How to Provide Information for Management Decisions

In a decision-making process, information can be categorized as situation information, supporting information and feedback information. This work experimentally studies several ways of providing information for a selected decision-making process to pinpoint decision-making improvement interventions. We manipulate (i) whether decision makers obtain decision-supporting information for free or at a cost and (ii) the decision-feedback information provided to them.

Situation information describes objective facts of a problem, which is formulated as independent parameters in a mathematical decision-making model. Supporting information provides suggestions on how to solve the problem, which is related to decision variables in the model. Feedback information is the output of decisions in an instance of the problem. In repeated one-period decision-making problems and multi-period decision-making problems, feedback information can play a role since it may influence decision making for the current period. If decision makers act rationally (unbounded rationality), they should always follow the suggestions provided by the supporting information regardless of the feedback information.

Nevertheless, in practice, decision makers do not behave rationally. Take, for example, the Newsvendor model, a building-block model in operations management. Behavioral research has found that orders deviate from ordering suggestions and show significant variance even though the situation information is fixed. Several behavioral factors have been proposed to explain the deviations from the theoretical prediction, such as limited computation ability, anchoring and insufficient adjustment, regret from inventory errors, over confidence, biased risk attitudes, random errors, and so on. That is, decision makers place biased orders because of bounded
rationality. Nevertheless, to the best of our knowledge, no research has systematically study how the way information is provided can improve decision-making.

For example, Bolton and Katok (2008) tested the effect of feedback information by providing decision makers with information on the payoffs of alternative orders, observing no significant improvement. Bolton et al. (2012) provided participants with supporting information on the optimal order. Nevertheless, participants’ orders still deviated from the decision-making suggestion. Others, such as Bostian et al. (2008) and Lurie and Swaminathan (2009), manipulated the frequency of feedback information and reported mixed effect between profit margin and frequency on the ordering variance.

To reveal the value of supporting information and explore feedback information alternatives, we ran a newsvendor experiment. Our design considers four factors: profit margin, supporting information, feedback information, and the cost of the supporting information. The profit margin has two levels: high and low. The supporting information has two levels: available or not. The feedback information has three levels: both realized demand and realized profit, only realized profit, and average realized profit. The cost of the supporting information has three levels: zero cost, low cost and high cost. We had a within-subjects design for supporting information, while a between-subjects design for the remaining three factors.

Given that the supporting information corresponds to the optimal order, decision making should be better compared with the treatment without the supporting information. Nonetheless, Bolton et al. (2012) has shown that this is not enough. The strength of the ordering bias requires different counterbalancing force. Because of the sunk-cost effect, obtaining the supporting information at a cost, instead of for free, should aid to mitigate the orders’ deviation from the suggested order.
On the other hand, in newsvendor experiments, feedback information usually comes in the form of realized demand and realized profit. Since this information constantly changes in ways that it is difficult for decision makers to link it with improved performance, it may confuse decision makers and reinforce the ordering bias (Kremer et al., 2010). The realized demand and realized profit are non-instrumental for decision making (Sengupta, 1995; Bastardi and Shafir, 1998). Alternatively, average realized profits over time is instrumental information because the objective of the task is maximizing the expected profit. Hence, with average-profit feedback, decision making should improve.

Participants for the experiment were recruited on campus. They made ordering decisions after reading the instructions and passing a manipulation check. They could ask clarifying questions to the experimenter at any time and the experimenter answered all questions without compromising the experiment's goals.

The experimental data show that participants perform significantly better when the supporting information is provided at a cost than at zero cost. In addition, the orders show less variance when the feedback information is instrumental (average-profit feedback) than when it is non-instrumental (realized demand and/or realized profits).

One implication of our results is that the sunk-cost effect can help decision makers to pay attention to supporting information, which mitigates the distraction incurred by certain behavioral factors and accordingly improve decisions making. In practice, this would imply that some effort investment should be required for obtaining the supporting information since free supporting information is not taken as important as it should be. Another implication of our results is that instrumental information can help reduce decision-making variability. It implies that information systems in practice should provide only information directly relevant to the decision process.