

Sequential Investment Decisions with Bayesian Learning

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Abstract:

Management must regularly make decisions under conditions of uncertainty that exist because of an inability to forecast the future accurately. More specifically, a firm may be unable to determine the level of demand for some product in the future; it may be unable to predict rivals' reactions to some particular action of its own; or it may be unable to estimate costs satisfactorily. These conditions of uncertainty are particularly critical when the firm is contemplating an investment in a fixed asset. Therefore, the organizational unit responsible for the original definition of the project may be able to estimate profit potential only within a wide range. In addition, the personnel who provide the impetus necessary to have the project considered may tend to understate certain perceived risks in order to obtain funding. In this institutional context, the top management must face the problem of making a decision on a large investment without adequate knowledge.

We consider a model in which partial investment is like an experiment that provides information later used to determine the scope of subsequent investment. In this model, we have identified conditions under which some investment is optimal when a sequential approach is followed, but no investment would be made under a nonsequential approach that did not permit experimentation. These experimental investments are attractive when the project appears to be uneconomical, but the management's prior knowledge about the profit from the investments is relatively imprecise. In addition, we have identified conditions under which partial investment is optimal when a sequential approach is followed, but a full investment would be made under a nonsequential approach. These partial investments are optimal when the project appears to be profitable, but again the management's prior knowledge about the profit from the investments is relatively imprecise. In these cases, ability to invest sequentially enables the management to avoid making large, potentially unprofitable commitments.