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QUANTIFIED DECISION FRAMING

By Scott K. Meyer

Quantified Decision Framing (QDF) is a methodology that satisfies all of the criteria of Top-Down principles. It is an approach to analysis that is focused on the decision to be made, is elegant in its simplicity, yet can be structured to be as rigorous as required for the decision being considered. It minimizes the necessary expenditure of time and money while providing a means of knowing if further analysis is warranted. Further, it puts the decision maker at the heart of the analysis. It permits him to see the sensitivity of his decision to his judgments about the unknowns of the problem. QDF is a methodology whose sole objective is to help the decision maker choose the best decision possible.[1]

To understand QDF, it is first helpful to look at each of the three words. QDF is a methodology that has the *decision* to be made at its center. If there is no decision to be made, then there is no QDF. It is not a methodology to be used to "study" or "research" something. While it uses "decision" in its name, QDF is neither Decision Analysis nor Decision Theory. QDF is a methodology that provides a structured and disciplined approach to providing a decision maker with the insights necessary to select the proper alternative.

"Quantified" means that QDF relies heavily on quantitative methods. QDF does not rely on any one "tool" from operations research, systems analysis, economics, mathematics, or any other academic discipline. Rather, it uses whatever tools and techniques are necessary to quantify and compare alternatives. To be most effective, QDF must be employed by analysts who are skilled in a wide variety of analytic tools.

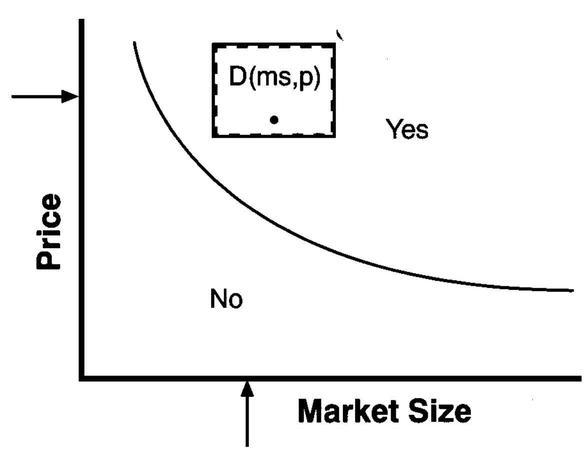
"Framing" refers to the technique of dividing the decision space into regions. Each region contains the cases for which a specific decision is the best. When completed, QDF says, "If you, the decision maker, believe 'thus and so' about these unknown factors, then 'A' is the proper decision. On the other hand, if you believe something else, then 'B' is the right decision." The QDF also says, "For 'A' to be the right decision, then this is what the decision maker has to believe about the unknown factors." In short, it builds a frame around the different sets of conditions for which each possible decision is best.

Figure 1 is typical of the type of "frame" which is used to present the results when QDF is used. It also serves to illustrate many of the features of a QDF analysis. In this example, the axes labeled "Market Size" and "Price" represent the range of assumptions about the two major unknowns in the analysis that have the greatest impact in determining the proper decision. Market Size and Price are the unknowns to which the problem is the most sensitive. In other examples, the unknowns could be factors such as size of the future growth of the market, cost to produce the new product, or expected productivity to be gained from the new design.

In reality, there could be more than two major unknowns. It is the job of a QDF analyst to conduct sensitivity analyses to identify the most important unknowns and eliminate those that have lesser impact on the "best decision." Experience has shown that the number of critical unknowns is nearly always far less than originally catalogued when attempting to bound the problem. Many times the set of critical unknowns can be reduced to only a couple!

In Figure 1, the two axes show the range of possible values for Market Size and Price. In this case, the arrows represent the decision maker's estimates of the most likely values for Market Size and Price.

Figure 1: QUANTIFIED DECISION FRAMING



The decision space is divided into two parts by the heavy "indifference" curve. One "half" of the space (in this case the area above the curve) corresponds to all the combinations of Market Size and Price for which "YES" is the proper decision. The area below corresponds to those combinations for which "NO" is the proper decision. Any combinations of Market Size and Price that fall on the line repre-

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sent cases where neither decision is preferred — both produce outcomes with the same value and the decision maker is indifferent to the choice of decision.

Drawing the indifference curve may be the result of extremely complex calculations, models, or simulations. On the other hand, the curve may have been drawn based on first order approximations or "guesses." The precision of the calculations can be represented by the width of the line. If very precise calculations were used, then a fine line can be drawn; the less precise the calculations, then the thicker the line.

