastern Europe and stretches out to Turkey. From here, it reaches the bays of Poti and Batumi in Georgia, adding richness to the transportation networks in South Caucasus and links the region to Turkey via highway. Additionally, the corridor reinstated the trade of Central Asian countries with the Far East countries and thus paved the way for a significant trade route.

After the dissolution of the Soviet Union, the underground and surface treasures of the decolonized countries began to attract Western countries' attention, especially United States' attention to the region. European Union attaches a special importance to the transportation linkages of Europe-Asia and Africa in its enlargement process. European Union started a new study to extend the Trans-European Networks (TENs) and Pan-European corridors to European Union neighboring countries, Turkey, Commonwealth of Independent States (CIS), Black Sea, the Middle East countries and countries having a coast on Africa. The TRACECA project which is an important part of this work and is funded by European Union consists of a range of investment projects and technical assistance programs.

Turkey, which is located on international transportation and energy corridors, occupies a privileged position due to its special geographical position joining three countries. Turkey is directly affected by the TRACECA project. The trade routes of the Turkish Republics that do not have a sea coast in Central Asia will reach to Europe and Mediterranean countries through Turkey. Overseas expansion via highway and especially railway will be continuously possible. Unlike other actors, Turkey has strong bonds and relations with the regional countries. Thereby, Turkey has a major role in solving probable problems and strengthening commercial relations. European Union began to see Turkey as the key country in the region (Hurmi 201:21).

In this study, TRACECA project is assessed in a broad perspective and the key role Turkey has in this project is discussed in various aspects.In addition to literature review, I have used the archives and resources of Turkey's national TRACECA agency, Turkish Statistical Institute data, State Planning Organization reports, Ministry of Transportation, Maritime Affairs and Communications, General Directory of Infrastructure Investments, Turkish State Railways, Ministry of Development Archives, the World Bank, European Commission Development Reports, and World Trade Organization.

2. Today's Silk Road Project: TRACECA

2.1. The History of TRACECA Project

It is known that historical Silk Road started in the era of Chinese Khan Dynasty in the first century of BC. The Silk Road is a transportation link which was set up in the era of Khan Dynasty, started from Chang, a Chinese city, and ended in the western Roma Empire and included north-south corridors (Heyderova, 2008: 21).

The road takes its name from caravans carrying the silk and spice of the Far East and South Asia. The name Silk Road was proposed by German geographer Ferdinand Van Richthoten in 1870. These caravans set up trade routes expanding from China to Europe. The Silk Road is not only a trade route connecting Asia to Europe but also carries the traces of cultures, religions, races living in the regions for 2000 years and it adds historical, cultural richness to the region(Tok, 2000:12).

The TRACECA project, named as the modern Silk Road, is a special project presented to developing countries in technical assistance framework by European Union. In addition to transportation and trade ministers of Azerbaijan, Armenia, Kazakhstan, Georgia, Kyrgyzstan, Turkmenistan, Tajikistan, Uzbekistan, the representatives from Romania, Russia, Iran, Turkey, China, Pakistan, and EU countries attended the "Brussels Conference" of TRACECA. The TRACECA corridor is accepted as a natural bridge between Asia and Europe by chief international organizations (UNECE, ESCAP, and EC).

At the end of the conference, the Brussels Declaration was signed in 1993. As a result, the TRACECA project was accepted as technical assistance program being funded by EU. The project was initiated urgently by a 15 million Euro credit assignment. In the conference, four sectorial working groups which were decided to gather periodically. These working groups would work on issues of highways, railways, maritime transportation and easing trade. The most hotly debated issue in the conference was border crossing (http://www.traceca.org.tr - 15.04. 2015).

At the beginning, Turkey was not incorporated into the project route but later Turkey approved the Multilateral Agreement (MLA) on 24 October, 2001. In the Intergovernmental Commission Conference (ICC), taking place in Tashkent on April 24 and 25, 2002, Turkey, Bulgaria and Romania acceded to the program. After the full membership of these three countries, the TRACECA map was redrawn including Turkey (Tozar et al., 2011: 13).

2.2. The Objectives of the Project

The objectives of the project were determined by 12 countries' presidents and heads of governments signing the Multilateral Agreement (MLA) in the international conference "TRACECA- Restoration of the Historic Silk Road" which was held in Baku in 1998. This agreement is the basis of the application of the TRACECA project and also was approved by the parliaments of the state parties. MLA has been approved by the Turkish Government's decision dated 24 October 2001 and numbered 3228. The general objectives of the project determined as listed below (Tozar et al., 2011: 13):

- Development of economic relations, trade and transport communication in Europe, the Black Sea region, the Caucasus, the Caspian Sea region and Central Asia.
- Ensuring the access to the world market of road, rail transport and commercial navigation.
- Ensuring traffic security, cargo safety and environment protection.
- Harmonization of transport policy as well as legal framework in the field of transport.
- Creation of equal conditions of competition for transport operations.

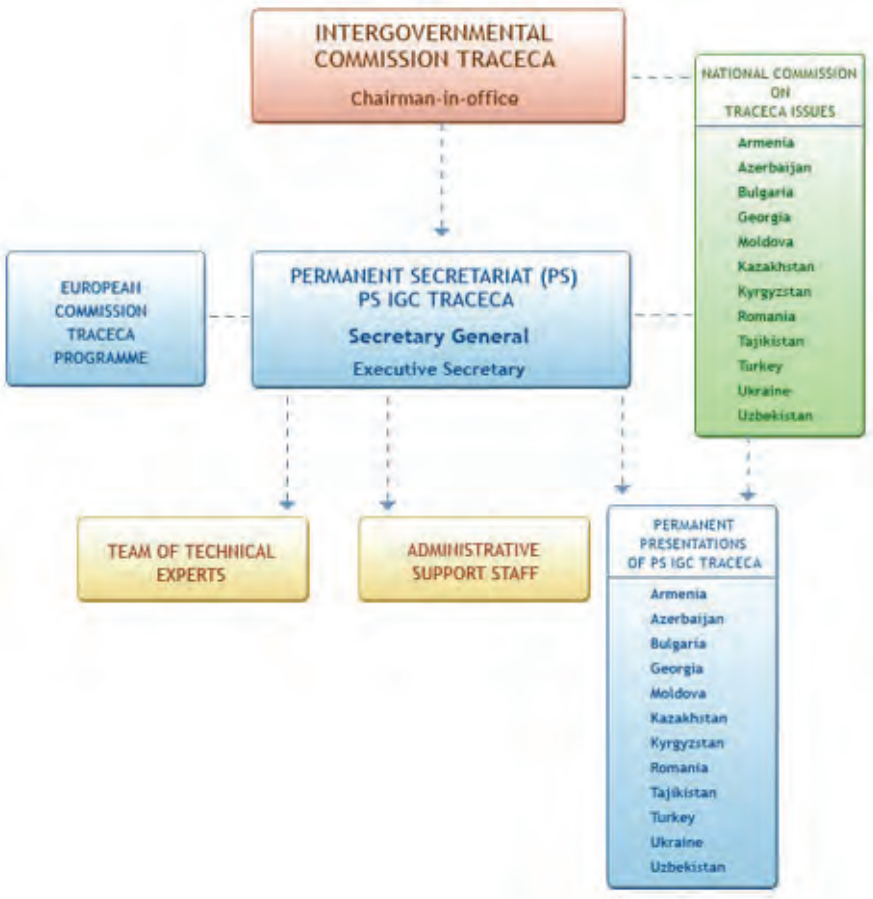
2.3. Member Countries

There are fourteen countries in the TRACECA Project. These countries are Turkey, Ukraine, Uzbekistan, Turkmenistan, Tajikistan, Iran, Romania, Moldova, Mongolia, Kyrgyzstan, Georgia, Bulgaria, Azerbaijan and Armenia. Turkmenistan is not state party within the scope of MLA though it is a participant country. Romania and Bulgaria are the EU member countries taking part in the project. Afghanistan and Pakistan applied for the official membership in 2005. Egypt and Lithuania have applied to be the observer countries in the project.

2.4. The Organizational Structure and Finance of the Project

The basic organizations of the TRACECA project are Intergovernmental Commission (IGC) which was started up in 2000 to implement and complete the decision of the MLA, TRACECA Permanent Secretariat (PS) founded in 2001 to act as the executive body of the IGC, national commissions, IGC TRACECA Permanent Representatives and Working Groups (See Figure11.1.) (TRACECA, 2015, www.traceca.org).

Figure 11.1. **Organizational Structure of the TRACECA Project**



Source: Adopted from www.traceca.org

The funding of the TRACECA Permanent Secretariat in the early years was undertaken by European Union. But after the year 2004, the financing was gradually shouldered by member countries. In 2006, more than 75% of the PS, IGC and TRACECA budget were met by associate members and eventually, in 2007, the funding of the programme was totally met by associate members.

European Union (EU), at this stage, was not alienated from TRACECA and continued to be the leading actor in financing of the projects. A lot of technical assistance and small-scaled investment projects boomed the interests of the international foundations in the region. From these foundations, European Bank of Reconstruction and Development, World Bank (WB), Asian Development Bank (ADB), Islamic Development Bank (IDB), and Kuwait Fund for Arab Economic Development foresee an estimated 700-million euro investment for ports, railways, and highways in the region. In addition to these investments, Japanese investors invested over 1 billion dollar in transportation infrastructure of the member countries (Tozar et al., 2011: 8).

3. Strategies and Routes of the TRACECA Project

3.1. The Strategy of the Project

The strategy plan prepared by support of EU is designed to meet member countries' needs and solve the problems in the transportation system of the region. With the strategy, it is aimed to deal with basic priorities which serve for the development of all transportation modes.

The strategy has mainly 6 objectives. These are:

- To strengthen and modernize institutional departments of transportation,
- To ensure the integration and combination of infrastructure networks,
- To promote the chain of non-stop, multi-mode transship,
- To use air transportation with its full potential and increasing the air traffic passengers,
- To provide a safer, more secure and sustainable transportation,
- To raise a safe fund.

3.2. The Routes of the Project

In the TRACECA project, maritime line, railway and highway routes were discussed. The ports in the Black Sea and Caspian Sea determined as the maritime lines. The highway and railway were determined to start from Ukraine and to reach four other countries over Turkey (See Figure 11.2.).

Figure 11.2. **The Routes of the TRACECA Project**

Source: Adopted from www.traceca.org

3.2.1. Highway and Railway Routes

The TRACECA corridor is connected to Europe via Trans-European Networks (TENs) starts from Ukraine (Yagodin) and reaches out to Odessa and İllichivsk ports. Here from the corridor is passed by ferry and Ro-Ro (roll on- roll off) expeditions and it reaches Caucasus passing through Georgia's Poti and Batumi ports. Following the main routes in Tbilisi and Erivan, the corridor reaches Baku via highways and railways. From Baku ports, again, through ferry and roll-on roll off expeditions, it reaches Turkmenbashi and Aktau ports in Central Asia. The TRACECA Project forms a transportation corridor starting from Tajikistan and coming to an end in China. Turkey provides, at the highway connection of the corridor between Europe and Caucasia, Istanbul-Samsun-Hopa highway and also Istanbul-Ankara-Kars-Tbilisi railway routes (Çetin, 2013: 44).

3.2.2. Maritime Lines Routes

The ports within this project in the Black Sea and the Caspian Sea are Odessa, İllichivsk, Constanta, Varna, Burgaz, Istanbul, Samsun, Batumi and Poti, the ports in the Caspian Sea are Baku, Turkmenbashi, and Aktau. For the transports which will be carried out over the Black Sea, Ro-Ro expeditions are planned among Istanbul, Odessa, İllichivsk and Costanza ports. Additionally, the Ro-Ro expeditions are going to be conducted among Burgaz- Poti, Constanza-Batumi, and Samsun-İllichivsk. Among Istanbul- Constanza and İllichivsk, Varna-Poti-Batumi, Constanza-Samsun-Batumi and İllichivsk-Poti ports, additionally, railway ferry expeditions are planned. And for the carriages which are planned to be carried out over the Caspian Sea, railway ferry expeditions and Ro-Ro expeditions are planned to be carried out (Ovalı, 2003:101).

4. The Role of Turkey in the TRACECA Project

Turkey attempted to join the TRACECA programme since 1993 but Turkey's requestto join the programme was rejected by the EU, as the EU had the reason that the technical assistance within the programme was granted by Technical Assistance to the Commonwealth of Independent States (TACIS), a foundation of EU providing assistance to the Commonwealth of Independent States. In the first planning of the TRACECA programme, Caucasus and Central Asia were aimed to be connected to Europe excluding Russia, Iran and Turkey. The initiative to include the highways and railways which could be built over Turkey into the TRACECA programme has not been accepted by the EU until recently.

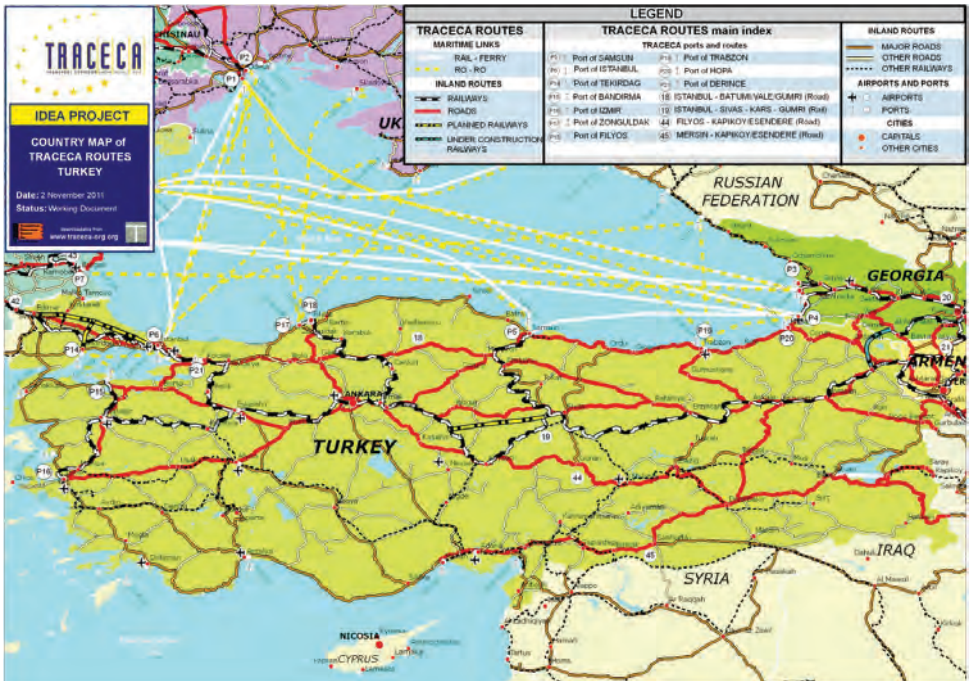
Nevertheless, Turkey was invited to the Silk Road Summit which was held in Baku on 7-8 September 1998 to enhance the international transportation on the

TRACECA corridor. At the end of the summit, in addition to the TRACECA member countries, Turkey also signed the "Basic Multilateral Agreement on International Transport for Development Corridor Europe-Caucasus-Asia".

The EU's opposition was over at the end of the Helsinki Summit taking place in 1999 and Turkey was granted a full candidate status. Turkey actually started to attend the TRACECA programme. Within this framework new routes for the TRACECA corridor were identified in the meeting of the TRACECA Intergovernmental Commissions which was held in Tbilisi on 10-12 December 2001. The Georgia-Bulgaria highway and Armenia-Bulgaria railway passing through Turkey, for the first time, were included in the corridor.

With the attendance of Turkey to the TRACECA program, Central Asian and Caucasus Republics were able to connect to Europe via highways over Turkey. The projects applications started immediately in this direction. The highways, railways and ports allocated to TRACECA were added to the TRACECA map. Samsun, Trabzon, Erdemir, Hopa, Derince ports which are in the Black Sea region and Istanbul, Bandırma, Izmir ports and the highways-railways connected to these ports are added to the map (See Figure 11.3.).

Figure 11.3. **The TRACECA Project Routes of Turkey**



Source: Adopted fromwww.traceca.org

4.1. The Impacts of the Project on Turkey's Transportation Sector

It is planned to pass two out of three main highways which connect Central Asia to Europe over Turkey. It is foreseen that Turkey will connect Asia and Europe. With the third way, it is aimed to have maritime and highway transportation to Poti Harbor in the Black Sea from Varna-Constanzaports and Odessa in Ukraine. With the completion of the Black Sea highway, the third main way is foreseen to be connected to the Black Sea ports (TRACECA, 2015, http://www.traceca.org).

4.1.1. The Impacts of the Project on Turkey's Highways

Major steps must be taken in the TRACECA project with regard to Turkey's geographical position and European Union's transportation policies. It is of great significance that Turkey has a developed transportation network and better highways. Turkey's developed transport network and improved highways will lead to comfort, mobility and traffic safety in reaching markets in Caucasus, Central Asia, the Middle East, and Eastern Mediterranean.

The highway line for intra-regional trade within the project is planned to pass through Turkey. The building of the Black Sea highway, which is believed to develop the quality of the transport connections between TRACECA and Pan-Europe have started. The completion of Samsun-Hopa highway will relieve Turkish shippers of incremental costs. Additionally, it is very important to improve hard infrastructure at border crossing points for a safer inter-regional trade.

In Turkey, the Ro-Ro transport is carried out among Rize-Poti (Georgia), Trabzon-Sochi (Russia), Samsun-Novorossiysk (Russia), Zonguldak-Skadovsk (Ukraine), Zonguldak-Evaporitaria (Ukraine), Zonguldak-Odessa (Ukraine). Goods supply of inner regions providestransition to Europe from ports. The potential of the Ro-Ro transport between Mersin-Trieste in Mediterranean is increasing. Within this context, Europe-connected goods transport traffic is aimed to be increased by 50%. Mersin-Trieste Ro-Ro route, at the same time, enables transit crossing to Iran, Iraq and Syria over Mersin port (UNRORO,2015, http://www.unroro.com.tr).

It is vital that the insufficient infrastructure of the border crossing facilities must be improved for an unproblematic trade in the TRACECA region. The needed supervision and control facilities, labs, warehouse, border-nearing roads, electricity and telecommunication power supplies and dredgers must be prepared at the border check-points for a trouble-free crossing. Such modernization projects can be realized by the Public Private Partnerships (PPP) (Tozar et al., 2011: 15).

4.1.2. The Impacts of the Project on Turkey's Railways

Within the TRACECA Project, Turkey took three important projects on its agenda to improve the infrastructure of the railways and railway transportation.The first of these projects within the TRACECA is *Marmaray Project* which will provide non-stop railway transportation between London-China. This project is important for lowering the present transit transportation burden carried out through the straits. Marmaray Project, which is being connected to high-speed tracks, enables non-stop railway transportation throughout the country (UDH, 2013).

The second important project is Kars-Tbilisi-Baku railway track. This track will enable connection of Turkey with high-speed tracks which is a follow-up of the fourth Trans-European Network (TEN). When Kars-Tbilisi railway is finished in east-west direction, the TRACECA's Caucasus connection will be completed. Upon the completion of Kars-Tbilisi railway, European railway transportation towards the region will be over Turkey. Thereby non-stop carriage will be possible till the territories of Turkic Republics (ARKITERA; 2009, http://www.arkitera.com).

The third important project is the High-Speed Train (HST) which is the most noteworthy objective of Turkey's transport policy. This project is carried out within the framework common transport policy by EU Maastricht treaty signed in 1992 and in parallel with EU Transport Policies determined by EU Commission (European Commission 2011). In the High-Speed Train projects, which is a part of the Trans-European Networks corridor, mutual serviceability is the basic principle. The main objective is to develop TRACECA corridor, connect Europe to Middle East and Central Asia over Turkey (Tozar et al. 2011:2).

The EU-funded Silk Wind project, which is conducted as a part of the Logistics Centers and Maritime Highways II Project is integrated into Marmaray and Kars-Tbilisi-Baku Railway Track projects. With this project, railway transport among Turkey-Georgia-Azerbaijan, and ferry transport between Georgian Alat port and Kazakhstan's Aktau port will be provided.

Another project, which is also considered important is *the Viking Train Project*. It will connect Europe to the Middle East and Asia in the shortest route over the TRACECA corridor. As a part of the project, railway-connected combined transportation among the Baltic Sea and the Klaipeda, Odessa and İllichivsk ports in the Black Sea will be possible. This corridor's Mediterranean, Europe, the Middle East, and Central Asia connections will be via Turkey. With the

adaptation of the project, the advantages such as low-cost transportation, short transit durations by means of scheduled expeditions, safe and secure transportation, convenience at custom and border transactions, the connection of two seas and eco-friendly transportation are foreseen to be gained (UIC, 2012).

4.1.3. The Impacts of the Project on Turkey's Maritime Transportation

In the TRACECA Project, non-stop shipment in seas is one of the significant objectives of the Multilateral Agreement (MLA) among other objectives. To that end, our ports being included in the TRACECA programme are Haydarpaşa, Derince, Hopa, Samsun, Filyos, Trabzon, Zonguldak and Izmir ports. Haydarpaşa, Derince and Samsun ports are on the Trans-European Networks corridor enabling Southern Europe connection. The containers' routes passing to the West Europe, Central Asia and Far East through Mediterranean are close to Turkish ports. Therefore, Izmir and Mersin ports are candidates to be the main ports in the region (Tozar et al. 2011:17).

4.1.4. The Impacts of the Project on Turkey's Aviation

In order to improve the international partnership in the field of aviation, "The TRACECA States First Meeting of the General Directors of the Civil Aviation" was held in Antalya on 29-31 March 2007, hosted by Civil Aviation General Directorate.

Within this scope, there was a deal on issues of aviation safety, rulemaking activities, legal issues, and supervision and observation competences, legislation, controller technical personnel exchange, certification, licensing, technical and flight education activities, aircraft maintenance, air navigation services and Air Traffic Control (ATF). Also, there was an agreement for partnership and coordination about issues such as the airfield infrastructure, terminal and ground services.

Moreover, it is foreseen that the partnership of the TRACECA countries in the field of aviation will improve as a result of subjects that were determined in the declaration signed at the end of the meeting. To have a safe and sustainable aviation in the region the first steps to provide an up-to-grade aviation market have been taken.

4.2. The Strategies of Turkey in the TRACECA Project

The intensity of energy and raw material in Caucasus, Caspian Basin and Central Asia sheered the international trade. By 2012, the anticipated annual trade

volume among the European-Asian corridors is about 75 million dollars (Yetkin, 2012: 25). Within the same year, goods exchange between Europe and Asia is 2 billion dollars, and transport price is over 200 million dollars (SIYASAL ILETISIM, 2013, http://www.siyasaliletisim.org). Turkey is directly affected, due to its geographical position, from the trade in the region.

Within the scope of the TRACECA project, a series of investments and technical assistance projects are carried out by the financial support of the European Commission and international finance companies. On that note, 64 technical and 15 infrastructure rehabilitation projects were funded until 2010.

Most of the financial support is used within the scope of the Technical Assistance to the Commonwealth of Independent States (TACIS). Not being a part of TACIS, Turkey experienced the difficulties in funding the proposed projects in the past. Under these circumstances, Turkish National Secretariat of the TRACECA raised the question of equal finance within the TRACECA programme in every platform and eventually Turkey became successful in its struggle.

By the year 2012, Turkey took part in 14 TRACECA projects, eight of which have been completed and six of them have been going on since 2013.

5. Conclusions

The TRACECA Project, which is called the modern Silk Road is the transportation project of European Union policies towards the Central Asia countries. This project aims to improve the economic relations, trade and transportation connections of the countries on the project route.European Union countries consider Turkey as the key country to enter the Central Asian and Caucasus market. The main reason for this is Turkey's geo-strategic position. After the Turkic Speaking Countries declared their independence, Turkey has the chance of gaining political and economic power in a wide area. EU cares about Turkey's close religious, language and cultural relations with these republics. Turkey's recent development achievements are also noticed. Similarly, Turkey took the task of being a bridge for the Central Asian and Caucasus countries to open up to western markets. It is only possible to reach to the region in a safe and quick way through Turkey. The Central Asia countries are struggling for this purpose since their independence. Turkey acceded the TRACECA project with its railways reaching several countries over Caucasus. Turkey is improving its transportation networks in the line of Europe-Asia (EURASIA). Marmaray has been completed to avoid congestions at the international traffic

and border crossings. The high-speed railway lines in the direction of Istanbul-Kars and 12 logistics base centers on these lines are completed. Turkey is contributing to the TRACECA with Kars-Tbilisi-Baku Railway Project.A substantial amount of transportation among Caucasus, the Central Asia and Europe will be able to be provided over Turkey. Turkey is in the position of an important bridge for transporting energy in the Middle East and Caucasus. And also, Turkey's strategic significance may increase in transportation by this project.

Turkey is located on the juncture of the three continents. Due to its geographic position that is of great importance for transportation lines, Turkey has grand potential for international transportation. Turkey's chance of being the base of railway and logistics in the region is very high after the adaptation of the TRACECA project. It is estimated that Turkey will improve its foreign trade volume and increase income of transit trade if it reaches the Central Asian market through the shortest route. After declaring their independence, regional countries could not complete their social and economic developments but they are aware of the significance of the project and its probable impacts. And this project provides Turkey wide economic opportunities.

Turkey's mission is to be aware of its key role in the project and act more seriously and fast in this issue. Additionally, Turkey must establish a better diplomatic relations with the Central Asian countries and the EU and take maximum advantage of the trade within the frame of the project. As a result, Turkey will be invited to join the European Union. On the other hand, Turkey has come a long way in gaining its dominance in the region by its own historical heritage and own resources without depending on the USA and the EU.

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12. The Importance of Turkey as a Potential Gateway Country in Eurasia for Sustainable Gas Supply

CAN DENIZ KOKSAL

Abstract

In particular, together with the recent political conflict between Ukraine and the Russian Federation, the military crisis which happened unexpectedly between Russian Federation and Turkey, have gained great importance into constituting and operating the reliable gas pipeline routes. The selection process of these possible routes and corridors is based on having right answers to the questions of multiple criteria which are related with the level of good neighborhood relations between countries, amount of energy demand and supply, amount of supply continuity, connectivity possibilities of new suppliers and demanders to the pipelines and the length of the pipelines. The described process also includes the identification and evaluation of ongoing and candidate pipeline routes such as; Blue Line, South Line, Ukrainian Line, German Line, Baku-Tbilisi-Ceyhan (BTC) and Trans Anatolian Natural Gas Pipeline Project (TANAP) with the quest for consensus among multiple decision makers.

