CHAPTER 1

INTRODUCTION TO MULTIPLE OBJECTIVE
UTILITY THEORY

Some speak of Multiple Objective Utility Theory (MOUT), others about Multiple
Attribute Utility Theory (MAUT). What is the difference? People during their
entirely lifetime are moved by numerous objectives, which are considered here as
independent from one another. A hierarchy of objectives exists going down from a
foggy notion to measurable items, called attributes, which are then optimized.
Objectives may be different for the several stakeholders: the public, the consumers,
the firms, the government, whereas all kinds of pressure groups try to influence the
choice of the objectives. Some speak of the theory of choice\(^1\). However, risk and
uncertainty influence the choice, whereas probabilities and planning also enter the
picture.

1.1 WHY FROM OLD TO NEW ECONOMICS?

A Belgian minister once launched the concept of *Gross Individual Happiness*,
without knowing what this implies. Many elements will compose this happiness.
Let us say that the individual is striving for several objectives and if they are
fulfilled in an optimal way, happiness has to be reached. In other words, there is a
problem of optimization of several objectives simultaneously. In addition, it will be
difficult to satisfy every objective and to satisfy every individual. Therefore, we say
with Steuer:

"Since multiple objective problems rarely have points that
simultaneously maximize all of the objectives, we are typically in a
situation of trying to maximize each objective to the greatest extent
possible"\(^2\).

The Green Parties in Europe maintain that economic theory cannot solve this
problem of human happiness. The reason is that they consider economics only as a
science for minimizing costs. Therefore, we promulgate the idea of new economics,
whereby all objectives are taken into consideration in an optimal way as much as
possible. Of course, there is a problem of quantification, either ordinal or cardinal.
Whereas insurance companies translate human life into monetary costs, here the
value of human life is expressed in units related to e.g., maximization of health
care or minimization of accidents.
A consumer buying a car faces several objectives. Indeed his objectives of safety, comfort, anti-pollution, and petrol consumption are in fact separate from the price of the car.

For the government the employment goal has to be an objective separated from its budgetary cost. This cost could include a compensation for unemployment. The unemployed, however, may not be satisfied with a monetary compensation alone. The government may also ask for pollution abatement and for new investments, for instance in public enterprises. Indeed most of these public enterprises show a shortage in investment.

An industrial firm aims on the one hand at an increase in productivity through a better motivation of personnel and through an improvement in the safety of workers and on the other at an increase in its market share. Additionally more and more a firm will also be pressed to satisfy ecological conditions "to the greatest extent possible". In the distribution sector for instance, one could strive for maximization of Net Present Value, minimization of the break-even period in the case of a new firm and to an optimal penetration in the European Union or in world markets. Project analysis may aim on the one hand at maximization of NPV, on the other at maximization of employment. Concerning privatization of public enterprises or services, the potential buyer will look for a minimum takeover price, a possible payback period, Net Present Value and Internal Rate of Return, whereas the government will look for a maximum takeover bid, employment, value added and new investments. Classical economics do not bring an answer concerning this multitude of objectives.

In fixing the objectives, one has to take into account all kinds of pressure groups, such as trade unions, employer organizations, consumer organizations and groups of ecologists or lobbies of all kinds. In addition, the state considers itself as the promoter of the general interest, ending up in Social Welfare or even in Social Well-being. All these agents may pursue different, even contradictory, objectives.

In order to define an objective better we have to focus on the notion of Attribute. