Assessment of oil and gas geopolitical influence

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Abstract: This paper investigated several stages in the formation of the geopolitical influence of oil and gas, including the basis of its gestation, the means of transformation, and the formation and exercise of power. Based on this theoretical framework, a system for assessing the geopolitical influence of oil and gas was developed. This system is comprised of 13 indicators, each with its own method of measurement. Then 21 representative oil and gas importing, exporting, and transit countries were selected as assessment subjects. A quantitative assessment of the geopolitical influence of oil and gas in the selected countries was carried out using the proposed indicators, and factor analysis was used to obtain the main factors of these indicators and the composite score of each country. The empirical results showed that the 13 indicators could be summarized into five main factors, in the order of contribution rate, specifically comprehensive national strength, energy, transportation, risk, and geopolitics, each with its own variance contribution rate. Results of the assessment indicated that the selected countries could be classified into five categories in terms of oil and gas geopolitical influence: strong, relatively strong, moderate, relatively weak, and weak.

Keywords: oil and gas; geopolitics; influence; mechanism; indicator system

1　Introduction

Oil and gas (O&G) resources are an important strategic energy source and safeguard for national economic lifelines and security. As the strategic position of global O&G resources expands, various countries are engaged in a fierce geopolitical game surrounding these resources, in the hope of securing a more favorable position in future O&G geopolitical competition. To have an accurate assessment of the contribution of O&G geopolitical influence to representative import, export, and transit countries of the world, it is necessary to develop an assessment system, along with performing a quantitative analysis and comprehensive assessment of that influence. This approach presents a clearer view of the current and future development trends in global energy geopolitics, and propels a more scientific and objective understanding of the status and roles of different countries in the global O&G geopolitical landscape.

A considerable amount of research has been done on various aspects around comprehensive assessments of energy geopolitics, including energy security assessments with related indicators (Kruyt *et al*., 2009; Löschel *et al*., 2010; Augutis *et al*., 2012), databases of operational indicators (Sovacool and Mukherjee, 2010; Sovacool, 2011), the development of an assessment framework (Hughes, 2012), a trend analysis (Cohen *et al*., 2011), and empirical research (Vivoda, 2010; Badea *et al*., 2011; Bambawale and Sovacool, 2012). Some research has focused more on the assessment of energy's geopolitical influence. For instance, Reynaud and Vauday (2009) conducted an in-depth analysis of factors influencing the geopolitical potential of nations and related indicators, and explored the relationship between national geopolitical potential and IMF loans. Related research by Chinese scholars has mainly focused on the influencing factors and comprehensive assessing systems of resource security (Wang, 2002 and 2008), and energy acquisition risks (Lang *et al*., 2003; Zhao *et al*., 2010). Other researchers have adopted the Reynaud indicator system and conducted an assessment of the geopolitical attractiveness of 35 O&G export countries (Sun *et al*., 2011).

This paper incorporated the topic of influence into the global geopolitical landscape of energy. We also developed an assessment system (including quantitative and qualitative indicators) based on an analysis of the mechanisms in the formation of O&G geopolitical influence. Twenty-one representative countries (including import, export, or transit countries) were selected for empirical analysis. National conditions, strengths, and characteristics were taken into account in the selection process. The objective was to further develop an assessment system for O&G geopolitical influence and conduct such an assessment of representative countries from around the world.

2　Mechanisms for the formation of O&G geopolitical influence

The formation of O&G geopolitical influence is an integrated process that encompasses objective conditions and subjective motivations, static and dynamic processes, as well as internal factors and the external environment. A country's O&G geopolitical influence must be based on certain objective strengths, and further be supported by various means (such as military, economic, diplomatic, and technological measures). Only then can the strengths be transformed into real capacity, that is, the power to dictate developments and control relationships in international affairs. Governments then exercise power through particular actions to realize the transformation of power into influence (Zhang, 2005).

2.1　Basis of gestation

The basic conditions for the gestation of a country's O&G geopolitical influence depend on essential factors such as its geographical conditions and resource base. Geographical factors constitute the spatial foundation. Vast territories represent economies of scale and strategic vertical depth, which are favorable to a country's survival and development. The larger a country's territory is, the more likely it is to become a strategic mega-country (Liu, 2009). Natural O&G resources have always been at the center of the geopolitical game (Gao, 2009). Currently, such strategic resources have become the focal point of geopolitical competition, and countries with rich O&G resources have significant inherent advantages over others.