Keywords: Analytic hierarchy process, Pipelines, Energy security

1. Introduction

Energy is one of the most important inputs for the economies of countries therefore it should be supplied by most economical and sustainable ways. Countries, which do not have enough natural resources to produce required energy for their use, are obligated to provide it from other sources. The European Union, known as one of the densly populated regions, needs continuous and clean energy for housing and industrial purposes beside its nuclear energy capacity. Geopolitically, the European Union is primarily dependent on the energy sources of the Eurasian region via pipelines. And, this energy dependence has been lasting for years and it seems it will last for many years ahead. But on the other hand, the ongoing crisis in the Caucasus and in the relations between Russia and Ukraine force the member countries of the European Union to find out more secure routes for these pipelines and transportation corridors together with the selection of supplier countries. Energy security issue is not solely an economic problem, but it is also a political and security issue, since the states are responsible for the welfare and well-being of their citizens and their economies (Kut, 2009).

The selection process of these possible routes and corridors is based on having right answers to the questions of multiple criteria, which are related with the level of good neighborhood relations between countries, the amount of energy demand and supply, the amount of supply continuity, the connectivity possibilities of new suppliers to the pipelines and the length of the pipelines. The described process also includes the identification and evaluation of candidate pipeline routes such as; Blue Line, South Line, Ukrainian Line, German Line, Baku-Tbilisi-Ceyhan (BTC) and TANAP Line with the quest for consensus among multiple decision makers.

2. Pipeline Geopolitics for Energy Security

In 1904, a British professor of geography, Sir Halford Mackinder, delivered a lecture before the Royal Geographical Society titled The Geographical Pivot of History, which was to shape a history of two world wars and subsequent wars and power relations. Mackinder, the father of geopolitics—the relation of geography and political economy and power—developed the systematic axiom of British imperial power. It was simple as it was fateful:

- Who rules East Europe commands the Heartland,
- Who rules the Heartland commands the World-Island,
- Who rules the World-Island commands the World.

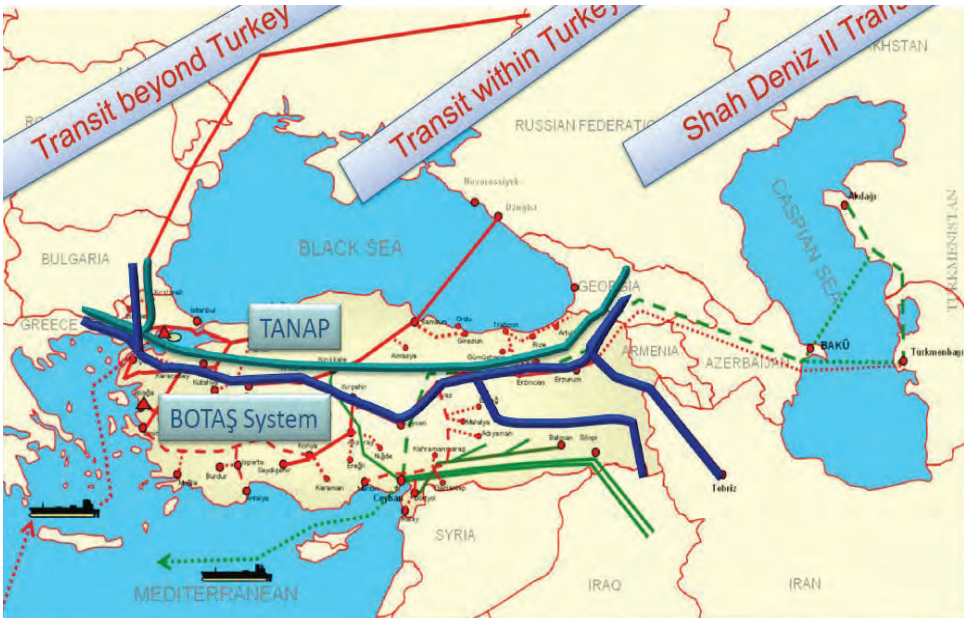
For Mackinder, East Europe was Continental Europe from Germany to Poland, France and Austria. The Heartland was the vast Eurasian land power, Russia. The World-Island was Eurasia. The meaning of this strong relationship between energy need and its geopolitics has never been changed since its delivery by words.

2.1 The Eurasian Energy Calculus

Calculus has two main variants—derivative and integral. The Eurasian energy pipeline geopolitics between Turkey, European Union (EU), Washington and Moscow today has elements of both. It is highly derivative in that the major actors across Central Asia from China, Russia to Turkey are very much engaged in a derived power game, which has less to do with any specific state and more to do with maintaining Superpower hegemony for Washington (Engdahl, 2009).

The future of any economic cooperation among the states of Eurasia, including Turkey, rests on the resolution of vital energy supply issues, but on the contrary, it means the same for EU countries as the energy demanders. Here, Eurasia is fortunate to straddle some of the richest energy regions on our planet, in Russia as well as the Caspian Basin state of Kazakhstan and the contiguous Middle East Gulf region.

Figure 12.1. **Primary and Proposed Eurasian Oil and Gas Pipelines to Europe**



Source: BOTAŞ (2014)

The role of pipeline geopolitics in the economic future of Turkey in particular and Eurasia in general generally is central. Among these actors from all sides, Russia brings to the table huge positive resource advantages in terms of its wealth of oil and gas reserves and energy technology no Western country possesses. Today the future of competing gas pipelines is at the heart of the Eurasian economic calculus. Here Turkey is in a position to play a central role given its geographic and historical role as a bridge between East and West, North and South - Europe and Eurasia. One key link through Turkey has been the oil and gas pipeline from Azerbaijan to the port of Ceyhan via Georgia. The Baku-Tbilisi-Ceyhan (BTC) oil pipeline and the Baku-Tbilisi-Erzurum gas pipeline are cited as part of Turkey's foreign policy strategy to become an energy conduit. By itself BTC, has limited strategic effect on the regional geopolitical balance without the effect of a second supportive project such as the much-discussed potential TANAP.

2.2. Turkey-Russia Cooperation Tied by Pipelines

Until the end of 2015, it was said of that, "…Turkish-Russian economic ties have greatly expanded over the past decade, with trade volume reaching $50 billion in 2013 and it is hoped to reach $100 billion by 2020, making Russia Turkey's number one partner (MOE, 2014). Gas and oil imports from Russia account for most of the trade volume. Turkey and Russia are already connected by the twin Blue Stream natural gas pipelines across the bottom of the Black Sea. Moscow and Ankara are talking about increasing deliveries through the network, which in 2008 carried 10 bcm of Russian gas to Turkey. More importantly, discussions are underway about a Blue Stream-2 project. It would be a new gas pipeline parallel to Blue Stream, in addition to the construction of a gas transportation system in Turkey by expanding Blue Stream to interlink with the proposed Samsun-Ceyhan line, with a spur line under the Mediterranean to Ashkelon in Israel".

After the military crisis which started at the end of 2015, the trustable situation between these trade partners began to seem to be broken due to Russia's restrictions on trade against the exports of Turkish originated products and services. But, on the other hand, despite this, there has been no reduction in energy-related trade volume up to now. According to analysts, this unexpected crisis will not compose large losses in the medium and long-term trade of the two countries.

Despite the ongoing crisis, the situation for Turkey, which currently imports 90% of its energy, the proposed projects would provide greater energy security

and, in the case of the Samsun-Ceyhan-Ashkelon pipeline, generate significant transit revenues. Preparations are also underway on possible extensions Turkey's gas lines across its Thracian territory to supply neighbouring Balkan nations Bulgaria, Serbia, Croatia and Hungary. In this case, Moscow would have gained a prime goal of lessening its dependency on the Ukrainian pipeline network for transit. Because, Russia has to choose the corridors and lines over Turkey while there are many serious and deep political problems with Ukraine. But, on the other hand, Turkey and Europe must have some different sources and routes of gas and oil to compensate for Russia's unilateral hegemony.

3. Multi-criteria decision analysis

Decision making problems faced by managements (public or private institutions) or sometimes individuals involve multiple criteria/objectives/attributes. Over the years, many quantitative methods have been developed to solve these types of complex problems and to facilitate making rational decisions involving multiple criteria (Abdullah and Rafikul, 2006).

3.1. Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process deals with complex decisions, rather than prescribing a «correct» decision. AHP helps the decision makers to find the one that best suits their needs and their understanding of the problem. It is based on mathematics and psychology and was developed by Thomas L. Saaty. The AHP provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions. It is used around the world in a wide variety of decision situations, in fields such as government, business, industry, healthcare, and education. AHP is most useful where teams of people are working on complex problems, especially those with high stakes, involving human perceptions and judgments, whose resolutions have long-term repercussions (Bhushan and Kanwal, 2004). Some decision situations to which the AHP can be applied include; Choice, Ranking, Prioritization, Resource allocation and Benchmarking (Forman and Saul, 2001).

3.2. Saaty's Scale of Importance for AHP Preferences

In application of AHP, users first decompose their decision problem into a hierarchy of more easily comprehended sub-problems. After it's built, the decision makers systematically evaluate its various elements by comparing them to one another two at a time. It is the essence of the AHP that human judgments, and not just the underlying information, can be used in performing the evaluations

(Saaty, 2008). These Pairwise comparisons as shown in Table-12.1. are made with respect to the given criterion of the control hierarchy and importance weights of each factor. The calculated values of pairwise comparisons are allocated in the columns of pairwise comparison matrix and priority vector is derived from eigenvector.

Table 12.1. **Saaty's Scale of Importance for Preferences**

Level of Importance	Explanations
1 : Equal importance	Importance of elements are equal
3 : Weak importance	First element is moderately more important than second one
5 : Strong importance	First element is strongly more important than second one
7 : Importance over the other	First element is very strongly more important than second one
9 : Absolute importance	First element is extremely more important than second one
2, 4, 6, 8 : Intermediate values	Intermediate values between above mentioned values
1/3, 1/5, 1/7, 1/9 : Reciprocal	Reciprocals for inverse comparisons

Source: Cheng and Li, 2001.

4. Selecting the Appropriate Pipeline with AHP

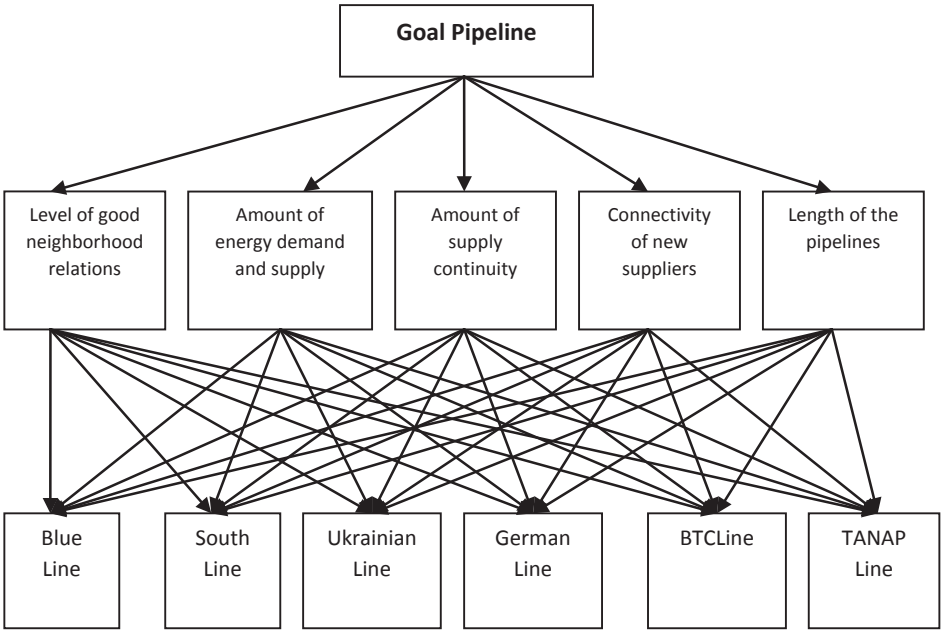
In this section of the paper, an AHP application is used in selecting the appropriate pipeline. The act of selecting the most appropriate pipeline brings its difficulties while there are many numeric and nonnumeric criteria to be compared pairwisely during the determination process.

4.1. Main Criteria and Alternatives

Criteria and alternative goal pipelines used in this study were gathered from the studies of (Socor, 2009; Olcott, 2009; Barysch, 2008 and Winrow, 2007) and were scored as knowledge by taking into account their conclusions. The outcome of this study was formed with focusing on goal as "level of good neighborhood relations between countries", "amount of energy demand and supply", "amount of supply continuity", "connectivity possibilities of new suppliers to the pipelines" and "the length of the pipelines".

The described process also includes the identification and evaluation of candidate pipeline routes such as; "Blue Line", "South Line", "Ukrainian Line", "German Line", "BTC" and "TANAP Line" were chosen to be the alternative lines. Proposed Analytic Hierarchic Process model is drawn in Figure 12.2.

