

Chapter 9

Decision Making under Risk and Uncertainty in the Oil and Gas Industry

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ABSTRACT

The energy system studies include a wide range of issues from short term to long term horizons. The decision making chain is fed by input parameters which are usually subject to uncertainties. The art of dealing with uncertainties has been developed in various directions and has recently become a focal point of interest. Decision making is certainly the most important task of Oil and Gas managers and it is often a very difficult one. The purpose of this chapter is to review and investigate the decision making processes under risk and uncertainty of Oil and Gas companies. Questionnaires were distributed to eight Oil and Gas companies in Ghana to solicit their view on decision making under risk and uncertainty. Results indicate that most managers use Maximax, Minimax Regret and Expected Value when making decisions under risk and uncertainty.

1. INTRODUCTION

Oil and Gas are the major source of world's fuel consumption. Most of the Oil and Gas is transported from one location to another through pipelines. Existing pipelines around the globe have been subjected to deterioration due to aging, aggressive environmental factors, inadequate design and improper protection and maintenance. To ensure optimal performance, this often requires extensive maintenance, repair and renewal practices or even replacement of certain components. Integrity of these pipelines is of primary interest to the Oil and Gas companies, governmental agencies, consumers and other stakeholder due to potential adverse consequences related to public health, safety and heavy financial liabilities in case of system failure. Increasing economic development is stipulating the growth of energy demand due to the limited availability of fossil energy, the high cost of renewable technologies and various environmental concerns on energy-related activities; energy systems planning is desired for supporting sustainable re-

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gional development. However, such planning is associated with various uncertainties that exist in many related impact factors. These uncertainties will affect various processes of energy systems management (Huang et al., 1993). Neglecting them may result in missed information and reduced decision robustness.

Modelling for decision making involves two distinct parties, one is the decision maker and the other is the model builder known as the analyst. The analyst is to assist the decision maker in his/her decision making process. Therefore, the analyst must be equipped with more than a set of analytical methods. Specialists in model building are often tempted to study a problem, and then go off in isolation to develop an elaborate mathematical model for use by the manager (i.e., the decision maker). Unfortunately, the manager may not understand this model and may either use it blindly or reject it entirely. The specialist may feel that the manager is too ignorant and unsophisticated to appreciate the model, while the manager may feel that the specialist lives in a dream world of unrealistic assumptions and irrelevant mathematical language. Such miscommunication can be avoided if the manager works with the specialist to develop first a simple model that provides a crude but understandable analysis.

After the manager has built up confidence in this model, additional detail and sophistication can be added, perhaps progressively only a bit at a time. This process requires an investment of time on the part of the manager and sincere interest on the part of the specialist in solving the manager's real problem, rather than in creating and trying to explain sophisticated models. This progressive model building is often referred to as the bootstrapping approach and is the most important factor in determining successful implementation of a decision model. Moreover, the bootstrapping approach simplifies the otherwise difficult task of model validating and verification processes (Arsham, 1987).

In deterministic models, a good decision is judged by the outcome alone. However, in probabilistic models, the decision maker is concerned not only with the outcome value but also with the amount of risk each decision carries. As an example of deterministic versus probabilistic models, consider the past and the future. One can do nothing to change the past, but everything we do influences and changes the future, although the future has an element of uncertainty. Managers are captivated much more by shaping the future than the history of the past (Ben-Haim, 2001).

Uncertainty is the fact of life and business. Probability is the guide for a good life and successful business. The concept of probability occupies an important place in the decision making process, whether the problem is one faced in business, in government, in the social sciences, or just in one's own everyday personal life. In very few decision making situations is perfect information all the needed facts are available. Most decisions are made in the face of uncertainty. Probability enters into the process by playing the role of a substitute for certainty—a substitute for complete knowledge.

Probabilistic modelling is largely based on application of statistics for probability assessment of uncontrollable events (or factors), as well as risk assessment of your decision. The original idea of statistics was the collection of information about and for the state. The word statistics is not derived from any classical Greek or Latin roots, but from the Italian word for state. Probability has a much longer history. It is derived from the verb to probe meaning to find out what is not too easily accessible or understandable. The word "proof" has the same origin that provides necessary details to understand what is claimed to be true. Probabilistic models are viewed as similar to that of a game; actions are based on expected outcomes. The centre of interest moves from the deterministic to probabilistic models using subjective statistical techniques for estimation, testing and predictions. In probabilistic modelling, risk means uncertainty for which the probability distribution is known. Therefore, risk assessment means a study to determine the outcomes of decisions along with their probabilities. Many decisions have to be made with inadequate information, perhaps because the outcome of a decision is uncertain or because

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