One of the major advantages of **QDF** is that the analyst need not be extremely precise in calculating the indifference line. In fact, the **QDF** process suggests using the *least* precise calculations necessary for a decision maker to decide.

In Figure V-1, the point marked D(ms,p) marks the decision point for the particular estimates of Market Size and Price chosen by the decision maker. In this case, D(ms,p) falls in the half of the decision space marked "YES." This shows that *if* the unknowns, Market Size and Price, have values corresponding to the values marked on the axis, then "YES" will have been the correct decision.

Notice the continued use of the word "decision maker" and the role assigned to that person. It is the decision maker, *not* the analyst, who will estimate the values of the unknown factors Market Size and Price. By this mechanism, the proper vehicle is provided through which the power of the judgements of the decision maker can be harnessed and brought sharply to bear!

The dashed box around D(ms,p) represents that range of uncertainty about the estimates for Market Size and Price. The range of uncertainty could be drawn by the decision maker —"I believe that the Price will be $25.75 plus and minus $.50."

The box shows the degree of certainty or "comfort" the decision maker has in the decision. In the case shown, the entirety of the box lies in the "YES" half of the space. The decision maker can now say: "I'm not sure just what Market Size and Price will turn out to be, but I am confident their values will fall somewhere within the dashed box. And for any of those values, YES is the right decision."

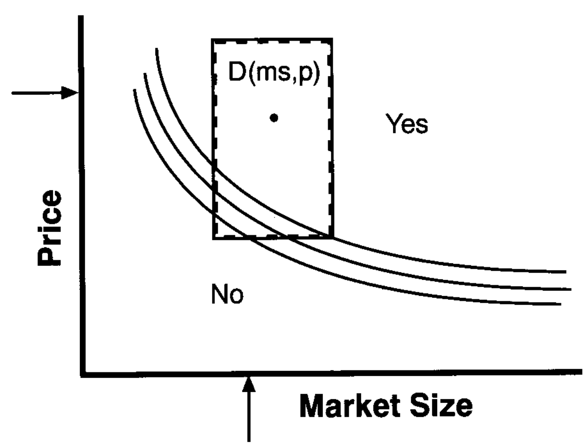
It becomes clear that the indifference line need not be drawn with much precision. Suppose it is only drawn approximately correct. It has the correct shape, behaves correctly in the broad sense, and possibly a few points on the line have been calculated — the rest have just been approximated. Now suppose that the decision maker estimates the values of Market Size and Price and the results are as shown. D(ms,p) and the box surrounding it fall clearly into one half the decision space. What is to be gained (except to spend more of the decision maker's resources) by drawing the indifference line more precisely? The decision maker knows everything that is needed to choose the best decision with an approximately drawn indifference line.

What if the box around D(ms,p) lies partially in both regions? For some estimates of Market Size and Price "YES" is the best decision while for others "NO" is the best decision. It is clear that the analyst could do either one or both of the following: reduce the range of uncertainty about the estimates of Market Size and Price (i.e., shrink the size of the box until hopefully it lies entirely within one half of the decision space) or compute the indifference line more precisely (again with the hope that the box will now fall entirely in one half of the space).

What is not always clear to the analyst is that both options cost time and money. To get better estimates might require product tests, market surveys, or prototype development. To be able to calculate with greater precision will require better models, more analysis time, or collection of additional data. The important questions are: Will the additional time and efforts allow the decision maker to increase the quality of his decision? How much should the decision maker be willing to spend to make a better decision? Fortunately, **QDF** answers both questions.

Figure V-2 shows a case where D(ms,p) is near the indifference line and the box around the decision point lies in both halves of the decision space. Two additional curves have been drawn on the graph. These lines, while usually not shown on the initial **QDF** graph, are iso-cost lines[2]. They are a byproduct of the calculations used to derive the indifference curve. These lines show the cost (in terms of the measure of merit selected by the decision maker) of the decision should the values of the unknowns fall along the iso-cost line. Thus, in this case, the lines give the cost of deciding "YES" if the actual values of Market Size and Price fall on one of those lines.