Figure 12.2. **AHP Flowchart of Determining Most Appropriate Pipeline**



4.2. Forming Pairwise Comparison Matrices and Obtaining Priority Vector

As seen in Table 12.2., experts knowledge which was obtained from related documents in the field is tabulated as pairwise comparison matrix for "level of good neighborhood relations between countries" criteria indicating the inconsistency ratio (0,030) in the last row of Table.

Table 12.2. **Pairwise Comparison Matrix of Easy of Good Neighborhood Relations between Countries Criteria**

	Blue Line	**South Line**	**Ukrainian Line**	**German Line**	**BTC Line**	**TANAP Line**	**Relative Priorities**
Blue Line	1	3	1/5	1/4	3	7	**0,074**
South Line	1/3	1	1/5	1/2	3	5	**0,109**
Ukrainian Line	5	5	1	3	7	9	**0,035**
German Line	4	2	1/3	1	4	9	**0,030**
BTC Line	1/3	1/3	1/7	1/4	1	5	**0,274**
TANAP Line	1/7	1/5	1/9	1/9	1/5	1	**0,479**
Inconsistency Ratio = 0,030							

Although tables for other criteria are not printed in this paper due to space constraint, their "Relative Priorities" are given in related criteria columns of Table3 with their inconsistency ratios in the last row of the table. As can be concluded from Table 12.3., every criterion has different priorities on the alternative pipelines.

Table 12.3. **Priorities of Goal Pipelines according to Criteria**

	Level of good neighborhood relations	**Amount of energy demand and supply**	**Amount of supply continuity**	**Connectivity of new suppliers**	**Length of the pipelines**
Blue Line	0,074	0,069	0,050	0,076	0,147
South Line	0,109	0,143	0,169	0,096	0,093
Ukrainian Line	0,035	0,038	0,066	0,033	0,314
German Line	0,030	0,074	0,113	0,064	0,361
BTC Line	0,274	0,163	0,164	0,192	0,035
TANAP Line	0,479	0,512	0,437	0,539	0,050
Inconsistency Ratio	0,090	0,090	0,060	0,040	0,020

As a final step, with the conclusions of the answers gathered from expert knowledge, the cells of the comparison matrix of criteria for appropriate pipelines (Table 12.4.) are filled. While forming Table 12.4., priorities of Table 12.3. are used together with the "Relative Priorities of Criteria" which were calculated from the pairwise comparison of criteria using generalized knowledge of experts. According the results given in Table 12.4., relative priorities for alternative countries are found as; (0,070), (0,126), (0,056), (0,090), (0,181) and (0,477) for Blue Line, South Line, Ukrainian Line, German Line, BTC Line and TANAP Line, respectively.

Table 12.4. **Comparison of Criteria for Goal Pipelines**

	Level of good neighborhood relations	Amount of energy demand and supply	Amount of supply continuity	Connectivity of new suppliers	Length of the pipelines	Relative Priorities
Relative Priorities of Criteria	**0,102**	**0,157**	**0,268**	**0,440**	**0,033**	
Blue Line	0,074	0,069	0,050	0,076	0,147	**0,070**
South Line	0,109	0,143	0,169	0,096	0,093	**0,126**
Ukrainian Line	0,035	0,038	0,066	0,033	0,314	**0,056**
German Line	0,030	0,074	0,113	0,064	0,361	**0,090**
BTC Line	0,274	0,163	0,164	0,192	0,035	**0,181**
TANAP Line	0,479	0,512	0,437	0,539	0,050	**0,477** ✓

It is quite clear to choose the goal pipeline from these results that TANAP Line is the most suitable pipeline as it has best priority scores among all.

5. Conclusions

Competing over rival pipelines together with the potential ones which are against each other's interest, in this paper, we have tried to determine the most appropriate pipeline route among the six alternatives using AHP methodology. In the application section of the study, the AHP model of the problem is structured with the predefined and evaluated criterions; as "level of good neighborhood relations between countries", "amount of energy demand and supply", "amount of supply continuity", "connectivity possibilities of new suppliers to the pipelines" and "the length of the pipelines". The pairwise comparison matrix formed based on the knowledge gathered from expert knowledge and the customer expectations vector derived to find the weights of pipeline options. According to the results, TANAP Pipeline project is found as the best alternative among all with a relative priority 0,477.

At the larger scale, it is seemed that connecting TAP (Trans Adriatic Pipeline) (Socor, 2013) with TANAP Pipeline Project (Gulmira, 2014) with the possible future connectivity of Iraq and Eastern Mediterranean (Turkish Republic of Northern Cyprus, Greek Cypriot Administration of Southern Cyprus and Israel) sourced pipeline would bring a balancing alternative to Russia's undisputed hegemony on this issue by considerably freeing EU as demander and any other countries in the region as suppliers and transit countries. It is also concluded that Turkey appears as a potential and secure main hub country within the scope of these projects.

However, these proposed potentials of the possible lines should be evaluated carefully due to flexibilities of conjuncture, because the values of their criteria composition are changeable due to interests and policies of the global and regional powers.

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13. Water Management in Central Asia

SAULE AKHMETKALIYEVA

Abstract

This paper presents an overview of water management issues and current legislations in Central Asia. Management of available water resources is one of the main issues of the Central Asian states, namely, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. Poor water management in the past such as intense irrigation practices during the USSR and decentralization of the water management after its collapse has led to inevitable environmental issues, such as shrinking of the Aral Sea. Sharing of transboundary waters, mainly of the Syr Darya and Amu Darya rivers, remains the main point of conflict between the countries in the region. The upstream countries poor in natural energy resources are interested in using water resources to generate hydropower, while the countries downstream need water for agricultural purposes. Moreover, most of the agricultural technologies are outdated due to insufficient funding and this issue leads to water loss in the area. Drainage waters pollute rivers and streams aggravating the transboundary conflicts between the countries and causing health problems among the population living close by the river basins. Over the years, the Central Asian states have adopted state laws and regulations, and have come to an agreement with the neighboring countries regarding the transboundary issues. Numerous local and international organizations have launched programs for improvement of water management of Central Asia.

Keywords: Water management, Central Asia, Aral Sea, Agriculture, Hydropower

1. Introduction

Water is one of the main sources of life and it has been a topic of dispute in Central Asian countries for a long time. It is one of the key factors of social and economic developments of the Central Asian states, namely Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. Most of the rivers start in the upstream states: Kyrgyzstan and Tajikistan and flow further to the downstream states: Kazakhstan, Turkmenistan and Uzbekistan. Most of the water comes from the two major rivers: Syr Darya and Amu Darya. These rivers supply the Central Asian countries with water for irrigation, hydropower, industrial and domestic uses. Needless to mention, the waters from the two rivers used to be the source of water supply for the Aral Sea. The economy of the region is highly dependent on agriculture driven by irrigation from the transboundary water systems.

Overall, Central Asian region has abundant natural resources, including water resources. However, water is the main topic of dispute as well. Kyrgyzstan and Tajikistan are rich in glacier water resources. Sectors that consume most water are agriculture, domestic and municipal use, and industry. In states other than Kazakhstan 90% of water used accounts for agricultural sector (FAO, 2013). The Central Asian states are among the top water consumers per capita in the world. Turkmenistan is number one water consumer (m^3/capita) in the world, Uzbekistan is the fourth, Kyrgyzstan is the fifth, Tajikistan is the seventh and Kazakhstan is the eleventh (Varis, 2014). The water use per capita in Central Asia can be seen from table 13.1. The main water user in the region is Turkmenistan. In the short to medium term perspectives the problem of shared water management and inefficient water supply systems can cause conflicts and affect economic development. In addition, in the long run the depletion of water resources can lead to socio-economic disaster and another environmental catastrophe.

There are many factors influencing the water management in the area. The poor water management in the past, the outdated post-soviet irrigation systems, arise of competing sectors (hydropower and agriculture), climate change, population growth are to name only few. Central Asia is seeking ways of improving water management in the area.

The paper proceeds as follows. Firstly, Section 2 provides information regarding the geographical location of Central Asia and main water bodies in the region. Secondly, Section 3 focuses on issues that Central Asian states are facing, including problems of post-soviet irrigation, conflicts between competing

sectors of upstream and downstream countries, such as energy and agriculture, environmental issues that have arisen due to water management in the area, environmental disaster of the Aral Sea Basin, and finally, issues at the Ferghana valley, Uzbekistan. Next, Section 4 provides an overview of the recent water management history in Central Asia. Further, Section 5 describes current water management practices, legislation and issues related to it in the Central Asian states. Mitigation actions to prevent and to solve water management problems are described in Section 6. Finally, the conclusion provides information about the main issues of the water management in Central Asia.

Table 13.1. **Water Use in Central Asia by Countries**

Country	Water use, m^3 per capita	Water use, m^3 per hectare
Kazakhstan	2,927.3	8,848.1
Kyrgyzstan	1,113.5	6,725.8
Tajikistan	1,832.2	12,434.8
Turkmenistan	4,323.6	11,454.1
Uzbekistan	1,740.5	10,067.2

Source: CAWaterInfo, 2011

2. Study Area: Central Asia

Central Asia is a vast landlocked region located in the heart of the Eurasian continent. Five countries comprise Central Asia, namely Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan and Turkmenistan. The area consists of highlands, deserts and steppe, besides, forests are present in the northern part of Kazakhstan. Drylands comprise about 75% of the area. The region is sparsely inhabited and vegetated due to climatic and environmental conditions of the region.

Most of the rivers and streams are fed by glaciers and precipitations in highlands that reach nearly 1000 mm a year, and are transboundary in nature. The rivers start in the upstream states: Kyrgyzstan and Tajikistan and flow further to the downstream states: Kazakhstan, Turkmenistan and Uzbekistan. Glacial melting in the summer months is the reason behind the flow maximum at this period of time. There is a number of rivers and streams running across the territory of Central Asia. However, most of the water comes from the two major rivers: Syr Darya and Amu Darya. The Syr Darya (1400 km long) starts in the Ferghana mountains, and is fed by Naryn. The river flows northward and feeds the Aral Sea from the northeast. The Amu Darya (2500 km long) takes a start at Pamir mountains and northern Hindu Kush. The main tributaries of the Amu Darya River are the Vakhsh and the Panj Rivers. The Vakhsh is one

of the main rivers of Tajikistan and the Panj flows across the Afghanistan and Tajikistan border. The main tributary of the Panj River is the Bartang River. Other tributaries of the Amu Darya are the Murghab and Hari Rivers. The Amu Darya feeds the Aral Sea from the south. The Zaravshan River waters the area between Samarkand and Bukhara and dries up in the desert sands. The Atrek River drains into the Caspian Sea in Turkmenistan (Central Asia, n.d.).

Moreover, man-made water reservoirs play an important role in the water system of Central Asia. Most of the reservoirs were constructed during the Soviet era in order to meet irrigation needs of the area. There are about 300 water reservoirs in Central Asia. About 30% of irrigated water is supplied by those reservoirs. After the 1990s only few reservoirs were constructed in the area. For example, only 3 reservoirs are under construction in Uzbekistan in the Namangan, Jizzak and Samarkand provinces (Rakhmatullaev et al., 2010).

Agriculture is one of the main source of income for the Central Asian states, which contributes to about 20% of GDP, with an exception of Kazakhstan that heavily relies on energy sector for economic revenue (Boonstra and Hasanova, 2012). According to the Central Intelligence Agency (n.d.), the share of GDP in the agricultural sector of Kazakhstan is only 4.9%. Meanwhile, agriculture accounts for about 19.3% of GDP in Kyrgyzstan, 27.2% in Tajikistan, 13.2% in Turkmenistan and 18.5% in Uzbekistan.

The climate of the area is arid to semi-arid with a low amount of precipitation. Most of the land is dry and unsuitable for agriculture, except for the banks of the Amu Darya and Syr Darya rivers, increasing the dependence of the nations on the rivers for agricultural irrigation. Cotton and wheat are the two main types of crop grown in Central Asia, and both types are water-intensive.

Moreover, Central Asia is home for two inland seas: the Caspian Sea and the Aral Sea. Since the collapse of the Soviet Union the geopolitical status of the Caspian Sea has not been decided upon, and the intensive irrigation has led to the environmental catastrophe of the Aral Sea near-extinction.

3. Issues on Water Management in Central Asia

3.1 Post-Soviet Irrigation

The territory of modern Central Asia is one of the oldest regions of civilization. Strategic location between Asia and Europe makes the Central Asia an important hub that connects the east and the west. In the 19th century the lands of Central Asia were added to the territory of Russia. This period in history marks

the new era of development of agricultural sector in Central Asia. Later the territory was part of the USSR. During the Soviet era the countries of Central Asia had an immense socio-economic development.

