The Project Screening Model for Natural Gas Projects: Focusing on The Gas Field Development

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ABSTRACT

Despite the large demand for Natural Gas (NG) that is needed to produce clean energy and resource sufficiency, entry of NG related construction market is limited by the inherent risks. Especially, the early stage of projects such as planning or feasibility study is more crucial on the uncertainty perspective than other following stage such as engineering or construction. Thus, it is necessary to implement a project screening model in the early stage of a project. This study proposes a project screening model for gas plants that incorporates two analysis aspects: market environment analysis and gas field analysis. Market environment analysis evaluates a country’s political stability and the stability of the project from the market perspective. Gas field analysis evaluates technical property, participant stability, and the stability of the target project from the project perspective. Finally, a case analysis is performed using the gas field project in South Africa. The case analysis uses documents of actual gas field development and interviews with site managers. Thus, the gas field site manager validated the proposed model and confirmed its usability. When a user integrates the own expertise and experiences with this model, the model will be able to support reasonable decisions.

INTRODUCTION

In recent decades, natural gas (NG) has become an energy priority, as it is a source of clean energy. According to PFC Energy (2013), the demand for natural gas will continue to increase until 2030, when natural gas will become the second largest energy resource. Despite the large demand for natural gas in producing clean energy and achieving resource self-sufficiency, entry into the natural energy construction market is limited by inherent risks. Natural gas exists in a small
number of countries, and most of those countries are controlled by unstable rulers. Such conditions create an unstable business environment and an increase in uncertainty.

According to Godisman (2011), the energy resource development market has a large capacity. The total amount of oil and gas produced in the world is worth nearly $180 billion, with nearly 300 contracts in place for producing that oil and gas (see Table 1). The oil and gas market is nearly three times larger than the international construction market (ENR 2013). North America produces nearly 60% of the world’s oil and gas. The US is the world’s largest economically and politically stable oil and gas producer. These types of characteristics are important in evaluating oil and gas production prospects from a financial perspective.

Table 1. The Transaction Amount of Oil/Gas Fields (Whole World)

<table>
<thead>
<tr>
<th>Area</th>
<th>No. of Contracts</th>
<th>Amount (Bil. US$)</th>
<th>Portion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>210</td>
<td>101.9</td>
<td>57</td>
</tr>
<tr>
<td>South America</td>
<td>16</td>
<td>32.2</td>
<td>18</td>
</tr>
<tr>
<td>Asia/Pacific</td>
<td>18</td>
<td>18.3</td>
<td>10</td>
</tr>
<tr>
<td>Russia and etc.</td>
<td>10</td>
<td>13.2</td>
<td>7</td>
</tr>
<tr>
<td>Europe</td>
<td>19</td>
<td>7.2</td>
<td>4</td>
</tr>
<tr>
<td>Africa</td>
<td>21</td>
<td>6.6</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>294</strong></td>
<td><strong>179.4</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Nevertheless, the current evaluation model for gas field valuation is insufficient. Gas field development is costly and requires long periods of operation to generate the revenues for investors. Moreover, gas development projects are strictly divided into project screening, project feasibility studies, Preliminary Front End Engineering Design (Pre-FEED), detailed engineering, procurement, construction and operations (including production). Various phases may be in progress based on the information from and analysis and outcomes of gas field analysis. Every phase generates products, such as Feed gas during the exploration phase and natural gas during the operation phase. Additionally, participants in each phase are responsible for selling the gas. These factors render the business structure of the natural gas market more complex. For these reasons, the project-screening model is important to every participant in making decisions.

The meaning of the project screening

In order to generate a project, extensive analysis and decision making from several actors is generated from various perspectives. Additionally, much of the data, such as economic indicators and risks, are required to evaluate alternatives in order to select an optimal project. Thus, early involvement in the development phase of project screening, as well as priority analysis, are effective in reducing risk and enhancing the probability of success. Generally, assessing feasibility by analyzing market information and the business environment is necessary for generating new projects. In this step, the details of a project have not yet been determined. Rather, the project’s potential is still being evaluated.

However, as an initial phase, the project screening phase evaluates individual projects based on limited information, assessed and expected risks,
variation of global market trends, and business-related national characteristics. Additionally, this phase considers the business strategies and risk assessments of later phases, and determines the appropriate balance level between stability and risk. Too much stability leads to missed business opportunities, and too much risk leads to a large amount of damages.

THE PROJECT SCREENING MODEL

Analysis of current method

The current international project screening model is concentrated in economic evaluation, including the Cash Flow method, which considers inflation. Changes in gas prices and the cost-benefit ratio are considered during analysis. In addition, an assessment of the current market trends is performed from the NG market trend perspective. However, the current method is still insufficient because it only consists of summarization reports of public information, and its decision-making process is also uncertain. For these reasons, the business environment of the target country, country risk, and NG market outlook were sufficiently managed for project evaluations. Thus, a more comprehensive and quantitative screening model is necessary. Such a model should include business strategy, characteristics of NG projects, broad information and recent market trends with quantitative evaluation methods.