Figure V-2: QUANTIFIED DECISION FRAMING CASE 2



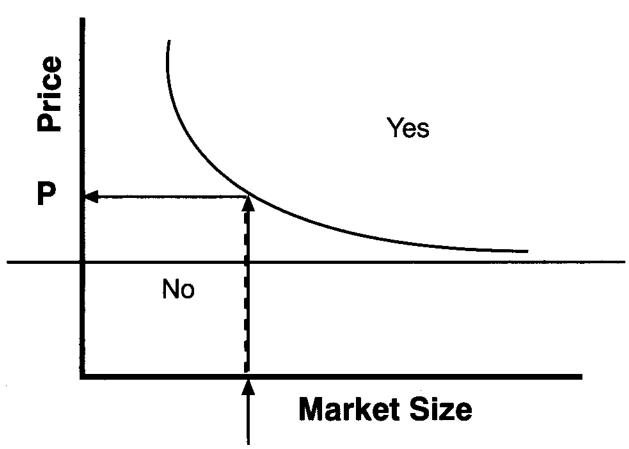
Now it is possible for the decision maker to answer the questions, "How much should I be willing to spend to increase the "goodness" of my decision?" "How much should I be willing to spend to get a better estimate of Market Size and Price?" "How much should I be willing to spend to get a more precise calculation of the indifference line?"

If the cost of deciding incorrectly is small compared to the cost of getting the additional information, then the decision maker should decide using the information that is available. If, however, the cost of making the wrong decision is large, then the decision maker should be willing to spend additional money and effort to get better information. Given estimates of how much better the information might be as developed through various activities, **QDF** sets bounds on how much to spend on these activities.

QDF also facilitates "backing-in." It can be used to let the decision maker go from decision to beliefs about the unknown factors. For example, suppose the decision maker is able to make a good estimate of Market Size, but has no confidence in his estimates of Price. As shown in Figure V-3, the **QDF** can be used to answer the following: "What would I have to believe about the value of Price for "YES" to be the correct answer?" In this case, Price would have to have a value greater than P. Now the decision maker needs to ask: "Based on experience, do I believe that Price will be greater than P?" If it is likely to be greater, then "YES" is the right answer. If it is unlikely, then "NO" is the right answer. Experience has shown that it is far easier to answer this type of question than it is to estimate the value of the unknown.

For example, it is possible that the decision maker won't be able to estimate accurately the value for Price. Further, he may not be able to get the Director of Marketing to give him an estimate. Using **QDF** and backing in, the decision maker then can ask the Director of Marketing: "How likely is it that the price will be greater than P?" The Director of Marketing might then answer: "No way in the world will it be that large. P is almost twice the highest price ever!" Or he could answer: "It will certainly be that large. Every one of our products have had prices three to four times that large." In both cases it is quite clear what the best decision should be though no one was able to (or had to) estimate the value of a major unknown.

Figure V-3: QUANTIFIED DECISION FRAMING CASE 3



CONDUCTING A QDF ANALYSIS

Quantified Decision Framing is an approach to providing information to permit the decision maker to make the best decision. It is not a recipe with a prescribed set of steps to be followed precisely. Nor is it a single methodology such as linear programming or queuing theory. Rather, **QDF** is an approach with an iterative and generalized set of steps to be followed, with the analyst choosing the proper tools to be used at each step.

Figure V-4 diagrams the steps to be followed and the iterative nature of the process. Briefly, the steps are:

STEP 1. Start with the decision to be made. Be sure that the decision maker clearly and unambiguously defines the decision to be made. Be sure that the possible options are defined and the correct measure of merit is selected. **If there is no decision to be made, STOP.**

STEP 2. Simplify the problem as much as possible. Breadth is more important than depth. At the highest possible level of aggregation, include as many aspects of the problem as possible. Avoid as much detail as possible.

STEP 3. Create the simplest possible quantitative model of the decision problem. Develop the capability to quantify, in terms of the decision measure of merit, the alternative decisions. The key words are "simplest possible." The goal is to do no more work than is necessary to permit the best decision to be made. If a simple approximation based on experience is sufficient, then that is all that is required. The process will permit the development of more precise values later if they are required.

STEP 4. Identify the drivers. Use the quantitative model developed in step three to examine the sensitivity of the decision to the various unknown parameters. Find the ones that are most important. Eliminate or combine the least important ones. Arrive at the smallest possible set of unknowns, keeping only those that have a major impact on the outcome of the decision.

STEP 5. Construct a Quantified Decision Frame such as shown in Figures V-1 through V-3. Use the model to divide the decision space into regions corresponding to the best decision as a function of the values of the unknown parameters. Draw the indifference line(s) so that the width of the line(s) represents the degree of precision in the calculations.

STEP 6. Have the decision maker estimate the values of the unknowns. As in the step to quantify the indifference line, the estimation should be done using the simplest, least costly method possible. Define the degree of uncertainty about the estimates.