Soviet irrigation system was mostly concerned with producing high yields of crops, in particular, cotton. Cereals, mostly wheat and cotton are the main types of crop, along with fodder and pastures grown in Central Asia. During the Soviet era the main crop was cotton, nowadays the main type of crop grown in Central Asia is wheat. The share of cotton grown in Central Asia decreased from 45% to 25% between 1990 and 1998, while the share of cereals including wheat, rice and maize increased from 12% to 50% (CAWaterInfo, n.d.). The amount of harvested irrigated crops by country in Central Asia can be seen in Table 13.2. From the table it can be seen that Uzbekistan and Turkmenistan are the main two countries producing most of the crops. The share of wheat in Central Asia is about 39%, with 45%, 35%, 35%, 24% and 17% shares in crops in Turkmenistan, Kyrgyzstan, Uzbekistan, Tajikistan and Kazakhstan respectively. In the meantime, the share of cotton in Central Asia is about 23%, with 38%, 33%, 32%, 11% and 4.5% shares in crops in Uzbekistan, Tajikistan, Turkmenistan, Kazakhstan and Kyrgyzstan respectively. However, cotton and wheat are both water intensive crops. For example, 20,000 liters of water are required to produce 1 kg of cotton (WWF, n.d.). Production of 1 kg of wheat requires about 1,000 liters of water (Waterwise, 2007).

Table 13.2. **Harvested Irrigated Crops in Central Asia in Hectares (ha)**

Crop	**Kazakhstan**	**Kyrgyzstan**	**Tajikistan**	**Turkmenistan**	**Uzbekistan**	**Central Asia**
Year	2010	2005	2009	2006	2005	
Wheat	208 000	360 700	179 742	917 000	1 295 000	2 960 442
Cotton	134 200	45 500	237 130	652 000	1 406 000	2474830

Source: FAO, 2013

During the Soviet era the water use for irrigation purposes has been constantly increasing since 1960s leading to the Aral Sea environmental catastrophe. After the collapse of the USSR the five Central Asian states faced problems of water management due to sharing of the previously commonly used agricultural and energy sectors.

High water demand for irrigation purposes is a main outcome of the outdated technology used in agricultural sector. Most of irrigation systems in Central Asia have been in operation for 30 to 40 years (IWMI, 2009).This can be seen as water losses from canals and furrows. Another problem occurring in the agricultural sector is waterlogged land, which has a high salt content and is bad for crop growth. Also, demand for water resources does not always meet the natural water supply. This is especially true for Uzbekistan and Turkmenistan.

Subsurface drainage that accounts only for 26.2% of drainage systems in Central Asia is thought to be the most effective system to avoid soil salinization problems (CAWaterInfo, n.d.). However, after the collapse of the USSR, the systems are not properly maintained due to lack of investments, also they initially were poorly designed and constructed. In some areas drainage systems are not in use for these reasons. Full control irrigation is accounted for 93% of the irrigated area, 98% of which is outdated surface irrigation (FAO, 2013). For example, surface irrigation is the main type of irrigation in Tajikistan despite the inefficiency. In order to remedy the situation investments into the modernization of irrigational systems of the Central Asian states are needed. For example, the demand for investments in agricultural sector of Kyrgyzstan is predicted to amount to 72 billion KGS (over $1 billion). The experts estimate the demand for investments in irrigational systems of the country to amount to at least to $15 million annually. In 2014 a total of 22 investments into the agricultural sector of the country amounted to $17.1 million. (Ministry of Agriculture, 2015).

3.2 Competing Sectors: Energy versusIrrigation

After the collapse of the Soviet Union ongoing competition between the energy generation and irrigation sectors of the upstream and downstream countries, management of water resources has been a hot topic of discussion. The downriver countries, Kazakhstan, Turkmenistan and Uzbekistan, are water consumers for agricultural purposes. Giant hydroelectric power plants (HPPs) in Central Asia were initially designed to operate in the water mode with the main purpose of ensuring stable and reliable water release and flood control. However, nowadays these HPPs mainly operate in the energy mode, thus, causing unduly water release to downstream states and increasing risk of flooding. Also the unbalanced cooperation between the countries regarding the water use for energy and agriculture due to planned construction of giant dams such as Rogun and Kambarata might turn into water shortages in the agricultural sector in summer, in favor of hydropower generation in winter. Moreover, attempts to implement projects of construction of hydraulic structures with dams in the

upstream countries can potentially cause an immense damage to the entire ecosystem of the region and lead to environmental, economic and social disasters. Another reason behind the disagreements between the upstream and the downstream countries is monetization of energy exchange. The downstream countries rich in fossil fuels introduced pricing policy for the energy that used to be supplied free of charge to the upstream states during the Soviet Union. The upstream states also want to introduce pricing for water supplies or for using the HPPs in energy mode. This causes tension and affect water management in the area. Total dam capacity in Central Asia reaches 180.5 km^3 with the largest dams in the region: Bukhtarma (Kazakhstan), Toktogul (Kyrgyzstan), Kapshagay (Kazakhstan), Nurek (Tajikistan) and Tuyamuyun Hydro Complex (Uzbekistan) (FAO, 2013).

It is planned to construct the world's tallest dam (335 meters) on the Rogun hydropower plant in Tajikistan. The critics argue that it can potentially lead to an increase of 22% of water deficit that can consequently lead to exacerbation of drought conditions in the area (Ivanova, 2011). The World Bank initiated the Fifth Information-Sharing and Consultation Meeting on the Assessment Studies of the Proposed Rogun Hydropower Project in June 2014. All the riparian countries participated the meeting, and as a result of the meeting the Environmental and Social Panel of Experts concluded that construction of the Rogun dam (300-335 m high, 1255-1290 m full supply levels) is feasible. The panel has also concluded that environmental and social impacts of the dam can be mitigated (World Bank, 2014).

Water conflict between Tajikistan and Uzbekistan has arisen over the Rogun Dam project. Tajikistan holds high hopes regarding the construction of the dam. The country is looking forward to overcome the energy shortage issues of its own and to become an energy exporter to other countries such as Kyrgyzstan, Afghanistan and Pakistan (Putz, 2015). While Tajik government perceives the project as an economic and hydro energy opportunity, despite the assessment results of the World Bank Uzbekistan is concerned with threat to a flow of the Vaksh River. Also, as a downstream country Uzbekistan would suffer greatly in case of any disastrous situation created by failure of the dam. In case of a disaster or an accident 1.5 million hectares of land and more than 700 settlements in the territory of Tajikistan, Afghanistan, Turkmenistan and Uzbekistan with a population of 5 million people would be flooded (Ivanova, 2011). Nevertheless, the experts state that if Uzbekistan to sponsor the project, it would be able to control the annual release of water downstream (Kasymov, 2013). Also, Kayrakkum reservoir in Tajikistan is another topic of dispute between the Central Asian states, and in particular, between Tajikistan and Uz-

bekistan. The dam supplies water for agricultural purposes in Uzbekistan and for hydropower in Tajikistan (Project information, n.d.).

Another water management conflict is between Kazakhstan, Kyrgyzstan and Uzbekistan. Unlike Kazakhstan and Uzbekistan, Kyrgyzstan has limited oil and gas resources. Therefore, the country mostly relies upon hydropower in order to meet its energy needs. However, demand for energy increases in winter, creating a conflict between upstream and downstream countries for water resources released in winter months for hydropower and irrigation needs in summer months. So the Toktogul reservoir in Kyrgyzstan is an example of conflict between the upstream of the Syr Darya basin, Kyrgyzstan, and two downstream countries Kazakhstan and Uzbekistan (Abbink, et al., 2005). Kazakhstan and Uzbekistan are interested in storing water for irrigation purposes in summer months, while Kyrgyzstan is interested in using water from the reservoir for hydropower in winter.

Turkmenistan and Uzbekistan have very high water consumption amounts due to outdated irrigation systems, and conflicts have arisen over the wasteful practices between these countries. Another conflict between the two countries is triggered by the construction of the "Golden Age Lake" in Turkmenistan. The Turkmen government hopes to improve the environmental situation in the Amu Darya basin, while Uzbekistan is concerned with contamination due to evaporation and with the risk of siphoning of water from the Amu Darya River (Jenkins-Young, 2013).

However, despite the remaining conflicts, over the years the independent states learnt to deal with a number of transboundary water management issues. For example, Kazakhstan and Kyrgyzstan reached an agreement on supplying energy resources to Kyrgyzstan in winter, in order to preserve precious water resources for agriculture. Also, Kazakhstan and Kyrgyzstan came to an agreement regarding the transboundary waters of Chu and Talas rivers in 2000 (Chotaev and Nurbek, 2013). In 1998 Kazakhstan, Kyrgyzstan and Uzbekistan agreed upon usage of dams in the upper Syr Darya (Granit, et al., 2010). Despite the conflicts, the "Water Management Partnership Agreement" was signed in 1996, and as a result the Tuyamuyun dam was recognized as being located on the territory of the Republic of Uzbekistan (FAO, 2013). Also despite the discontent of Uzbekistan with such decision, in the framework of the Agreement of 18 February 1992, construction of the Kambarata 1 and Rogun reservoirs in Kyrgyzstan and Tajikistan respectively were planned. Later the "Agreement on joint actions to address the problem of the Aral Sea and socio-economic development of the Aral Sea basin" was signed in 1996 (FAO, n.d.).

3.3 Environmental Issues Related to Water Management

Water quality is also an issue between the upstream and downstream countries. Generally, downstream countries have lower water quality as opposed to the upstream countries due to the accumulation of discharged wastewater. The studies show that settlements located midstream and downstream from the Amu Darya and Syr Darya Rivers are prone to be affected by waterborne diseases (Votrin, 2003).

Water management issues have led to numerous environmental problems in Central Asia. The five Central Asian states are bounded by the Aral Sea Basin. Non-point pollution, mainly from agricultural runoff, is the main reason behind the poor water quality in the basin. Intensive irrigation practices in the region have resulted into lowering of water quality and land degradation issues. Using water for irrigation led to insufficient water income into the Aral Sea from the Amu Darya and Syr Darya rivers, which subsequently led to desiccation of the Aral Sea and an increase in the salinity from 10 to 60% (FAO, 2013). Also, according to SIC ICWC (2011), 30% of municipal waste and 50 to 60% of agricultural wastewater discharged into the Amu Darya River is untreated.

Infiltration of runoff from irrigation waters that is full of chemicals and pesticides, low water quality due to discharge of agricultural, industrial and municipal waste, and water discharged from return flow from collector drains into the inflowing rivers in conjunction with climatic conditions cause soil degradation of the Aral Sea Basin. Soil salinization due to high salt content in the rivers of Central Asia is a major problem. The studies show that only half of 50 million tons of salt washed into the Amu Darya River comes from natural sources. Similarly, about 20 million tons of salt dissolved in waters of the Syr Darya River comes from drained return flow (SIC ICWC, 2011).

On top of that, arid climate in the region causes soil salinization due to lack of precipitation. Hydrology of the Central Asia is highly affected by global warming. The rivers of Central Asia are under risk of depletion due to reduction of glacier reserves. At first, glacial melting can lead to an abundance of water resources and as a result to floods, land- and mudslides in highlands. However, further melting of the icecaps can cause drought conditions of the rivers fed by seasonal floods due to disappearance of glacial resources. 0.1% to 0.8% of the glaciers in the Tien Shan mountains have already melted away in the last decades, causing an increasing demand for freshwater sources in the area (Source: Universite de Geneve, 2012). For example, it is predicted that Amu Darya's water content will decrease by 5 to 15% by 2085 (FAO, 2013). An increase in

temperature, a decrease in precipitation and an increase in evaporation alters water cycle and potentially cause drought conditions. Climate change alters rainfall patterns leading to difficulties associated with watering rain fed agricultural areas. Climate change and global warming have provided temporary water resources due to glacial melting; however, the situation is expected to be aggravated by the end of the 21st century due to lessening of the snow and ice covers (Eurasian Development Bank, 2009). Central Asia is also a subject of flooding, and global warming has aggravated the issue even further. The environmental issues in Central Asia caused by irrational water management practices has caused socio-economic and health problems in the region.

3.4 Aral Sea Basin Environmental Disaster

In 1960s the Aral Sea was fourth largest sea in the world (Lindsey, 2000). However, over the years the Aral Sea has been gradually shrinking, leading to one of the greatest global environmental catastrophes of the near-disappearance of the Aral Sea (see figure 13.1.). The reasons behind the crisis are irrational water use for irrigation purposes during the Soviet era, salinization of irrigated lands, water, air, and soil pollution jointly with arid climate in the region (Spoor, 1998). The Aral Sea is mainly fed by Amu Darya and Syr Darya Rivers. Some tributaries also feed the Aral Sea; however, most of them are ephemeral in nature and inflow into the sea only during wet seasons.

Agricultural water withdrawal and construction of major dams is the main reason behind the water shortage in the Aral Sea basin. While some areas were historically irrigated, most of the irrigation areas have been a result of the USSR's intense agricultural practices in Central Asia. As part of the Soviet five year plans, the irrigation area in the Aral Sea basin had increased from 4.5 million ha in 1960 to 7 million ha in 1980 (FAO, 1998). By the early 80s only 7 km^3 of water reached the Aral Sea, the rest was used up for irrigation purposes (Spoor, 1998). Over 90% of the agricultural area in the Aral Sea Basin is artificially watered. Currently the irrigation area of the Central Asia, including Afghanistan is 13 million ha (FAO, 2013). The Aral Sea is not a single water body anymore, nowadays there are two parts of the sea: Northern, located on the territory of Kazakhstan (Small Aral) and larger Southern part located in Uzbekistan (Large Aral).