2.2　Means of transformation

Military, economic, diplomatic, and technological means promote the transformation of

geopolitical energy factors and conditions into real power. Building upon objective conditions such as geography, resources, and the economy, a country takes subjective initiatives, including the deployment of military, economic, diplomatic, and technological means, during the transformation process in order to seek O&G geopolitical power. This is specifically illustrated through a country's military strength, which helps to safeguard and strengthen its possession of, and/or control over, regions that are rich in O&G resources (Zhang, 2004). Multinational oil corporations have become important trusted forces in the battle over O&G geopolitical power. Overseas energy investments by homegrown multinational oil corporations and cross-border mergers and acquisitions (M&A) can help a country enhance the security of its national industries (Ding and Fu, 2011) and expand its controlling rights. Energy diplomacy is another important means for securing interests in and control over geopolitical energy power. This diplomacy can provide a country with safer and more diversified O&G supplies, or attract financial and technical support through collaborative projects (including exploration contracts between countries, the construction of crude oil pipelines, long-term crude oil trading and loans, and other packages) (Pan, 2008). Significant technological changes, such as large-scale non-conventional O&G exploitation, and the widespread adoption of renewable energy (wind and solar powers, and biofuels) can reshape the existing distribution of O&G geopolitical power (Mcneill and Ge, 2008).

2.3 Formation and exercise of power

Possession of, and/or control over, major O&G production regions and transportation routes is a tangible form of O&G geopolitical power. When the transformation process is completed, the formation of power means that a country has obtained real capabilities in dictating developments and controlling relationships in O&G geopolitical affairs (Zhang, 2005). When an O&G geopolitical body exercises its power, the latter is transformed into influence via the international platform. The country's government becomes involved in the capacities of international politics, risk control in the international market, and the stability of its domestic environment.

Based on the above analysis, the mechanisms for the formation of O&G geopolitical influence are summarized in Figure 1.
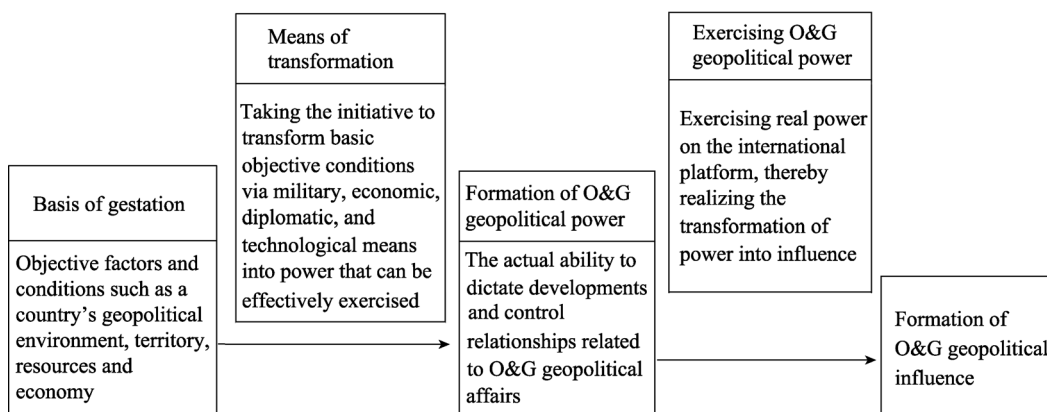

Figure 1   Mechanisms for the formation of O&G geopolitical influence

3 Assessment framework for O&G geopolitical influence

3.1 Development of the assessment system

An assessment system with indicators capable of measuring all the characteristics of O&G geopolitical influence must be developed in order to perform a comprehensive, objective, and fair assessment. Based on the general requirements of developing such a system, and taking into account the compatibility between the system and topic, the selection of assessment indicators should comply with the following five principles: the indicators should be systemic, scientific, independent, operable, and comparable (Du *et al*., 2005). The proposed assessment framework and indicators for assessment are listed in Table 1.

Table 1 Assessment framework for the formation of O&G geopolitical influence

Process	Mode of action	Indicator
Basis of gestation	Geopolitical environment	Geopolitical environment advantage C_1
	Territory scale	Territorial scale effect C_2
	Resource reserves	Domestic O&G reserves C_3
	Economic strength	Economic capacity C_4
Means of transformation	Military intervention and control	Naval power C_5
	Cross-border M&A and investment	Production by O&G corporations C_6
	Energy diplomacy	[*Included under* C_{11}]
	Technological innovation	Potential O&G and alternatives C_7
	Major construction projects	New sea-lanes and pipeline expansions C_8
Formation of power	Possession of—and/or control over—major O&G production regions	Net import/export of O&G C_9
	Possession of—and/or control over—critical O&G transportation routes	Control over key transportation routes C_{10}
Exercising power	Government's involvement in international politics	Diplomatic capability C_{11}
	Ability to control risks in the international market	O&G import/export concentration C_{12}
	Support from stable domestic environment	Domestic stability C_{13}

3.2 Interpretation of the indicators and measurement methods

(i) Geopolitical environment advantage C_1

The geopolitical environment is an objective factor in geopolitics. Countries with complex geopolitical environments often face more risks and threats, and are likely to be involved in conflicting situations, fall into passive situations, and face various constraints when dealing with their international relationships (Jin, 2008). This indicator is divided into five grades (Table 2) based on factors such as the number of neighboring countries, the threats from powerful neighboring countries, the level of political and economic development and disparity among neighboring countries, interference from problematic countries, and territorial disputes.