Figure 1. Concepts of the project screening model

Concepts of the project screening model

In order to create a project screening model, various data were collected and analyzed from the Gas sector of The British Petroleum, Shell, Business Monitor International, IHS Global Insight, and other market research agencies, Oil & Gas Journal, Oil & Gas Financial Journal, and other professional journals as data providers. The concept of the project screening model is divided into four parts: the gas field exploration, feasibility study, processing plant operation and business strategy phases (see Figure 1). Each of these phases can take place either independently or together. This can distinguish upstream and midstream decision making from customized analysis. Additionally, the business strategy chosen can
influence each phase in deciding whether to advance to feasibility study phase. In this paper, the author discusses the gas field exploration phase as an upstream developer. Other phases should be discussed in future research.

**Market environment analysis**

Existing research on the market environments that overseas business enter entail several characteristics. First, the concepts of project investment and development are insufficient because they focus only on the construction industry and its contractor areas (Han et al, 2007; Ozorhon et al, 2007). Second, the positive effects of risk, such as opportunity and expected rewards, are neglected because most risk analysis focuses on the reduction of negative results (Castilo et al, 2011). Third, objective and reliable indicators and data have a lower priority than does the personal knowledge of practitioners and the intuition of experts. Fourth, the normative evaluation method is a more frequently used method than the absolute evaluation method. The normative evaluation method is based on the risk checklist or the probability-impact assessment.

Thus, market environment analysis aimed at overcoming concerns and establishing a market environment analysis model for targeted countries at the macro level is important. To this end, the characteristics and the business environment of the target country are assessed in order to determine opportunities and risks. Details of the characteristics are as follows (see Figure 2):

![Figure 2. The classification of market environment analysis](image)

- Stability of the target country’s political and institutional systems: NG development projects typically needed several decades. Thus, political and institutional business maturity, stability of legislation, government efficiency and low corruption are essential to positive macro-level analysis.
- Stability of current businesses: In order to assess the target country’s stability and begin investing in businesses there, the characteristics of the country’s administrative procedures, the level of protection of property and investments, taxes, and contract compliance must be assessed.
- Stability of businesses in the natural gas industry: the natural gas industry requires specific conditions to garner a positive assessment. Thus, the expected rewards for each phase of projects such as upstream and downstream are necessary. And also require the analysis coupling with similar projects in target countries.
It is impossible to assess the characteristics, opportunities, and rewards of the natural gas industry using the current general industry evaluation method. Thus, a total of 31 sub-indices were derived. Users determined the weight of each indicator, and assessment results were expressed in a quantitative scale.

**Gas field analysis**

The quantitative evaluation of gas fields with rational methods is the most effective way to achieve stability of existing investors and potential investor interests. The fund will not draw a large income for a long period of time in the initial stage (gas exploration, etc.). Many of the projects floundered due to conflicts between participants and uncertain business progress. In addition, potential investors who want to acquire a stake of a project at a specific point of time use various evaluation methods for calculating value at a specific point in time. However, in the absence of a clear evaluation method and system, most cases use only price volatility and expected reserves to conduct financial assessments. Such assessment assumes the successful completion of a project. Thus, the progress of the project, operational risk during long payback periods, and the volatility of the business environment render natural gas projects difficult.

In order to evaluate the sustainability of a gas project, we identify the critical evaluation factors through analysis of existing cases and a review of the literature. Additionally, we establish the evaluation model to evaluate sustainability through expert surveys and interviews. This model contains financial, technical, and organizational factors and is reconstructed as a classification framework based on the characteristics of gas fields. The details of the characteristics are as follows (see Figure 3):

- **Characteristics of gas fields (limited information and high volatility):** In order to evaluate the nature of a gas field, various information and analyses are required. However, the exploration and planning phase of the gas field labors under limited and inaccurate information that is difficult to acquire. The exploration of gas fields requires obtaining several drilling samples for analysis. Geological exploration and the use of various statistical techniques also demand the estimation of reserve and mining periods. Despite complex and detailed analysis, the results still have high volatility and uncertainty.

- **The stability of project participants (high stability and trust between each participant):** Gas projects have a high probability of failure and require high levels of risk and expense. In addition, it will take a long time to
generate revenue. The revenue will equal a certain amount each year. Thus, the participation of gas companies and their continued investment in gas projects is essential.

- Stability of project progress (the level of experience and knowledge of project developments): Gas field projects require long-term natural gas sales contracts agreed to at the beginning of the projects. Annual, step-by-step implementation of the contracts on the property is also necessary. Understanding the nature of gas exploration projects and the stability of investors is important to the success of these projects.

