

Mining project evaluation process for investment decisions: Demonstration of the risk assessment model - part three

by H.M. Park and M.G. Nelson

Risk is a major factor in all mining activities, arising from many internal and external variables. The authors' research has resulted in a systematic method for the quantification of risk in mining projects (Park, 2012), and this research is being presented in a series of papers. The first paper (Park and Nelson, 2013a) identified the variables associated with risk in mining projects, and their effects and was published in the October issue of *Mining Engineering* magazine. The second (Park and Nelson, 2013b) discussed methods of assessing the overall risk associated with those variables (published at www.me.smenet.org), and presented a statistical model based on a survey of 31 experts. This paper will present an evaluation of the statistical model, using data from previous mining investment decisions in which the authors have been involved.

Demonstration

This paper describes demonstration of the statistical model using data from investment projects previously executed by the authors (Part One was published in *Mining Engineering* magazine, Oct. 2013 and part two was published at www.me.smenet.org). To increase the validity of the tests, the authors used 14 developing and operating projects where investment was made during the exploration phase. At present, seven of those operating projects are providing good cash flow, and are a key part of its profitable operation. Seven developing projects have already overcome several risks and are expected to begin production within two years.

One sample project, a producing coal mine, will be discussed in detail to demonstrate how the criteria are used. One of the authors, Park, was in charge of this project from 2007 to 2009. Table 1 shows a general description of a coal project, summarized from an analysis at the

time the decision was made to participate in the project. One important factor in the risk analysis was that the project is located in New South Wales, Australia. Consideration of the project began when the investors received

an investment offer from a medium-sized Australian coal firm. The investors surveyed the proposed mine site twice. The second survey found that exploration was almost completed, and the operating company was preparing to do a feasibility study and prepare an environmental impact statement. Based on these and other factors, the investor decided to invest in the project.

During these surveys, the investors also confirmed that coal quality at the site was suitable for their market. There are several operating coal mines near this project, so that there were no infrastructure risks. The operating company had contracts with a railway and the port authority, for transport and export of the coal produced, and had even made a coal supply agreement with a local power plant. Investors made a decision to invest and submitted the proposal for consideration by domestic power generation companies, who were potential partners. Negotiations were difficult but eventually successful, and the deal was completed.

Table 2 shows investors' evaluation of the risks associated with the investment, which was based on the company's internal documents, including reports for the board of directors and signed agreements.

The following discussion explains how the model can be used to evaluate the project. Calculation of the investor's risk for each of the five major categories is shown, with a detailed discussion of the partner risks provided for further clarification.

The investor joined the project in 2008. Prior to making the investment, the investor made a consortium with five domestic private companies. All of those companies have good financial status and are registered on reputable stock exchanges. Among them, they have several coal mines in other countries. Thus, the grade for the first minor category was 'A.' The foreign company is a senior mining company in Australia. It has five coal projects and is registered on the Australian Stock Exchange. Its management team was judged to have adequate operating and management skills. Thus the grade for this minor category was also 'A.' The investment assessment proportion for the 'partner risks' major category

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Table 1

Sample coal project description.

| | |
|--|---|
| Location | New South Wales, Australia |
| Ownership | Australian registered company has 100% equities |
| Commodity | High quality thermal coal for export market |
| Project stage | Under feasibility study |
| Resources | 325 million tons, reserves based on JORC |
| Proposed annual production | 16 million tons of thermal coal |
| Infrastructures | Transportation, power, water, and port allocation are secured |
| Economic values | IRR 18.5%, positive NPV, 8 years payback |
| <i>Source:</i> Information in possession of author | |

is calculated as shown below:

$$(34.5 \times 100\% + 65.5 \times 100\%) \times 8\% \quad (1)$$

Thus, in this case, the risk assessment for the “partner risks” major category is eight points — the maximum possible.

The risk assessment calculations for the five major categories are summarized in Table 3.

Other projects already executed by the investor were also analyzed using the risk assessment model described in the second paper of this series (Park and Nelson, 2013). For these projects, the average ranking was 73 points, with range of 69 to 77. This indicates that the level of investment risk which the investor is willing to assume, assessed using the criteria in Table 2, is 73 points, at least for new project investments.

Table 2

Coal project risk evaluation.

| Major (proportion) | Minor (weight) | Grades and comments | | |
|----------------------------|---------------------------|---------------------|--|-------|
| Partner risk (8%) | Domestic partners (34.5%) | A | Five Korean power generation companies joined | 34.5 |
| | Foreign partners (65.5 %) | A | Australian listed company is operator | 65.5 |
| Technical risks (43.2%) | Project execution (17.3%) | C | Exploration work completed | 4.325 |
| | Geological risks (38.6%) | A | 325 million st of coal reserves basis | 38.6 |
| | Operating risk (20.7%) | A | Standard opencut mining and typical coal washing | 20.7 |
| | Production scale (13%) | A | 16 million st/a of thermal coal | 13 |
| | Data reliability (10.5%) | A | International standard (JORC) applied | 10.5 |
| Marketability (8.6%) | Product standard (100%) | A | Suitable for South Korea, trial shipping and test burn completed | 100 |
| Investment climate (18.2%) | Country risk (35.2%) | C | New South Wales in the lowest ranked in the mining world | 0 |
| | Permitting (31.1%) | C | Ready for Environment Impact Statement | 0 |
| | Infrastructure (33.6%) | A | Secured rail haulage, power and water supply | 33.6 |
| Economic values (22%) | IRR (23%) | B | Greater than 15% | 11.5 |
| | NPV (57.7%) | A | Positive NPV | 57.7 |
| | PBP (19.3%) | B | Less than 12 years | 9.65 |

Table 3

Risk assessment calculations.

| | |
|---------------------|---|
| Partner risks | $8\% \times (34.5+65.5)$ |
| Technical risks | $+ 43.2\% \times (4.325+38.6+20.7+13.0+10.5)$ |
| Marketability | $+ 8.6\% \times 100$ |
| Investment climates | $+ 18.2\% \times (0+0+33.6)$ |
| Economic values | $+ 22.0\% \times (11.5+57.7+9.65)$ |
| Total score | $= 77.7$ |

Of course, the risk assessment model will be applied differently in each company, depending on the size of the organization, the magnitude of the mining projects where the company is involved, and the company's internal investment

philosophy. Nonetheless, the authors believe that the use of a systematic, quantitative model will be valuable for all companies. This value will be greatly increased when companies using the model make regular and periodic assessments of the weightings assigned to each major and minor category, updating those weightings based on the company's accumulating experience in making mine project investments. Such a procedure, when followed conscientiously, will contribute a valuable measure of continuity and consistency to a company's investment analysis strategies. ■