(ii) Territorial scale effect C_2

Table 2 Geopolitical environment advantage

Grade	Description	Ranking	Score
Complex	Has many neighboring countries, both big and small; has past and present disputes with some of these countries; homeland security costs are extremely high.	V	2
Relatively complex	Has several neighboring countries, both big and small; has past and present disputes with some of these countries; homeland security costs are relatively high.	IV	4
Moderate	Has 1–2 strong neighboring countries and a few small neighboring countries; relationship with these countries is relatively good despite past disputes; a certain amount of homeland security costs is expected.	III	6
Relatively simple	Has one strong neighboring country and maintains a relatively good relationship with the neighbor; or only has small neighboring countries; natural barrier(s) is present; homeland security costs are relatively low.	II	8
Simple	No threats from any strong neighboring countries or interference from problematic countries; natural barrier(s) is present; almost no homeland security costs.	I	10

Source: Jin, 2008.

The effect of territorial scale measures a country's ability to exercise its national sway and is measured by the relative size of its territory. The size of a country's territory is correlated to its potential for becoming a strategically powerful country, and its geopolitical influence is also enhanced proportionately.

(iii) Domestic O&G reserves C_3

Domestic O&G reserves form an important bargaining chip for O&G exporting countries looking to secure an advantageous position in O&G geopolitics. For this study, this is measured by the established amount of remaining O&G reserves (converted to standard oil equivalent).

(iv) Economic capacity C_4

Economic capacity reflects a country's material guarantee condition for military consumption, its control of foreign energy trade, and its own political stability. It is measured by the relative economic strength of a country overall, normally represented by its gross domestic product (GDP) measured in terms of the US dollar at current exchange rates.

(v) Naval power C_5

Naval power is an important indicator of military strength, which measures a country's ability to protect and fight for its national interests. Countries with powerful naval forces often effectively realize their control over energy production regions and key transportation routes, and safeguard the smooth realization of other geopolitical energy influences. Naval power can be indirectly represented by a navy's ranking in the world (Table 3).

(vi) Production by O&G corporations C_6

Multinational O&G corporations are an important means for a country seeking to transform its objective factors of strength into tangible control over O&G resources (Hu, 2008), as well as for strengthening its possession of O&G resources. Data on crude oil and natural gas production (measured in standard oil equivalent) by the 50 largest oil companies in the world, published in the U.S. *Petroleum Intelligence Weekly,* were used as reference (American Petroleum Intelligence Weekly, 2013).

(vii) Potential O&G and alternatives C_7

Table 3 World naval power

Grade	Description	Representative country(s)	Ranking	Score
Global control	The navy's core is large aircraft carriers; has large number of nuclear submarines	USA	I	10
Global challenge	The navy's core is cruisers and destroyers supplemented by large aircraft carriers; has large number of nuclear submarines	Russia	II	8
Global presence	The navy's core is aircraft carriers, with destroyers as escorts; has nuclear submarines or submarines	France, UK	III	6
Global dispatch	The navy's core is cruisers or frigates, with universal destroyers as escorts; has considerable number of submarines	Japan, Germany	IV	4
Regional	The navy's core is destroyers; has a large number of frigates; has a small number of submarines	South Korea	V	2

Source: Wang, 2008.

This potential refers to the development and utilization of non-conventional O&G and renewable energy, the discovery of major O&G fields, and a higher O&G reserve production ratio as a result of technical advancement. Great future potential is contained in those countries involved in the production of sustainable O&G resources and the use of alternative resources (Table 4). They are part of the growing powers in O&G geopolitics and may reshape the future of O&G geopolitics.

Table 4 Potential O&G and alternatives

Grade	Description	Ranking	Score
High	Revolutionary increase in O&G production arising from technological progress or significant discoveries of O&G fields; extremely high O&G reserve–production ratio	I	10
Relatively high	Significant increase in O&G production arising from technological progress or significant discoveries of O&G fields; relatively high O&G reserve–production ratio	II	8
Moderate	Small- and medium-sized O&G fields are being discovered gradually; relatively high investments in the renewable energy sector	III	6
Relatively low	Limited potential for the increase of O&G or its alternatives; certain amounts of investment in renewable energy	IV	4
Low	No sign of activities in the increase of O&G or its alternatives	V	2

Source: PetroChina Economic and Technology Research Institute, 2013; Global Trends in Renewable Energy Investment 2012.

(viii) New sea-lanes and pipeline expansions C_8

This indicator reflects the increasing potential of some countries to possess and control new O&G transportation routes and distribution patterns. This can be brought about by the establishment of new sea-lanes in future plans and/or the construction and expansion of major O&G pipelines (Table 5).

(ix) Net import/export of O&G C_9

This refers to the amount of O&G (measured in standard oil equivalent) owned or controlled by a country, which can be deployed in the exercise of its O&G geopolitical power. A greater net export amount enhances a country's ability to achieve dominance and enhance its

O&G geopolitical influence. Conversely, a greater net import amount means that the country is more dependent on other countries and will be in a relatively passive position in O&G geopolitics.