The current financial evaluation method is unable to assess the technical characteristics of gas, the stability of the project participants, and the stability of project progress. Thus, a total of 12 sub-indices were derived. Users determined the weight of each indicator, and assessment results were expressed in a quantitative scale.

CASE APPLICATION

In order to verify the project-screening model, we perform a case application. The case is located in South Africa and involves a large amount of gas. However, many researchers and practitioners caution potential investors against investing in the South African site because South Africa has unstable institutions, and all of its past gas field projects have failed. Moreover, the leading investor does not have enough experience and knowledge in gas field development.

![Figure 4. Results of market environment analysis](image)

To evaluate the project, the author uses an established model with 31 factors for “market environment analysis”, including 6 factors under the target country’s stability of political and institutional systems, 10 factors under the stability of current business, 15 factors under the stability of current businesses in the natural gas industry, and 12 factors under “gas field analysis”, including 4 factors under gas field, 4 factors under the stability of project participants, and 4 factors under the stability of project progress. Under to the suggested model, market environment scored 63 points out of 100, and the gas field scored 74 points out of 100. Detailed results of evaluation are as follows (see Figure 4 and 5):
- Market environment analysis: The model averages is 66 points out of 100. Thus, the determined score (63 point) indicates that the case project was slightly insufficient for deciding the investments. According to the suggested model, the “maturity of political and institutional system” is extremely low, but “expected reward from gas industry” and “stability of same projects in target country” are high.
- Gas field analysis: The model averages is 66 points out of 100. Thus, a determined score (74 point) indicates that the case project was somewhat successful in deciding the investments. According to the suggested model, highly weighted factors, such as “expected reserve” and “NG sales risk”, score highly. These factors garnered higher scores than market environment analysis, even though “risk of feed gas exploration” was low.

DISCUSSION AND VALIDATION

Based on the results of the suggested model, the case project is an attractive project, despite the fact that the target country has below-average attractiveness. However, these results were generated from the data and expert opinion. Thus, the author conducted interviews to validate the results of the participants in the case project. To secure objectivity, seven expert interviews were conducted. According to the interviewers, results of market environment analysis are strongly similar, and results of gas field analysis are slightly similar with the results of case project. Detailed results of comparison are as follows:

The target country had no laws or supplemental rules to continue the project. Corruption was the most critical problem, expediting or disturbing gas projects despite the existence of laws against corruption and rules for starting businesses. Influential individuals are critical to expediting projects. Nevertheless, the rewards and advantages enjoyed during the operation of projects in South Africa are more numerous than they are in other countries. In particular, South Africa guarantees the export of products, the remittance of revenues and protection of the invested properties for the duration of the project. Moreover, government payments are discounted, such as taxes on various projects, in order to guarantee exploration success.

On the other hand, the practical evaluation of gas fields falls below the suggested model, but is acceptable. None of the project investors have the experience or technical equipment to develop gas fields. They are beginners in this field, except for those working on a project located in deep in the country.
Nevertheless, all of the natural gas sales contracts have been completed. The relationship between investors is good. On a different note, the geological survey and seismic data show the existence of large reserves.

CONCLUSIONS

The early phases of a natural gas project, such as the planning and feasibility study phases, are more crucial to project success (from the perspective of uncertainty) than are subsequent stages, such as engineering and construction. This study examined the business opportunities and risks for overseas natural gas projects based on the project screening model. The author suggests using the market environment analysis model and the gas field analysis model to evaluate new natural gas projects. Suggested model benchmarks include the current project evaluation method, enhancing the characteristics of the natural gas industry, and reviewing the literature.

The market environment analysis model contains the target country’s political, institutional, economical, and industrial factors, and is classified into three categories: stability of political and institutional system, stability of current businesses, and stability of business in the natural gas industry. The gas field analysis model incorporated the factors of feed gas, expected reserve, relationship between participants, stability of project, and sales risk of products, which were classified into three categories: characteristics of gas fields, stability of project participants, and stability of project progress. A total of 31 factors for market environment analysis and 12 factors for gas field analysis were identified. Finally, to validate the project screening model, the author performed a case application. According to the results of case application, the project screening model represents the quantitative numbers as a calculated value. Additionally, the author validated the results through interviews with experts, finding that they were sufficient at the early stage of projects.

However, the project screening model has some limitations. In particular, the model used just one case with seven experts, and the weight of each factor was not defined. Additional research is essential to generalize the model. Nevertheless, this paper suggests that the project screening process and its detailed factors focusing on gas field projects, as well as its establishment of a quantitative evaluation method, is significant. Consequently, the project screening model can support the decision making process for gas field projects using quantitative results.

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REFERENCES