STEP 7. Plot the decision maker's estimates and the uncertainty box on the frame. Show the results of the analysis to the decision maker. Show the decision maker where his estimates of the unknowns fall within the decision space.[3]

STEP 8. Can a decision be made? Is the decision point and the box entirely within one decision region? Does the decision maker feel comfortable deciding with the information available? If so, decide and STOP. If not, proceed to step 9.

STEP 9. Display the iso-cost lines. Show the decision maker the costs of deciding incorrectly and how much of the decision box falls into a different decision region. Is the cost of a wrong decision small enough to permit a decision to be made? If yes, make the decision and STOP. If not, proceed to step 10. (See Appendix A for a discussion of cost analysis criteria.)

STEP 10. Evaluate options for obtaining better information. Can the estimates of the unknowns be refined? How? How much will it cost? Can the indifference lines be drawn more precisely? How? How much will it cost? How much better information will be provided? Will the additional information permit the decision maker to make a better decision? A decision with greater confidence? Is it worth the cost to develop the additional information? If not, make the decision now and STOP. If so, then conduct the necessary actions to develop better information and return to steps 3 or 4.

Avoid at all costs the trap of jumping to the most complex and detailed analysis on the second pass through the process. Incrementally increase the degree of precision of the analysis. The words "as simple as possible" still apply with every iteration.

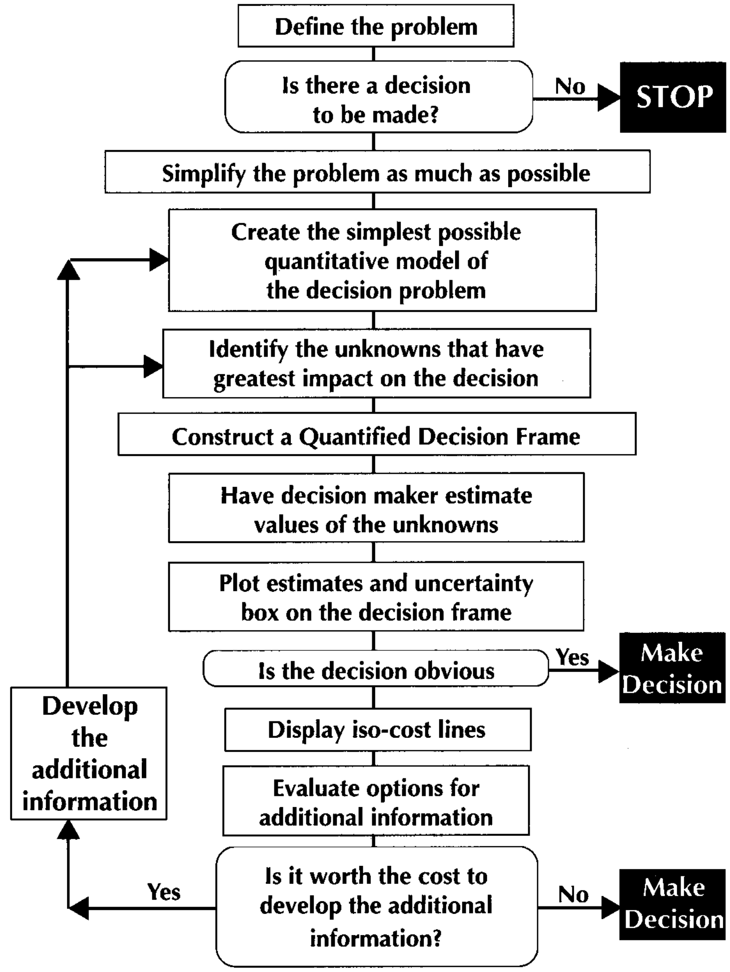


Figure V-4: THE QDF PROCESS

[1] It is important that the reader understand the difference between making the "correct" decision and making the "best" decision. Because almost every tough decision depends upon unknown factors, the "correct" decision will not be known until, or if, the value of these unknowns become known. Then, in hindsight, one can make a judgement as to whether or not the decision was the correct one. At the time of the decision, one can not judge "correctness" so the issue is one of making the "best" decision — the decision that is most likely to produce the best results given the uncertainty of the situation.

[2] The iso-cost lines connect all points on the graph where the difference in the value of the measure of merit compared with any point on the indifference line is the same. If, for example, the measure of merit were "break even" on profit/loss, then the iso-cost lines above the indifference line connect points of equal profit and the lines below connect points of equal loss.

[3] Some times it is difficult to reduce the number of key unknowns to only two (or three if a three dimensional graph can be used) so a QDF graph as shown in this chapter can be drawn. In such cases, a phase diagram as discussed in the next chapter is often useful.

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