Table 5   New sea-lanes and pipeline expansions

Grade	Description	Ranking	Score
High	Transit hub country with a number of major multinational O&G pipelines under construction	I	10
Relatively high	Has some control over several major O&G pipelines that are under construction or the future Arctic route	II	8
Moderate	Has major multinational O&G pipelines in production or is a country that surrounds the Arctic Circle	III	6
Relatively low	Major O&G pipelines under construction pass through the country, or it is in proximity to potential new routes	IV	4
Low	No sign of O&G pipelines under construction or any new route being established in the surrounding area	V	2

Source: PetroChina Economic and Technology Research Institute, 2013.

(x) Control over key transportation routes C_{10}

Routes used for the transportation of O&G are classified as either sea routes or overland pipelines. For this study, only major transportation routes that play a key role in O&G trading were considered (Table 6).

Table 6   Control over key transportation routes

Grade	Description	Ranking	Score
Strong	Has relatively strong control over various key O&G transportation routes globally	I	10
Relatively strong	Has relatively strong control over major regional O&G transportation routes or pipelines	II	8
Moderate	Has sufficient usage rights and partial control rights over 1–2 surrounding major transportation routes	III	6
Relatively weak	Close to 1–2 major transportation routes, but has relatively weak control capability	IV	4
Weak	Does not possess or control any O&G transport routes	V	2

Source: Li, 2006; Lopez, 2008.

(xi) Diplomatic capability C_{11}

Diplomatic capability represents the position and role played by a country in international and diplomatic affairs and activities (Table 7). It can be specifically measured through a comprehensive assessment of various aspects, including having a permanent seat in the United Nations, the ability to carry out diplomatic initiatives, allied relations, diplomatic independence, and the ability to provide economic and military assistance. Countries with strong diplomatic capabilities often have deeper involvement in international mechanisms, greater international influence, and the ability to dominate key issues in international affairs (Shen, 2006).

Table 7 Diplomatic capability

Grade	Description	Ranking	Score
Strong	Vigorous global diplomatic activities; has global influence and control	I	10
Relatively strong	Actively promoting global diplomacy; has some global influence and control	II	8
Moderate	Global diplomatic efforts are being carried out; has some global influence	III	6
Relatively weak	Focus is on regional diplomacy; does not have deep involvement in international mechanisms; does not have global influence	IV	4
Weak	Focus is on diplomacy with surrounding countries; is often in passive diplomatic positions	V	2

Source: Shen, 2006.

(xii) O&G import/export concentration C_{12}

This indicator refers to the concentration of O&G import/export sources (Table 8). The more diversified the sources are, the greater the country's ability to be in an active position in international O&G markets will be. The reverse situation leads to more constraints on the country's ability to act. Regions where O&G are the largest proportion of a country's total import/export were selected as the main sources and destinations. Calculations were done to compute the proportion of import from/export to a country's main O&G sources/destinations versus total O&G import/export of the country. A few atypical O&G import/export countries have relatively smaller import/export quantities and lower import/export risks. Hence, their scores may be raised accordingly.

(xiii) Domestic stability C_{13}

This refers to a country's internal stability, including whether it has a stable foundation for its regime, sound legal systems, and stable policies. Countries with a higher level of domestic stability can provide better internal support to facilitate the full exercise of their O&G geopolitical power (Table 9).

Table 8 O&G import/export concentration

Grade	Share of key channels	Ranking	Score
High	(80, 100]	V	2
Relatively high	(70, 80]	IV	4
Moderate	(50, 70]	III	6
Relatively low	(30, 50]	II	8
Low	≤30	I	10

Source: BP, 2013.

Table 9 Domestic stability

Grade	Share of key channels	Ranking	Score
Stable	Regime with stable foundation; sound legal system; strong continuity of policies; regime changes do not affect its economy, finance & trade, and foreign relations	I	10
Relatively stable	Some minor instabilities; no impact on overall political situation	II	8
Moderate	Major emerging industrial countries and some of the original socialist countries in Eastern Europe that have substantially completed their transition from a planned to a market economy	III	6
Relatively unstable	Civil unrests; violent political struggles; frequent changes of regimes; some states may even be at war with one another	IV	4
Unstable	In a state of chaos and war; continuous terrorist incidents in all or most parts of the country	V	2

Source: Wang, 2008.

4 Assessment of O&G geopolitical influence of representative countries

4.1 Basic principles in the selection of assessment subjects

Considering the general requirements of the assessment system, representative O&G import, export, and transit countries were selected as subjects (Table 10). These countries have varying characteristics in certain aspects (e.g., endowment of factors, national conditions, and strengths), allowing for the verification of the reasonableness of the system from different angles. They arouse much attention in global O&G geopolitics, and there is relatively complete statistical data on these countries. Attention was also focused on the balance of global geographic distribution among the selected countries (He, 2005). Taking into consideration the aforementioned principles and actual O&G geopolitical influences, the following countries were selected as assessment subjects.