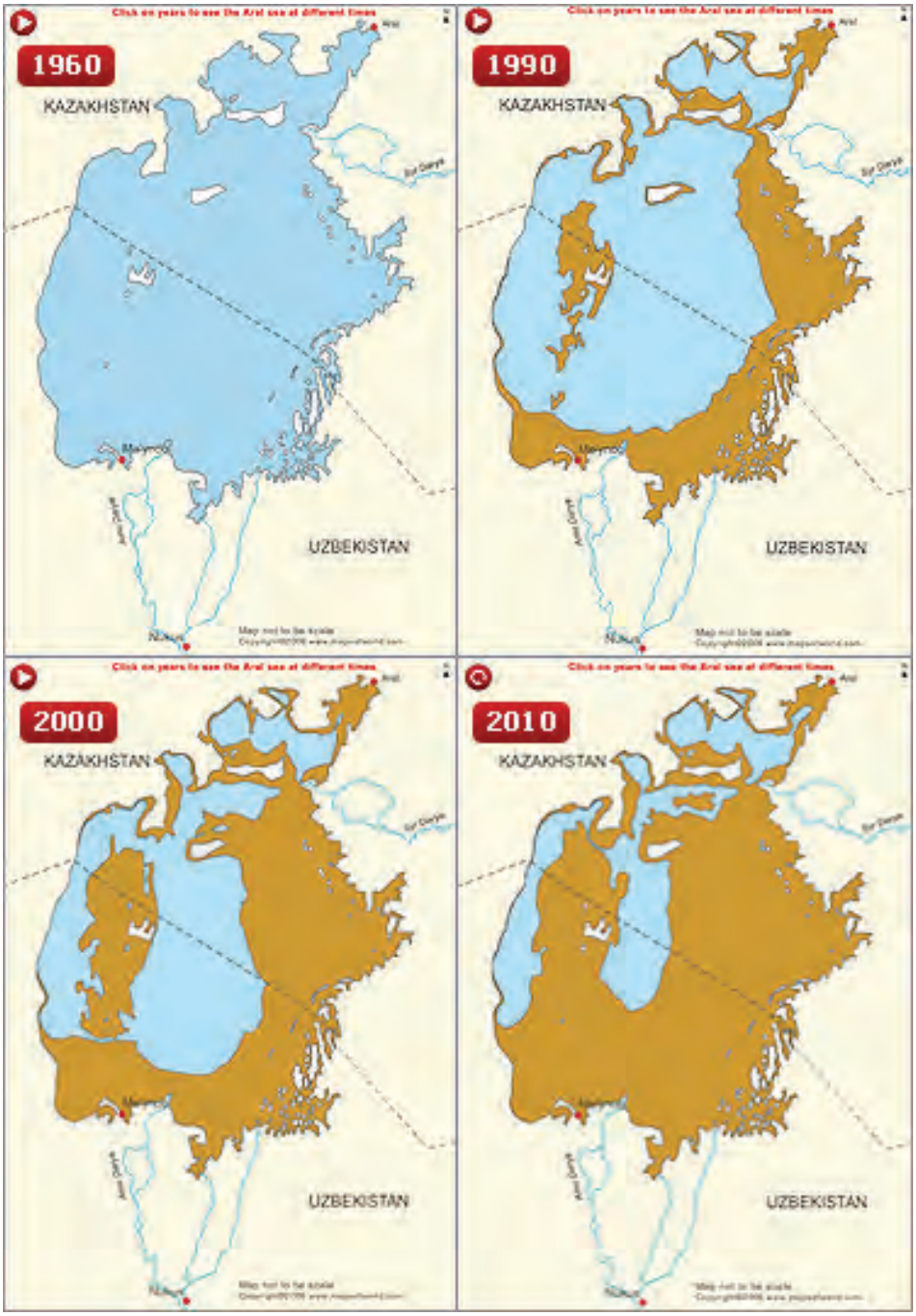
In 2005 Kazakhstan in cooperation with the World Bank built a Kokaral dam in order to trap water within Small Aral. The project has proven itself to be efficient. The water level in the Small Aral has increased by 12 meters since 2003. The shoreline has also shifted from 100 km to 12 km away from the Aralsk

town. The project even reinstated fishery in the sea. The catch increased from 695 tons in 2005 to 5,595 tons in 2014. Even though there is an obvious progress a lot needs to be done to reinstate the fishery before the catastrophe that stood at 34,160 tons (Bland, 2005). Meanwhile, the situation in the Large Aral has deteriorated even further. The Large Aral had split into eastern and western lobes. The eastern lobe disappeared in 2014. The government of Uzbekistan still runs inefficient irrigation practices. The critics argue that the Kokaral dam negatively affected the Large Aral leading to further lowering of water in this half of the sea (Lindsey, 2000).

According to Wolf and Newton (2008), the "Agreement on Cooperation in the Management, Utilization and Protection of Interstate Water Resources" was signed in 1992 by the Central Asian states. The agreement was aimed at jointly solving the Aral Sea issues. The Interstate Commission for Water Management Coordination was established in the framework of the agreement in order to manage the issues related to the agreement. Also, the "Agreement on Joint Actions for Addressing the Problems of the Aral Sea and its Coastal Area, Improving of the Environment and Ensuring the Social and Economic Development of the Aral Sea Region" was signed in 1993. The coordination of the agreement was conducted by newly established Interstate Council for the Aral Sea (ICAS). The funding was managed by the International Fund for the Aral Sea (IFAS). A long term program targeted towards solution of the Aral Sea crisis, the "Concept" and a short term solution, the "Program," were adopted in 1994 (Wolf and Newton, 2008). According to FAO (2013), the "Agreement on Joint Actions to Address the Problems of the Aral Sea and Socio-Economic Development of the Aral Sea basin" was signed in 1996 by the same five independent countries. The two organizations ICAS and IFAS were joined into IFAS to implement the Aral Sea basin programme. The organization is managed by the deputy prime ministers of the Central Asian countries. One of the main goals of the agreement is to increase the water inflow into the Aral Sea (FAO, 2013).

It can be concluded that the volume of the Aral Sea has dramatically decreased mainly due to intensive irrigation and to poor water management. There have been several programs initiated in order to overcome the consequences of the crisis. However, the disaster has not been reversed yet.

Figure 13.1. **Changing dynamics of the Aral Sea (1960-2010)**



Source: Seria a pegada, 2015

3.5 Case Study: Water Management Projects in the Ferghana Valley

Ferghana valley is a flat valley floor with rich soils in Central Asia located on the territory of Kyrgyzstan, Tajikistan and Uzbekistan. Ferghana valley has the highest population in the area and the main source of income of people living

in the valley is an agriculture. The water for agricultural irrigation is fed by Karadarya and Naryn rivers that make up larger Syr Darya River, and other smaller streams. Water resources of the Ferghana valley is a topic of dispute between the countries sharing the valley because of interdependency in terms of energy and water for irrigation. Also, after the collapse of the Soviet Union the border conflict that was an issue even during the soviet era has aggravated even further. Therefore, two main areas of conflict in the area can be specified as conflict over natural resources and socio-political problems (Baker, 2011). From the standpoint of water management, an absence of well-organized drainage system is one of the main problems in the area. High seismic activity of the region causes a potential risk of flooding. Also rising of groundwater table (GWT) can damage infrastructures in the area. High GWT causes problems such as waterlogging, flooding of the settlements and soil degradation due to salinization which consequently lead to poverty of the already underdeveloped region. Therefore, projects aimed at improving irrigation and drainage systems has a potential to create better farming conditions in the valley.

One of the projects aimed at improving the water management issues in the valley is the Ferghana Valley Water Resources Management Project initiated by the World Bank that was approved on July 26th, 2005. The project was conducted in Tajikistan and the main objectives of the project were to improve the agricultural infrastructure and to solve security issues at the Kayrakuum Dam and Reservoir by improving water management strategies. Despite the difficulties during the implementation of the project such as cost overruns and slow implementation, the project was successfully completed on May 31st, 2014 with a total cost of US $14.17 million. As a result of the project 3530 ha of flooded and waterlogged land areas within project perimeters near embankments were reduced, 7349 ha of land was returned to effective irrigation, 86% of water fees were collected by WUAs, early warning systems were established, and 6 forecast accuracies of reservoir storage and inflow/outflow volumes were improved (World Bank, 2014).

Another water management program initiated in 2001 by International Water Management Institute (IWMI) and the Scientific Information Centre of the ICWC (SIC ICWC), the Integrated Water Resources Management in the Ferghana Valley (IWRM-Ferghana), is sponsored by the Swiss Agency for Development and Cooperation (SDC). The project is aimed at improving water management practices by establishing water user groups (WUGs) and water user associations (WUAs), by setting up the system-wide management organization (SMO), by establishing the union of system-wide water users (UWU) in order to join forces and by establishing system-wide water committee (SWC), the water management entity governed both by the government and by ordinary water users. The project is also concerned with transboundary issues in

the area (IWMI, 2001). The initiatives taking action at the valley is an example of how water management conflicts can be solved by applying international practices to sharing natural resources and to solving transboundary issues. Similar practices and programs can be applied to the entire region of Central Asia.

3.6 Other Issues on Water Management in Central Asia

Inadequate water management is widely practiced both on the governmental and local levels. Lack of centered management and of appropriate laws and regulations lead to numerous problems. For example, lack of maintenance, inadequate management, impoverished soils, old equipment, political instability and insecurity are the other issues related to water management in the Central Asian states. Evaporation from artificial lakes and ponds is another problem of sustainable water management. Especially taking into account hot summer months that exacerbate the evaporation. An increase in temperature, a decrease in precipitation and an increase in evaporation alters water cycle and potentially cause drought conditions (desiccation of water in the Aral Sea basin) in already prone to drought Central Asia. Outdated technologies cause water loss issues. Other than outdated technologies the lack of maintenance of the existing equipment due to lack of financing often leads to water loss. Due to water loss the efficiency of the irrigation systems in Central Asia is only at 55% (FAO, 2013). Inadequate water drainage systems have also caused salinization and water logging problems in the area. Moreover, usage of chemical fertilizers and repeated usage of irrigation lands cause an issue of impoverished soils. Besides, there is a lack of timely information sharing among Central Asian states, especially in the emergency situations.

4. Overview of the Recent Water Management History

The water management in Central Asia went through numerous transformations throughout the agricultural history of the region, the main one being the transformation to and from Soviet water management policy was aimed at promoting cotton industry in Central Asia. Central Asia is emerging as a separate independent entity. Decentralization of water management after the collapse of the Soviet Union has led to numerous problems, the main one being the collapse of previously well planned economic system and shift to new for the Central Asian countries market economy (Abdullaev and Rakhmatullaev, 2015).

After adaptation of the Belovezhskoe Agreement in 1991, the five independent Central Asian states faced an economic crisis (Slivenko, 2014). As the main income of the countries was based on the agricultural sector, this sector has suffered the most. The system of exchange of goods between the post-soviet

countries collapsed and the countries established a market economy despite the lack of previous experience.

The "Basics of water legislation of the USSR and Union Republics" signed in 1970, was the basis of water management in Central Asia countries (FAO, 2013). Before the collapse of the USSR, the last plans of the Soviet era for development of water resources in the Amu Darya River basin, adopted in 1987, and Syr Darya River basin, adopted in 1982, were followed when allocating these transboundary water resources (McKinney, 2004). However, after the collapse of the USSR the newly independent countries had to adopt new state laws and regulations. After the collapse of the Soviet Union in 1991, the countries agreed upon regulations of water allocation on February 18, 1992 (Votrin, 2003). According to McKinney (2004), the agreement on "Cooperation in the Field of Joint Management and Conservation of Interstate Water Resources" was also signed between the Central Asian states and the Interstate Coordination Water Commission (ICWC) was established in the framework of the agreement. The ICWC is the major water management entity in Central Asia and is responsible for water management, allocation and monitoring. However, even though the agreements were signed, in the reality, actual transboundary water sharing and cooperation was far from being reached.

Apart from the main agreement signed in 1992, other water management agreement were also signed since then. According to the FAO (2013), Kazakhstan adopted "Water Code" in 1993, with following two amendments in 2003 and 2009; Kyrgyzstan adopted "Water Code" in 2005; Tajikistan adopted "Water Code" in 2000; Turkmenistan issued "Water Code" in 1972, later in 2009 the country adopted the "Introducing amendments to some legislative acts of the Republic of Uzbekistan in connection with the deepening of economic reforms in agriculture and water management;" Uzbekistan adopted "Water Law" in 1993. Today different local and international organizations and ministries participate in water management on a regional level.

Nowadays, a number of water management project are implemented in Central Asian states on national and international levels by local and international agencies (Table 13.3.). Due to lack of funding countries seek for an international funding from developed countries. The main donor programs in the region are initiated by the United Nations Development Programme (UNDP), the World Bank, the Asian Development Bank (ADB), the European Union (EU), the Organization for Security and Cooperation in Europe (OSCE), the Global Water Partnership (GWP) and others (UNDP, 2004). Even though international organizations provide help to the Central Asian states in terms of transboundary water management, it is a responsibility of each country separately and in collaboration with each other to solve the water issues in the region.

