Teaching Case

Quantifying the Value of a Decision Support System

George Schell Ph.D.
schellg@@uncw.edu
Cameron School of Business
University of North Carolina Wilmington
Wilmington, NC 28405-5611

Abstract

Business professionals should be capable of establishing the economic value of creating an information system that supports a decision-making process. To understand this concept it is best presented in the context of a situation that can be expressed quantitatively – i.e. in terms of dollars for decision making. A simple spreadsheet can help to clarify the decision choices, possible outcomes from decisions and also the economic impacts of decisions. Decision support systems (DSS) are only one category of information systems and others may be better measured by efficiency gains or influence over a customer base. However, establishing the potential value of a decision support system allows business professionals to critically probe the assumptions of the accuracy of the DSS predictions, the dollar amounts to be gained by different decisions, and costs to develop/acquire the DSS.

Keywords: Decision Support Systems, Spreadsheets, Economic Value.

1. CASE SUMMARY

Your organization, Caifu Furniture Manufacturing, is faced with a difficult decision about the size of its manufacturing staff. Senior management believes that the demand for its products is closely tied to the general economy. Since Caifu's lease is about to expire on their current facilities they must decide whether to renew their lease or lease another facility in the area that is smaller.

It would be nice to assume that many facilities are ready to be leased but that is not the case. Caifu must choose from facilities close to their present location in order not to cause issues for customers, suppliers, and employees and only one facility is currently available that meets their criteria. A standard, open-ended relocation is not an option.

The only other facility available that meets the company's need is small and would necessitate a 10% smaller manufacturing staff. If Caifu stays at its current facilities it can maintain the current staff levels.

To complicate the situation, Caifu senior management must predict demand for their product in the next year. To make it simpler they have chosen to consider only three alternatives; a 10% decrease in product demand, demand stays the same as this year, or demand for the product increases by 10%.

You are an information analyst who was hired by Caifu only a year ago but you have become familiar with the company goals and procedures. You have heard that Caifu makes these decisions every one or two years yet every time they "reinvent the wheel" and begin the process all over again.

You have been asked by the Director of Manufacturing for some help. Although the type of help was not specified, you have begun to

establish a reputation as a problem solver who uses information and technology as tools to find the best decisions.

You decide that you should visit Bob Danzberg, the floor manager in the manufacturing department. You have worked with him on several projects in the past and all but one was successful.

2. THE INTERVIEW

You: Hello Bob, thanks for agreeing to talk with me for a few minutes.

Bob: I'm happy to get some help. We have some of the answers but we're struggling to make a decision that has consensus. It boils down to this, we feel we have a good estimate of what will happen if we downsize or maintain manufacturing staff. We have put dollar amounts to each action (downsize or maintain) against what the demand might do (decrease 10%, stay the same, or increase by 10%). [Then Bob hands you a piece of paper with Table 1 on it.]

You: OK, this is good. So what's the problem?

Bob: We can't get enough people to agree what to do. Some believe we should downsize staff because making that decision we would have at least $250,000 from operations. But others don't believe demand is going to fall. So they see either $1,000,000 or $1,250,000 from operations next year.

You: Our investors and senior managers are not experts at predicting demand, we have always looked at predictions of the economy that government and service agencies put out. Why not just act on what the prediction says?

Bob: Nobody has a crystal ball. Remember the fall of 2012 when the "experts" predicted gas prices would be a lot more than $4 per gallon within a year. Well, gas prices are just over $3 now. But that prediction was enough for some of our competitors to turn away orders. We picked up those orders and made a huge profit in 2013. That's why some are willing to take the gamble and just keep staff where it is now.

In the end, management decided to get a cost proposal from a firm that specializes in predicting furniture demand. They said they could make a prediction but each prediction would have percentages of being right or wrong. Their model might predict a 10% increase in product demand but they say there is only a 90% chance their prediction would be correct. There's also a 3% chance that actual demand is a 10% decrease when they predict a 10% increase. [Bob gives you Table 2.]

And they want $27,500 for them to run the model and generate a prediction. How can we justify that cost when they can't guarantee their predictions? At least we know from other companies that have used them that they are accurate in that what they say will happen – and their contingencies for being wrong.