Table 10 Selection of O&G geopolitical influence of representative countries

Region	Representative Countries		
	Import countries	Export countries	Transit countries
North America		US, Canada	
Europe	UK, France, Germany		Ukraine
Asia Pacific	China, Japan, India, Turkey		Malaysia, Indonesia
Central Asia-Russia		Russia, Kazakhstan	
Middle East		Saudi Arabia, Iran, Iraq	
Africa	South Africa	Libya	
S.&Cent. America	Brazil	Venezuela	

Source: BP, 2013; IEA, 2012.

4.2 Sources of data

For the six quantitative indicators C_2–C_4, C_6, C_9, and C_{12}, values were calculated using the collected data. For the other seven qualitative indicators C_1, C_5, C_7–C_8, C_{10}–C_{11} and C_{13}, their scores were graded based on the collected data.

For the individual indicators, C_2 was based on the land area of countries listed in the *2001 Monthly Bulletin of Statistics*, a publication of the Food and Agriculture Organization of the United Nations. (United Nations: FAO Database, 2001). C_3 was extracted from the standard oil-equivalent of established remaining O&G reserves in major countries and regions in the world in 2012, as listed in *International Petroleum Economics* (Liang, 2013). C_4 was calculated using the 2011 GDP data from the World Bank (World Bank, 2011). C_6 was based on the standard oil-equivalent of crude O&G production in 2012 by the 50 largest petroleum companies in the world, as found in the U.S. *Petroleum Intelligence Weekly* (American Petroleum Intelligence Weekly, 2013). C_9, was based on the net import/export data of the standard oil-equivalent of crude O&G published in IEA's *Key World Energy Statistics 2012* (IEA, 2012). C_{12} was calculated using data extracted from BP's *Statistical Review of World Energy 2012* (BP, 2013).

C_1 was graded based on information by Jin Canrong (2008) in *Change of International Geopolitical Pattern and Its Impact on China*. For C_5 and C_{13}, references were both made to

the illustration by Wang Limao (2008) in *Index system for appraising national petroleum security*. C_7 was assessed based on data on the discovery of non-conventional gas production and major O&G fields published in the *2012 Domestic and International Oil and Gas Industry Development Report*, and financial and investment data on renewable energy published in *Global Trends in Renewable Energy Investment 2012* by Bloomberg New Energy Finance (Global Trends in Renewable Energy Investment 2012). C_8 was graded based on information on major O&G pipelines under construction published in the *2012 Domestic and International Oil and Gas Industry Development Report*" (PetroChina Economic and Technology Research Institute, 2013), and information related to Arctic geopolitics (Lu, 2010). For C_{10}, reference was made to publications by the U.S. Military, which listed 16 global offshore oil transportation thoroughfares for which control is critical (Li, 2006), as well as information on overland oil pipelines consolidated by Philippe Lopez in 2006 and published in *Petroleum Politics* (Lopez, 2008). The scores for C_{11} were assigned by Shen Jiru (2006) and other experts in *2006 Global Politics and Security Report – Comparison of Comprehensive National Strength of Major World Powers*. The final assessment for the qualitative indicators C_1, C_5, C_7–C_8, C_{10}–C_{11}, and C_{13} was made using the grades proposed by the study and taking into consideration related information from the other sources stated above.

4.3   Data processing

For the qualitative indicators C_1, C_5, C_7–C_8, C_{10}–C_{11}, and C_{13}, a semi-quantitative approach was adopted. For the quantitative indicators C_2–C_4, C_6, C_9, and C_{12}, the data were normalized before comprehensive assessment. Subsequently, when subjected to factor analysis, all data had been processed as normal distribution, so a positive or negative score in the assessment result expresses the relative size of O&G geopolitical influence instead of the positive or negative effect of the influence.

4.4   Assessment method and results

Using KMO and *Bartlett's test* of *sphericity*, the KMO value was 0.630, the *Bartlett's sphericity* test value was 212.709 and the sig value was 0.000, indicating significant correlation among the variables (indicators) and suitability for factor analysis.

   Using the SPSS factor process, the top five factors with cumulative variance contribution rates greater than 85% were selected as common factors and denoted as F_i. The indicators' communality was also calculated. The regenerated communalities were all relatively high (close to 1), based on the selection of the five common factors. This indicated a minimal loss of information from each indicator, that is, the five common factors selected could effectively describe those indicators (Table 11).

   The results of the analysis of the loading matrix of rotated factors are listed in Table 12. The common factor F1 has a relatively large loading on C_2 (*Territorial scale effect*), C_4 (*Economic capacity*), C_5 (*Naval power*), C_{11} (*Diplomatic capability*), and C_{13} (*Domestic stability*), and could be named "*Comprehensive national strength factor*", with the highest variance contribution rate of 33.7%. Factor F2 has a relatively large loading on C_3 (*Domestic O&G reserves*), C_6 (*Production by O&G corporations*), C_7 (*Potential O&G and alternatives*), and C_9 (*Net import/export of O&G*), and is mainly an indication of a country's O&G

Table 11 Statistical analysis of the main factors affecting O&G geopolitical influence