Table 13.3. **Implemented and Ongoing Projects by International Organizations**

International Organizations	Projects & Programs
Asian Development Bank (ADB)	- Central Asian Regional Economic Cooperation (CAREC) forum; - Regional project on management of shared watercourses; - Investments with Water Resources Ministries/ Committees in Central Asia; - Asian Development Bank Projects in Chu-Talas; - Asian Development Bank Projects in Syrdarya and Amu-Darya
Economic and Social Commission for Asia and Pacific (ESCAP)	- Inventory of Transboundary Rivers in the Asia - Pacific Region
European Union	- Technical Assistance for the Commonwealth of Independent States program (EU/TACIS); - Regional environment programme for Central Asia (EURECA)
GIZ - German Federal Foreign Office	- Transboundary water management in Central Asia
Global Water Partnership	- Global Water Partnership's Caucasus and Central Asia program (GWP-CACENA)
Green Cross International	- Water for Peace
International Fund for saving the Aral Sea (IFAS)	- Northern Aral Sea and Syrdarya Control project; - Programme on improving the Central Asian Hydromets Service; - Regional Transboundary Water Dialogue Support
International Water Management Institute (IWMI)	- Analyzing and comparing regional security implications of micro-, meso- and macro-level water management collaboration and policy options in Central Asia; - Asian water security outlook 2010; - Bright spots in Central Asia for capacity building and knowledge sharing; - GIS and remote sensing support for transboundary water management in Central Asia; - Improving land and water productivity in Makhtaral irrigation project, Kazakhstan; - Improved potato varieties and water management technologies to enhance water use efficiency, resilience, cost-effectiveness, and productivity of smallholder farms in stress-prone CA environments; - Integrated water resources management in the Ferghana Valley; - MAR in the Syrdarya River Basin; - Revitalizing irrigation and agricultural water governance in Asia to meet Millennium Goals; - Strengthening the capacity of local stakeholders in agricultural innovation systems through strategic alliances in the Ferghana Valley Groundwater and irrigation canal water-case study; - Sustainable groundwater management in Central Asia; - Sustainable use of groundwater in Central Asia; - Water productivity improvement at plot level

Table 13.3. (Continued). **Implemented and Ongoing Projects by International Organizations**

Interstate Coordination for Water Coordination of Central Asia (ICWC)	-	Fergana Valley Project
Organisation for Security and Cooperation in Europe (OSCE)	-	Support for the Creation of a Transboundary Water Commission on the Chu-Talas Rivers between Kazakhstan and Kyrgyzstan
Regional Environmental Centre for Central Asia (CAREC)	-	Harmonization and Approximation of Water Standards and Norms in Central Asia;
	-	Local Multi-sectorial Efforts for the CAI Water Dialogue
United Nations Economic Commission for Europe (UNECE)	-	Project "Regional dialogue and cooperation on water resources management in Central Asia";
	-	Capacity building for cooperation on dam safety in Central Asia;
	-	Support for the Creation of a Transboundary Water Commission on the Chu and Talas Rivers between Kazakhstan and Kyrgyzstan (Chu-Talas I);
	-	Developing cooperation on the Chu and Talas Rivers (Chu-Talas II);
	-	Water quality in Central Asia;
	-	Strengthening cooperation on hydrology and environment between Afghanistan and Tajikistan in the upper Amu Darya River basin;
	-	Network of EECCA Water Management Organizations
United Nations Development Programme	-	Support in organization of the 2003 Global Freshwater Forum;
	-	Project to help the Water Resources Committee of Kazakhstan develop a National Integrated Water Resources Management Plan;
	-	GEF Caspian Enviornmental Program;
	-	UNDP 2004-2007 water strategy program;
	-	Adaptation to climate change in the Chu-Talas river basin
United Nations Development Programme (UNDP) & United Nations Economic Commission for Europe (UNECE)	-	Water and Climate Change
World Bank	-	Aral Sea Basin Program;
	-	Central Asia Energy-Water Development Program (CAEWDP);
	-	**S**tudies and Riparian Consultations on Proposed Rogun Regional Water Reservoir and Hydropower Project in Tajikistan;
	-	Investments in the irrigation sector

Note. Data for the World Bank from Karaban (2010), for the European Union from European Commission (n.d.), for the GIZ - German Federal Foreign Office from GIZ (n.d.), the United Nations Economic Commission for Europe (UNECE) from UNECE (n.d.), for the International Water Management Institute (IWMI) from IWMI (n.d.), for the United Nations Development Programme (UNDP), Asian Development Bank (ADB) from UNDP (2004) & SIWI (n.d.), for the Interstate Coordination for Water Coordination of Central Asia (ICWC), the Regional Environmental Centre for Central Asia (CAREC), the Economic and Social Commission for Asia and Pacific (ESCAP), the International Fund for saving the Aral Sea (IFAS), the Green Cross International and the Organization for Security and Cooperation in Europe (OSCE) from SIWI (n.d.).

5. Water Management by Countries

5.1 Kazakhstan

Water management in Kazakhstan is conducted on the basis of the Water Code. All other documents, standards and programs are implemented taking into account the regulations stated in the code (Jumagulov et al., 2009). "Basics of water legislation of the USSR and Union Republics" adopted in 1970 and the "Water Code of the Kazakh SSR" adopted in 1972 were basis for any water relations within and outside the country. After 1993 the "Water Code of the Republic of Kazakhstan" was adopted. However, the reform has become obsolete and in reality is hindering the development of water management in the 21st century. Therefore, a new Water Code was adopted in 2003 and amended in 2009. As a result of the new program water management in the basin level has been enhanced and transboundary waters have been discussed in detail. Also, the "Law on rural consumer cooperatives of water users" was adopted in 2003 (FAO, 2013). The State Committee of Water Resources is an authorized state body that conducts water management in Kazakhstan on national level, while local representatives are responsible for managing water resources within their competence. Also, basin water management units are used to manage water resources within particular basin under the committee (Sarsenbekov and Ahmetov, n.d.). Even after the collapse of the USSR, in 1993, sovkhoz and kolkhoz, which are state and collective farms respectively were the main courses in agricultural sector. Only after 1994 most of the irrigation lands were privatized and leased out for a long term, up to 99 years. Further, in 2001-2002 most of the water facilities were transitioned from national to communal ownership. These reforms helped to improve water management in the country by delineation of responsibilities of certain water resources to certain authorities. Just like other Central Asian states Kazakhstan is seeking for an international funding for water management from organizations such as World Bank, Asian and Islamic Development Banks, UNDP and other organizations. Following is a list of projects and programs currently being implemented: "National integrated water resources management and water efficiency plan," regulation of Syr Darya riverbed and preservation of the northern portion of the Aral Sea (Phase 1), water supply and sanitation for northeast Kazakhstan, restoration and management of the environment in the Nura-Ishim basin, "Ak Bulak," "Drinking water programme," etc (FAO, 2013).

Kazakhstan is mainly a downstream country and it receives most of its water resources from abroad, therefore, water management is one of the security issues of the country. According to McKinney (2004), one of the problems

that has arisen due to transboundary water management is excess electricity delivered in summer months from Kyrgyzstan because of the agreement between the two countries to receive Kyrgyz electricity in summer in exchange to deliver Kazakh coal in winter. Due to this problem the energy sector of Kazakhstan has to go through some issues such as temporary stopping the electricity production in some power stations in South Kazakhstan. Moreover, since its independence Kazakhstan has reduced irrigation lands because of their low productivity and inefficiency. Despite the existence of the WUAs in Kazakhstan, most of them are not efficient enough to overcome issues related to water supply and drainage systems. The issue of low water availability has been aggravated by worsening of water quality and by increasing water deficit. Another water problem of Kazakhstan is poor water quality and health issues related to that.

Unlike other Central Asian states that are dependent on each other in terms of water supply, Kazakhstan also has water supply relations with China in the East and with Russia in the North. Kazakhstan is concerned with a proper allocation of water resources of the transboundary Ili, Irtysh, Talas, Korgas and other smaller rivers as these rivers originate in the territory of China. An agreement between the countries on equal allocation of water resources was reached regarding the Korgas River (Mustafina, 2014). Kazakhstan and China signed an agreement regarding the use of transboundary waters including the Irtysh and the Ili in 2001. China is planning to develop its northwestern provinces. In this regard, an increase of water withdrawal by China that would deprive Kazakhstan of water resources is predicted (Weinthal, 2006). The unresolved transboundary water issues between the two countries pose a risk of water deficit in the eastern part of Kazakhstan. Kazakhstan and Russia also cooperate regarding the use of waters of 20 rivers, the largest ones being Ural, Ishim, Tobol, Irtysh, Bolshoi and Malyi Uzen Rivers. The river runoff from the Irtysh is divided between Kazakhstan and Russia. Unlike China, Kazakhstan and Russia were able to establish joint water management regarding the water shares of the Irtysh River. The two countries signed an intergovernmental Treaty on joint use and protection of transboundary water objects in 1990s and renewed it in 2010 (Dunn, 2013).

5.2 Kyrgyzstan

The “Law about water” (1994) and the “Law about interstate use of water schemes, water resources and water facilities of the Kyrgyz Republic” (2001) are the documents regulating the water management system (NWG of Kyrgyzstan, 2001). The Water Code that was adopted in 2005 in Kyrgyzstan is

the main water management document and is based on the integrated water resources management (IWRM) (FAO, 2013). The Government of the Kyrgyz Republic is the main body that is responsible for water management and is mainly responsible for the management of water on national level, such as programs on state level and external water relations. The next level in the water management hierarchy is the Parliament that is responsible for the development and regulation of water related legislations, and also international agreements concerning issues of water resources. The Ministry of Agriculture and Water Resources and Processing Industry (MAWR&PP), the State Agency of Geology and Natural Resources, Ministry of Environment and Emergency and regional authorities manage water resources in the country (NWG of Kyrgyzstan, 2001). The State Water Inspection (1999) is an organization responsible for the management of irrigation infrastructures (FAO, 2013). WUAs are also an important link in the water management of Kyrgyzstan.

The following projects were conducted in Kyrgyzstan in order to improve water management in the country: the irrigation schemes rehabilitation project of the World Bank (1998-2006) and the irrigation schemes rehabilitation project Phase II (2007-2012), the water management project (started in 2006), and the new land development project Phase I (2007-2010). As a result of these projects 47 irrigation schemes were rehabilitated, 4 reservoirs were constructed, irrigation schemes were modernized and safety of dams were ensured. The Agricultural Development Strategies are supported by the Asian Development Bank (ADB) in 2007 and FAO in 2010, the new strategy is to be implemented in 2011-2020 and its main goal is to ensure the food security in Kyrgyzstan (FAO, 2013).

The problems associated with water management in Kyrgyzstan have transboundary character. Kyrgyzstan has ongoing water conflicts with downstream Kazakhstan and Uzbekistan. Kyrgyzstan supplies water resources to these countries, in exchange, it receives energy resources. However, to meet the energy demand of the country it heavily relies upon hydropower generated at Naryn cascade and the Toktogul reservoir. According to McKinney (2004), using the reservoir for hydropower generation and releasing water for irrigation have resulted into fluctuations of accumulated storage. Construction of giant dams for hydroelectric power generation is a source of conflict and but also can be a solution to some challenges. In other words, there are both advantages and disadvantages to construction of reservoirs and dams. First, there is an obvious advantage of energy generation, sufficient water supply and control over water releases for upstream countries. On the other hand, the downstream counties would suffer from water deficit for irrigation purposes and drinking water sup-

ply. Hence, the relationship between the upstream and downstream countries would become even tenser. However, if an agreement regarding water shares as during the Soviet Union is reached some issues can be resolved. So flooding of downstream states due to regulated flow can be solved if managed in coordination with other states. Also, precautionary cofferdams should be built in order to prevent flooding.

Moreover, outdated technologies and methods is the problem that needs to be solved in the framework of water management of the country. The issue have resulted into 90% of water losses in the agricultural sector of Kyrgyzstan (Mamatov et al., 2007). Despite the problems, Kazakhstan and Kyrgyzstan are the two countries that are improving the water management policies faster than the other Central Asian states (Abdullaev, 2004).

5.3 Tajikistan

Water is an exclusive property of the Republic of Tajikistan and it ensures an effective use of the available water resources (Khlomatov and Pulatov, n.d.). According to FAO (2013), the government is responsible for the management of departments of water management, such as MLRWR, State Unitary Organization on Water Supply, State Committee on Land Management and Geodesy and others. The "Water Code of Tajikistan" was first adopted in 1993 and after revisions the new code was adopted in 2000. The Water Code of 2000 gave an assisted in privatization and support of irrigation system management (McKinney, 2004). Land reform in 1996-2000 in Tajikistan has led to privatization of previously sovkhoz and kolkhoz, and to organization of farms and WUAs. The adaptation of the WUAs Law in 2007 is the basis for water management on the level of privatized farms associations. The Basin Water Management Organizations (BWMO) manage water resources on a district level, while WUAs are responsible for the management of secondary and tertiary canals (FAO, 2013).

Tajikistan being one of the most rural Central Asian states with more than half of the population working in the agricultural sector is one of the problems associated with water management. Same as the countries discussed earlier, the environmental problems in Tajikistan also arise due to outdated irrigation systems. The poor water management has led to soil salinization because of unlined canals, inadequate length of drainage systems and poorly designed irrigation systems, and waterlogging problems because of high groundwater levels in aquifers in Central Asia. Also the rapid population growth in the country requires efforts to achieve food security (McKinney, 2004). Over the recent years, the agricultural sector of Tajikistan has shifted from cotton to rice pro-

duction, leading to water deficit due to inefficient water use. Deficit of funds has also aggravated the problem of water deficit in the agricultural sector. The lack of funds is mainly caused by low rate of water tariff collections (40% in 5 years). Additionally, water allocation during dry years is very complicated in this arid region (Khlomatov and Pulatov, n.d).