You: I've seen this kind of problem before in the company where I had an internship. They were able to make a model on a spreadsheet that provided them with numbers to work with. Let me see what I can do.

3. FORMULATING A MODEL

You go back to your office and try to remember how your mentor explained a similar process where you had your internship. It was a series of steps; a prediction is made (the demand level), the organization takes an action (decrease or maintain staff), and then the actual event occurs (the actual demand level).

Your mentor drew out a diagram on a notepad for you that looked like branches on a tree. She said that to know how many branches you end up with means you simply multiple the number of possible predictions times the number of decisions you can take for each decision time the number of actual outcomes. The number of actual outcomes is the same number as the possible predictions.

For your problem there are 3 possible predictions, 2 decision possibilities, and 3 possible actual outcomes per prediction. So you create the spreadsheet shown in Table 3.

5. COMPLETING THE SPREADSHEET

The first thing to do is copy all the information from the first two tables into the third table. For example, Table 2 tells you the percent chance for seeing an actual 10% decrease in product demand if the prediction was a 10% decrease – i.e. 70%.

And you also know that when you downsize staff and then a 10% decrease in demand follows you expect $400,000 in profit. So complete all of

the boxes under the headings "probability of actual demand given prediction" and "dollar payoff of action."

To calculate the "expected payoff of action" you need to sum the three probabilities of demand based off the prediction and the dollar amounts resulting from actions. This means when a 10% decrease is predicted and the organization decides to downsize staff the expected payoff is $355,500.
(70% * $400,000) + (20% * $250,000) + (10% * $255,000)

You will find that the expected payoff when a 10% decrease in demand is predicted and you maintain staff size is $255,000. So naturally you choose to downsize staff when a 10% decrease is demanded so that your expected payoff is $355,500.

Complete the entire spreadsheet. Then be prepared to show Bob Danzberg your spreadsheet and tell whether or not to your spreadsheet supports paying the firm providing the predictions.

Appendix

FOR THE INSTRUCTOR

There are several layers to this case depending upon the audience. For an introductory course in information systems you can start with simple spreadsheet skills. Simply completing a spreadsheet provides a platform for practice in cell formats, relative versus absolute cell formula reference, and simple calculations.

The next level would be to have students run various scenarios on the accuracy of a predictive information system and then a sensitivity analysis on the dollar payoffs.

1. Have students assume the predictions always come true. How would that affect expected payoffs?

2. What happens to expected payoffs when the predictions are only 50% accurate>

3. Make students reflect upon the choice of using expected payoffs as opposed to maximizing the minimum benefits of a decision (the pessimistic managers in the case) or maximizing possible benefits (the optimistic managers in the case).

4. Have students decide the maximum amount they'd be willing to pay for the firm to make a prediction.

FOR THE STUDENT

		possible demand levels		
		10% decrease	stay the same	10% increase
possible actions	downsize staff	$400,000	$250,000	$255,000
	maintain staff	-$100,000	$1,000,000	$1,250,000

Table 1: Payoffs from Decision Making

		predicted demand levels		
		10% decrease	stay the same	10% increase
actual demand levels	10% decrease	70%	15%	3%
	stay the same	20%	80%	7%
	10% increase	10%	5%	90%

Table 2: Probability of Actual Demand Given Predicted Demand

predicted demand level	action	actual demand level	probability of actual demand given prediction	dollar payoff of action	expected payoff of action	maximum payoff given prediction
10% decrease	downsize staff	10% decrease	–	–		–
		stay the same	–	–	–	
		10% increase	–	–		
	maintain staff	10% decrease	–	–		
		stay the same	–	–	–	
		10% increase	–	–		
stay the same	downsize staff	10% decrease	–	–		–
		stay the same	–	–	–	
		10% increase	–	–		
	maintain staff	10% decrease	–	–		
		stay the same	–	–	–	
		10% increase	–	–		
10% increase	downsize staff	10% decrease	–	–		–
		stay the same	–	–	–	
		10% increase	–	–		
	maintain staff	10% decrease	–	–		
		stay the same	–	–	–	
		10% increase	–	–		

Table 3: Spreadsheet for Calculating Expected Payoffs for Decision-Making