Factor	Non-rotated			Orthogonal rotation		
	Eigenvalues	Contribution rate (%)	Cumulative contribution rate (%)	Eigenvalues	Contribution rate (%)	Cumulative contribution rate (%)
F1	4.619	35.533	35.533	4.384	33.722	33.722
F2	3.172	24.398	59.931	3.124	24.027	57.749
F3	1.565	12.042	71.973	1.523	11.715	69.465
F4	1.265	9.733	81.706	1.407	10.824	80.289
F5	0.972	7.481	89.187	1.157	8.898	89.187

Table 12 Loading matrix of the main factors affecting O&G geopolitical influence

Type of variable	Name of variable	Loading of individual factor				
		1	2	3	4	5
Basis of gestation	Geopolitical environment advantage C_1	0.159	0.021	0.026	0.151	0.957
	Territorial scale effect C_2	0.571	0.530	0.252	−0.066	0.006
	Domestic O&G reserves C_3	−0.183	0.936	0.090	−0.086	−0.099
	Economic capacity C_4	0.966	−0.048	−0.068	0.086	−0.004
Means of transformation	Naval power C_5	0.908	0.141	0.144	0.212	−0.008
	Production by O&G corporations C_6	0.325	0.758	0.024	0.450	−0.140
	Potential O&G and alternatives C_7	0.203	0.904	0.001	0.093	0.119
	New sea-lanes and pipeline expansions C_8	0.355	0.185	0.849	−0.166	−0.132
Formation of power	Net import/export of O&G C_9	−0.490	0.716	0.087	−0.158	0.122
	Control over key transportation routes C_{10}	−0.267	−0.004	0.825	0.355	0.178
Exercising power	Diplomatic capability C_{11}	0.947	−0.017	0.056	0.144	0.071
	O&G import/export concentration C_{12}	0.123	0.020	0.076	0.935	0.157
	Domestic stability C_{13}	0.864	−0.057	−0.073	−0.188	0.321

resources, reserves, market position, company strength, and development potential, called "*Energy factor*". This factor has a variance contribution rate of 24.0%. With a variance contribution rate of 11.7%, factor F3 has a relatively large loading on C_8 (*New sea-lanes and pipeline expansions*)and C_{10} (*Control over key transportation routes*), and is an indication of a country's control over existing O&G transportation routes and development of new routes, named "*Transportation factor*". F4 has a relatively large loading on C_{12} (*O&G import/export concentration C_{12}*) and is related to the market risks of O&G import/export, named "*Risk factor*". This factor has a variance contribution rate of 10.8%. Factor F5 has a variance contribution rate of 8.9% and a relatively large loading on C_1 (*Geopolitical environment advantage*), named "*Geopolitics factor*". This factor can be used as an indication of the surrounding environments of a country.

Given this analysis, the system of 13 indicators for the assessment of O&G geopolitical influence could be summarized into five main factors: comprehensive national strength, energy, transportation, risk, and geopolitics. The entire assessment system, comprising five main factors and 13 indicators, is shown in Figure 2.
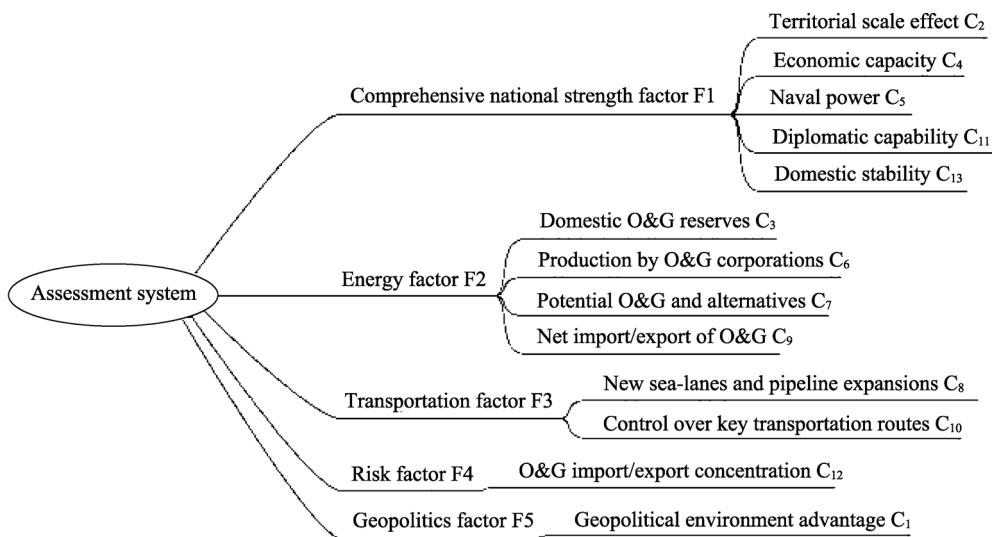
Figure 2 Assessment system for O&G geopolitical influence

The main factor and composite scores for the selected representative countries were obtained using the factor score coefficient matrix (calculated using SPSS) and weighted by the variance contribution rates of the five common factors. The scores are listed in Table 13.

