AGRICULTURE BUSINESS PLANNING

Chapter 3

Solution Formulation

Lecturer: Liska Simamora, S.P., M.Sc

Lecture Overview

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Introduction to this chapter: [1]To effectively deal with operations management problems in practice, human decision-makers must not only find effective solutions but also understand the nature, or formulation, of the problem itself. When problems are not only ill-defined but also urgent, decision-makers must act quickly, sometimes before completely understanding the problem they face. In emergencies like the Haiti earthquake and Hurricane Katrina, operations management decisions were needed in a rapidly changing situation with little reliable information. As a result, responders needed not only to make fast decisions but also to understand quickly the decisions that were required. They had to identify relevant information, determine the problems and goals, and decide what to do. Good decision-making requires a good formulation: a poor formulation may lead to a precise solution to the wrong problem[2].

In this chapter, the students learn the type of problems and adjust to the range of possible solutions and the kind of strategies appropriate for achieving those solutions.

Four Types of Problems[3]

The nature of a problem determines the strategy appropriate for dealing with it and, conversely, that the use of a particular strategy makes certain assumptions about the nature of the problem to which it is applied. Such a proposition, it is argued, can help to clarify some aspects of planning theory as well as to provide a useful guideline for the practicing planner.

Problems and solutions are, however, based on the perceptions of individuals. They are not objective conditions of the real world. They are subjective. Constructions-what Kenneth Boulding would call "images" of the real world-although such perceptions may be and often are shared in roughly the same form by many people[4]. Nevertheless, problems may appear in different forms to different people. What is a critical problem for one person may appear unimportant, or even not a problem at all, to another people. To paraphrase it, a problem is what somebody or something perceives as a problem; and, without somebody or something to perceive it, a problem is an absurdity.

That the perception of a problem implies a particular range of possible solutions to it appears intuitively obvious. If the problem of poverty (for example) is defined in terms of family income, then solutions to that problem must equally be capable of definition in terms of family income. A problem and its solution were defined as different states of a single process, with the latter being in some sense a more desirable state than the former.

The things elaborated above generated four types of problems:

1. **Simple problems** are problems which are completely understood: they are defined in terms of a specified number of calculable variables. It should be added that to denote a problem as simple (in the sense implied here) need have no bearing on how easy or how difficult it is to implement a solution to that problem. Unless implementation is explicitly defined as forming part of the problem-which it frequently is not in the case of problems defined in simple terms-the solution to a simple problem may turn out to be either relatively easy or relatively difficult to implement.

The definition of a problem as a simple problem may or may not be appropriate in a given case; for example, a planner may decide that a simple definition of his problem is somewhat academic in circumstances where implementation is expected to be relatively difficult. But that is not the point here; the point is that a simple problem is one which, wisely or unwisely, is defined in terms that are finite and calculable.

2. **Compound problems** are problems some, but not all, of whose parts are known: they are defined in terms of an unspecified number of calculable variables. This means that a compound problem may consist in part of one or more simple problems, if it includes among its variables one or more subsets which can be defined as problems in their own right.
3. **Complex problems** are problems which look like simple problems but are not: they are defined in terms of a specified number of variables, but the variables are incalculable rather than calculable.
4. **Metaproblems**, on the other hand, are the least precise of all: they are defined in terms of an unspecified number of incalculable variables5 In other words, a metaproblem acknowledges that a problem is perceived to exist and that some particular variables are involved in its definition; but precisely what these particular variables are and with what other variables they might be involved is not specified. Thus, a metaproblem is distinguished by its lack of precision.

In fact, the four types of problem represent varying degrees of precision, from the quite precise simple problem to the least precise metaproblem. But it should not be concluded from this that simple problems are better or more "scientific" than metaproblems. Precision of meaning in planning, as in other branches of science, can be functional or dysfunctional in different circumstances.

It may be useful to take a specific example again at this point: consider the problem of poverty. According to what has been suggested before, it should be possible to define poverty in four fundamentally different ways. One example of each different type of definition is as follows:

1. As a simple problem: poverty means having an annual income of less than three thousand dollars.
2. As a compound problem: poverty means having an annual income of less than three thousand dollars, having an education below the level of grade eight, living in substandard housing (according to some spe cific criteria), and/or other characteristics.
3. As a complex problem: poverty means the inability to obtain for oneself the minimum basic necessities of life (i.e., adequate food and shelter).
4. As a metaproblem: poverty means relative social deprivation.

Of course, these are not the only definitions of poverty that can be proposed, tested, and found useful. The point is that each of the above definitions is possible and each illustrates one of the four different types of problems identified earlier in this section.

The Appropriateness of Strategy to Problem[3]

The use of a particular strategy makes certain assumptions about the nature of the problem to which it is applied. It will be recalled that planning was defined as deliberate intervention in some process; this, in turn, was held to imply the existence of a problem and a solution. The nature of a problem may, of course, change over time; indeed, to induce such a change deliberately may form part of a planning strategy in a given case.

Do the four fundamental types of problems identified earlier imply any special conditions for carrying out analysis and action and, if so, what are these conditions?

Table 1. Limits of Analysis and Action by Type of Problem[3]

Type of Problem	Limits of Analysis	Limits of Action
Simple (a specified number of calculable variables)	Complete understanding of all of the variables (comprehensive analysis)	Maximization or optimization
Compound (an unspecified number of calculable variables	Complete understanding of some of the variables (in depth analysis of subproblems)	Suboptimization (second best, "satisficing," etc.)
Complex (a specified number of incalculable variables)	Partial understanding of all of the variables (quick surveys)	Overall improvements (Pareto optima)
Metaproblem (an unspecified number of incalculable variables	Partial understanding of some of the variables (points of departure, benchmarks, etc.)	Partial improvements (Pareto suboptima)

simple problems are solved by comprehensive analysis and planned optimization; compound problems are solved by analyzing those parts of the problem which are amenable to analysis (i.e., the known calculable variables) and planning to optimize those parts; complex problems are solved by analyzing all the variables of the problem to the extent necessary to permit the planning of improvements in the situation as a whole; and metaproblems are solved by analyzing some of the variables to the extent that some improvements can be planned in some parts of the problem.

Formulate the Solutions[4]

1. Which solution is most feasible?

A feasible solution is determined by following these:

• Can be implemented within an acceptable timeframe?

• Is cost effective, reliable and realistic?

• Will make resource usage more effective?

• Can adapt to conditions as they evolve and change?

• Its risks are manageable?

• Will benefit the organization/ Which solution is favoured?

2. Which solution is favoured by those who will implement and use it?

Acceptance by the people who will use and implement the solution is key to success. This is where the previous steps come into play. To users and implementers, a solution may seem too radical, complex or unrealistic.

Implement the Solutions[4]

Once the solution has been chosen, initial project planning begins and establishes:

• The project manager.

• Who else needs to be involved to implement the solution.

• When the project will start.

• The key milestones

• What actions need to be taken before implementing the solution

• What actions need to be taken during the implementing the solution

• Why are these actions necessary?

References

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