5.4 Turkmenistan

According to FAO (2013), the Cabinet of Ministers of Turkmenistan is the main national organization responsible for water management in the country. The Ministry of Water Resources (MWR) operates under the Cabinet of Ministers of Turkmenistan and is responsible for the management of irrigation systems and distribution and delivery of water to water users. Local Aministartions, Ministry of Nature Protection, "Turkmengeologia" and Ministry of Construction are the other departments that operate on a state level (Berdiev, n.d.). Local authorities manage water resources under the MWR on their territories. In 2007 a national development program on water economy was adopted. In the framework of the program it is planned to construct the trans-Turkmen collector at the Turkmen Golden Age Lake in order to collect drainage waters from different regions of the country. The construction of the collector should help in salt reduction of drainage waters. Also, it is planned to transfer state owned irrigation lands into private ownership by 2020 (FAO, 2013).

There are numerous problems associated with water management in Turkmenistan: inefficient irrigation systems due to old technologies, lack of available water resources, poor quality drinking water. Only 30% of total population receives clean water, 51% cannot access drinking water and only 44% has sewage systems (Berdiev, n.d.). Urban areas have piped water supply, however, the existence of pipes does not guarantee clean drinking water. Also people reside to hand dug wells in order to obtain potable water. The situation is worse in rural areas. In rural areas people use wells to obtain clean water sources due to the lack of piping systems. The water quality in the country is very poor due to high mineral concentration in the drainage waters. As a result of the mentioned problem and the issue of the closeness of aquifers to the land surface an issue of waterlogging arises as well. Poor water quality due to agricultural and industrial runoff cause health problems and negatively impacts agricultural productivity of Turkmenistan. It is thought that most of the pollutants are carried in from the territory of Uzbekistan located upstream from Turmenistan (McKinney, 2004). Besides, Different areas within the country itself have conflicts over the water resources: so the upstream areas use up water at the beginning of the irrigation season leaving the downstream areas short of water resources.

5.5 Uzbekistan

In 1993 the initial water law was adopted in Uzbekistan, and later in 2009 after several amendments a new law that improved the water management in the country was approved. The MAWR was established in 1996 in Uzbekistan. The General Authority of Water Resources (GAWR) is responsible for water management under the MAWR. State, provincial and district organizations operate under the MAWR. In 2003 the Basin Authorities of Irrigation Systems (BAIS) was created as an initiative in improving water management in Uzbekistan. The Association of Uzbekistan for Sustainable Water Resources Development (AUSWRD) was created in 1998. One of the main goals of the association is to develop cooperation between the Aral Sea workers. In 1996 WUAs were introduced in Uzbekistan. In 2003 the post-soviet collective farms started being transformed into individual farms, and as a result of these actions *dehkan* farms, family farms, arose. In 2003 the water management was transferred from state control to basin approach. Before that all the water resources in the country were managed by the government. WUAs and Canal Management Organizations (CMOs) were established as a result of the reform. Later is 2009 the WUAs were renamed as the Water Consumer Associations (WCAs) (FAO, 2013).

More than half of the surface waters in Central Asia is consumed by Uzbekistan. So water deficit is the major problem of the country. In recent years due to overuse of its water resources the volume of the Amu Darya River running through the territory of the country reduced to two thirds of its previous amount. Water shortage for irrigation purposes in summer in Uzbekistan stays a current topic. Obtaining water resources is problematic with Uzbekistan being a downstream country. Even though Uzbekistan has generally good relations with the neighboring countries, same cannot be stated in regards the relationship with its upstream neighbor, Kyrgyzstan. The countries have ongoing water-energy conflicts (McKinney, 2004).

There are 45 reservoirs in Uzbekistan with a total capacity of 19 km3. 75% of these reservoirs were constructed during the Soviet era. In order to meet its water needs for agricultural sector Uzbekistan mostly uses water dams and reservoirs for irrigational purposes (90%). Uzbekistan provided electricity to Kyrgyzstan in winter in exchange for sufficient water discharge in return. After the collapse of the USSR in the period of 10 years (1990-2000) the amount of water released in summer decreased to 45%, while the amount of release in winter increased to 55% of annual discharge. New water reservoirs that are designed for accumulation of water that is unduly released from upstream states in order to meet

its irrigation needs are being established in Uzbekistan. In this regards, 3 more water reservoirs are in the process of construction in the Namangan, Jizzak and Samarkand provinces (Rakhmatullaev et al., 2010). On top of that, excessive agricultural runoff has led to poor water quality with high content of salts and minerals. The percolation of drainage waters has also led to low groundwater quality unusable even for agricultural purposes (Jalalov, n.d.).

5.6 Relationship between the Central Asian States and the Outside Countries

Relationship between the Central Asian states and their outside neighbors, Afghanistan, Russia and China, have a substantial impact on water distribution in Central Asia. Afghanistan shares water resources with Central Asia in the Amu Darya basin. The Amu Darya is a border river between Afghanistan and Tajikistan, Turkmenistan and Uzbekistan. Therefore, water relations between the Central Asian states and Afghanistan is important. Afghanistan is a conflict zone, therefore, the country was not able to be involved in discussions regarding transboundary water management in Central Asia. Afghanistan does not use its share of water that it is entitled to according to the 1946 treaty with the USSR. However, if the country decided to develop its agricultural sector in the northern part of the country or to build dams and reservoirs along the river, the flow of the Amu Darya River would change (FAO, 2013).

Transboundary water relations of Central Asia with Russia and China mostly consists of the relationship with Kazakhstan. As mentioned earlier, China is planning to expand its western provinces and it is predicted that water withdrawal from Irtysh and Ili rivers by the Chinese side would increase posing threat to water deficit in eastern Kazakhstan (Balkash Lake). Also, other than water relations regarding water management of the transboundary rivers with Kazakhstan mentioned above, Russia is mainly interested in hydroelectric potential of the region. The country is mainly involved into water management in Central Asia through investments into hydropower projects in Kyrgyzstan and Tajikistan (ex., loan to Kyrgyzstan to build the Kambarata HPP) (Yuldasheva et al., 2010).

6. Mitigation Actions

Healthy ecosystem and sustainable water use in the region are the main tools in achieving a balanced water management. Rational water use is the main objective of projects aimed at improving of the water management in Central Asia. Modern technologies, well designed drainage systems, systems for collecting rainwater for dry season and of course implementation of effective water management policies are the key solutions to problems associated with water dis-

tribution in Central Asian region. The UNDP, the ADB and the World Bank are the main international organizations that provide funding for the improvement of water management in Central Asia, namely modernization of irrigation systems. It is also essential to cooperate in order to create effective, economically and environmentally beneficial transboundary water management policies. Regional cooperation should start with improved agreements in energy and agricultural sectors Most of the rivers and streams are fed by melting glaciers and snow in summer months. It is important to regulate the flow of such waters in order to adequately manage water resources.

Introduction of new irrigation systems, such as drip irrigation has already started. Recently this technology has been adopted by Kyrgyzstan. Also, to avoid waterlogging the groundwater can be used instead of waters from rivers. This will also aid to reduce the amount of water used for irrigation.

Most of the land being irrigated in Central Asia is prone to soil salinization and degradation due to continental arid climate in the area. Poor water quality of the local rivers and streams, and seepage of agricultural drainage waters aggravates the problem even further. Artificial drainage systems are required in the area in order to avoid issues of soil salinization and waterlogging. Disposal of untreated agricultural return flows into water systems should be monitored and controlled. Appropriate transboundary water quality agreements should be adopted by the states.

It is important for institutions to be able to enforce agreements. However, after the collapse of the Soviet Union there is no longer an effective supra-national water management mechanism that could enforce bilateral and multilateral agreements in Central Asia. A lot of agreements were reached regarding water management in Central Asia. However, in reality, implementation of those agreements has suffered due to the lack of enforcement mechanisms. Even though there are various international organizations assisting the Central Asian states to improve the water management system (table 13.3.), a common center that could systematically manage, monitor and enforce water management laws, regulations and project does not exist. Due to the lack of enforcement mechanisms in Central Asia mentioned above there has been noted a number of issues. Duplication of efforts and as a result, reduced effectiveness of programs, and inadequate distribution of funds are some of the examples of consequences of weak enforcement mechanisms. Finally, it has been noted that most of the citizens in the area are poorly informed about the water management issues. It is essential to involve public to participate in formation and adoption of water policies. (McKinney, 2004).

7. Conclusions

After the collapse of the USSR the newly independent Central Asian states were left with transboundary water management issues. Since then the countries have adopted a number of state and transboundary policies. The main ones being the individual water codes of each country that have been revised and improved over the years. Despite the efforts the countries are faced with results of the Soviet water management practices. To conclude, the main water management problems in Central Asia are the Aral Sea desiccation due to poor water management, inefficient water losses due outdated technologies and methods, poor water quality due lack of control of agricultural and industrial runoffs and ongoing water-energy conflicts between upstream and downstream countries.

The following recommendations arise based on the studies. First, the Central Asian states need to develop effective water management systems on national levels taking into account the transboundary bodies of water. Next, the Central Asian states need to develop common agreement on sharing transboundary waters. Also a decision making body that is recognized by all the states needs to be established in order to achieve an effective water management system. The governments could establish joint data collection and analysis programs. As mentioned earlier the civil society is poorly informed about the water management in their countries. Therefore, it is important to encourage the involvement of civil societies into water management programs. Implementation of technical projects is also important. However, it is important to develop socio-economic and environmental programs in order to overcome existing issues. Financial and political support as well as well trained professionals are needed to implement national and international programs and projects. Development and implementation of common water management policies would assist the countries to solve the water management issues. To conclude, even though it would take time to recover from the Aral Sea disaster and other environmental issues because of the poor water management practices in the past, introduction of new technologies and adoption of efficient national and international water policies and agreements could solve the problems of water management on local and transboundary levels in the long run.

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NEVZAT SIMSEK, PHD

Associate Professor Nevzat Simsek graduated from the Department of Public Administration in the Faculty of Political Sciences in Ankara University in 1994. He completed his master thesis named 'A Study on the Cyclical Behaviour of Prices: The Case of Turkey (1963-1995)' in the Economics Program in the Institute of Social Sciences of Dokuz Eylul University in 1998. In 2005 he completed his PhD thesis named 'Intra-Industry Trade (The Analysis of Intra-Industry Trade in Turkey)' in the Economics Department in the Institute of Social Sciences of Dokuz Eylul University. In the same year he got the best PhD thesis prize on economics given by the Turkish Economic Association. Dr. Simsek got the academic degree of associate professor in the field of International Economics in 2012. Associate Professor Nevzat Simsek started his academic life as a research assistant in the Department of Economics in the Faculty of Economics and Administrative Sciences of Dokuz Eylul University in 1995. Between July 2003-November 2003 he stayed in the Institute of Statistics and Econometrics in Justus Liebig University in Giessen in Germany for doing research on his PhD Thesis. Between July 2010-July 2012 he studied on his post doctoral thesis on energy economics in Oxford Institute for Energy Studies in the University of Oxford. During this period Dr. Simsek focused on energy economics and especially studied on worls crude oil and natural gas markets. He has written several boks and articles on energy economics, renewable and non renewable energy sources and environmental problems, foreign trade (new foreign trade theories, intra-industry trade), business cycle theories, macroeconomic aspects of international trade and finance, development plans and development policies, regulations and industrial policies.

Dr. Simsek worked as the Vice Rector, responsible for Development and Financial Affairs in the International Turkish-Kazakh Hoca Ahmet Yesevi University between 2013-2014. Dr. Simsek knows English and Arabic.

HAYAL AYCA SIMSEK, PHD

Hayal Ayca Simsek graduated from Public Finance Department of the Faculty of Economics and Administrative Sciences in Dokuz Eylul University in 1995 and she started working as a research assistant in Public Finance Department in 1996. Starting her master education in 1995, she completed this process in 1997 by presenting her master thesis namely 'Alternative Fiscal Policies in Determining the Limits of Government'. Hayal Ayca Simsek started doctorate process in 1998 and completed this process in 2003 by presenting her doctoral thesis namely 'Constitutional Economics As An Alternative for Achieving Economic Stability: The Case of Turkey'. She became an assistant professor in 2005 and associate professor in 2011. She has still been working in Public Finance Department of the Faculty of Economics and Administrative Sciences in Dokuz Eylul University.

Hayal Ayca Simsek studied on her post-doctoral thesis namely 'Financial Liberalisation and Public Regulatory Policies in Developing Countries' in Buckingham University and London School of Economics in the UK between 2010-2012. She has been giving lectures on public economics, public finance, fiscal policy and public debt. She studies especially on macroeconomics, financial economy, public economics and fiscal policies. Hayal Ayca Simsek has been researching on issues especially on economic policies in Central Asian countries, energy policies of Central Asian countries and possibilities for achievement of macroeconomic stability in this region in Eurasian Research Institute in Almaty in Kazakhstan as visiting researcher since September 2014.

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