Table 13 O&G geopolitical influence of representative countries

Country	Composite result		F1		F2		F3		F4		F5	
	Ranking	score	Ranking	score	Ranking	score	Ranking	score	Ranking	score	Ranking	score
US	1	1.426	1	0.781	4	0.239	3	0.166	1	0.100	1	0.140
Russia	2	1.069	2	0.474	1	0.415	1	0.184	10	−0.011	8	0.006
China	3	0.399	3	0.406	8	0.081	9	−0.005	2	0.045	20	−0.128
Canada	4	0.352	4	0.310	7	0.094	9	−0.005	21	−0.121	2	0.073
Brazil	5	0.314	5	0.222	9	0.078	18	−0.103	2	0.045	2	0.073
Saudi Arabia	6	0.165	12	−0.209	2	0.383	6	0.007	2	0.045	14	−0.061
UK	7	0.159	6	0.214	11	−0.070	18	−0.103	2	0.045	2	0.073
France	8	0.030	6	0.214	13	−0.107	16	−0.072	10	−0.011	8	0.006
Germany	9	−0.055	9	0.153	17	−0.181	13	−0.023	10	−0.011	8	0.006
Venezuela	10	−0.061	14	−0.240	3	0.256	16	−0.072	10	−0.011	8	0.006
India	11	−0.145	8	0.169	16	−0.152	13	−0.023	10	−0.011	20	−0.128
Iran	12	−0.211	17	−0.291	5	0.200	6	0.007	17	−0.066	14	−0.061
Kazakhstan	13	−0.222	11	−0.205	12	−0.100	4	0.086	10	−0.011	8	0.006
Indonesia	14	−0.270	13	−0.233	15	−0.143	11	−0.012	2	0.045	2	0.073
Iraq	15	−0.303	21	−0.420	6	0.174	15	−0.042	2	0.045	14	−0.061
Malaysia	16	−0.325	17	−0.299	14	−0.132	11	−0.012	2	0.045	2	0.073
South Africa	17	−0.341	14	−0.240	18	−0.226	6	0.007	2	0.045	2	0.073
Japan	18	−0.384	10	0.096	20	−0.251	18	−0.103	17	−0.066	14	−0.061
Turkey	19	−0.393	14	−0.245	21	−0.261	1	0.184	10	−0.011	14	−0.061
Libya	20	−0.573	20	−0.357	10	−0.054	18	−0.103	17	−0.066	8	0.006
Ukraine	21	−0.632	17	−0.299	19	−0.245	5	0.037	17	−0.066	14	−0.061

4.5   Analysis of the assessment results

From the composite and each factor scores calculated in the assessment results (Table 13), the O&G geopolitical influence of the 21 representative countries could be classified into the following tiers (Figure 3).
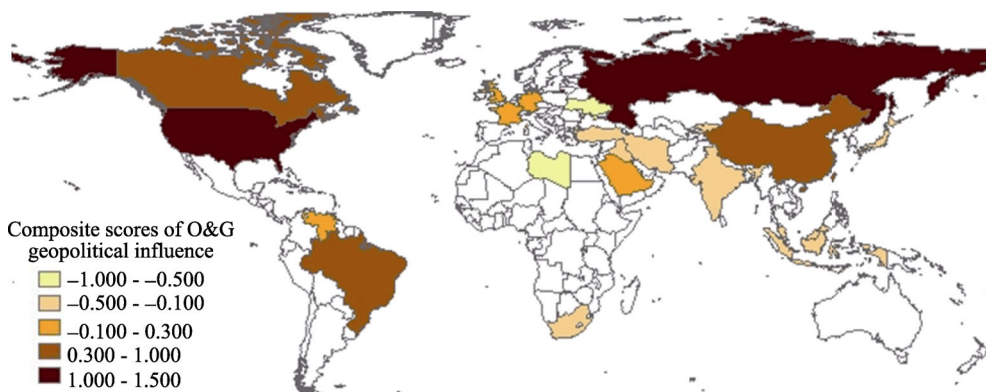

Figure 3   Composite scores of O&G geopolitical influence of representative countries
Source: Table 13.

(i) Tier 1 – Strong influence:

Tier 1 contains countries scored greater than 1.000. The USA and Russia belong to this tier. Their composite scores were significantly higher than the rest. They have a firm and powerful position in global realm of O&G geopolitics and are able to effectively seize their O&G geopolitical interests and realize their strategic goals. They are in dominant role-playing positions in the energy geopolitical pattern and related national strategy formulations, assuming an active role with their strong influence. These two countries exhibit outstanding qualities in the comprehensive strength factors (e.g., domestic economy, military, diplomacy, politics, and territory), and also behaves quite good in other four factors as mentioned above. The USA, for instance, has global control over key O&G transportation routes. The 16 global offshore oil transportation thoroughfares focused on by its military broadly cover the Atlantic, Mediterranean, Indian Ocean, and Asia-Pacific regions (Li, 2006). Its O&G import concentration is relatively low, with diversified sources from Canada, Central and South America, the Middle East, and West Africa (BP, 2013).

(ii) Tier 2 – Relatively strong influence

Tier 2 contains countries scored between 0.300~1.000. The countries in this tier include China, Canada, and Brazil. They scored relatively high overall in the main factors F1–F5 and have a relatively strong O&G geopolitical influence. The formation of China's O&G geopolitical influence can be largely attributed to the two factors of *comprehensive national strength* and *risk*. The O&G geopolitical influence of Canada is largely a result of the factors of *comprehensive national strength* and *geopolitics*. However, 96.6% of Canada's crude oil is exported to the USA, resulting in relatively high export risks. Brazil scored relatively well for the factors of *risk* and *geopolitics*, supplemented by *comprehensive national strength*.

(iii) Tier 3 – Moderate influence

Tier 3 contains countries scored between –0.100 and 0.300. Saudi Arabia, the United Kingdom, France, Germany, and Venezuela are the countries in this tier. They can all be

classified as one of the following two types: (a) strong EU and key O&G import countries; and (b) key O&G exporting countries. They have prominent positions in O&G politics and may exert a certain amount of influence by using their advantages. However, these countries have their certain problems, for instance, countries in the Middle East that rely on the O&G industry as the pillar of their national economy may experience a weakening of their O&G geopolitical influence, and face risks of economic stagnation if their export channels remain overly concentrated.

(iv) Tier 4 – Relatively weak influence

Tier 4 contains countries scored between –0.500 and –0.100. The countries included in this tier are India, Iran, Kazakhstan, Indonesia, Iraq, Malaysia, South Africa, Japan, and Turkey. Although these countries have some specific features in the O&G geopolitical pattern, their influence is limited, given their relatively low scores in the various factors. India, being a mega-country, has seen a significant increase in its overall national strength and influence in recent years. However, its scores for the factors of *geopolitics* and *energy* were relatively low. Malaysia and Indonesia straddle the Straits of Malacca, controlling most of the transportation of petroleum from the Middle East to East Asia. Turkey is an important energy corridor for the EU for energy imported from the Middle East and Central Asia.

(v) Tier 5 – Weak influence

Tier 5 contains countries scored less than –0.500. This tier comprises countries such as Libya and Ukraine. They are in a weak position in terms of O&G geopolitics and their global influence is also relatively small. Libya has relatively rich O&G resources, while Ukraine hosts 80% of the natural gas transported between Russia and the EU in 2009 (Xinhuanet, 2009). Nevertheless, their scores on the other factors were all relatively low.

5 Conclusions and discussion

5.1 Conclusions

Some conclusions can be drawn as follows.

(1) This paper incorporated the concept of influence into the research on energy geopolitics, and directed the assessment of O&G geopolitical influence specifically to energy that has special strategic value, specifically petroleum and natural gas. Compared to traditional research on comprehensive assessments of O&G geopolitics, this paper focused on an analysis of O&G geopolitical influence, with in-depth investigations into the mechanisms of the formation of that influence. This paper characterized the development of O&G geopolitical influence through various stages: they were the basis of gestation, the means of transformation, and the formation and exercise of O&G geopolitical power. In so doing, we corrected a main shortcoming of traditional studies, specifically, the lack of a theoretical framework behind the assessment system and indicators used.

(2) *Comprehensive national strength* was the main factor that determined a country's O&G geopolitical influence, with a contribution rate of more than 33%. The other factors that followed were *energy* (25%) and *transportation* (12%). The combined contribution rate of the remaining two factors (*risk* and *geopolitics*) was less than 20%. That is to say, a country's O&G geopolitical influence was largely depend upon its power of comprehensive national strength, the richness of energy resources, and ability to control transportation routes.

Rich O&G resources alone were insufficient to transform a country into a mega power in terms of its O&G geopolitical influence.

5.2 Discussion

Some issues in the research on O&G geopolitical influence are worthy of further exploration.

(1) The formation of O&G geopolitical influence is an integrated process that encompasses objective conditions and subjective motivations, static states and dynamic processes, and internal factors and external environments. The process requires the involvement of various basic conditions, transformation processes, and intermediate links. However, this study was based only on the understanding of current situations in O&G geopolitics, and did not incorporate any considerations for short- and long-term changes in the indicators. To further improve the assessment system in future studies, it is suggested that more in-depth focus be placed on the short- and long-term factors that influence O&G geopolitical influence.

(2) O&G geopolitical influence is constantly developing and evolving. Based on foreseeable future trends, some changes in the energy and transportation sectors are worthy of notice. In the aspect of energy, exploration and development of non-conventional O&G, specifically shale gas in the USA, oil sands in Canada, and deep-water oil in Brazil, is advancing rapidly. Also, renewable energy technologies have been put into wider adoption. Both may shift the center of the global energy map, currently dominated by the Middle East, towards the West. This will represent a trend toward more balance between the East and West. As for the transportation aspect, global O&G pipelines are aiming for peak production, with a number of major O&G pipelines under construction in China, Russia, and Central Asia. Additionally, global warming has gradually reduced the time needed for the full navigation of the Arctic shipping route. This may reshape the future pattern of global O&G transportation, with the focus shifting toward Russia, Central Asia, and the Arctic region.

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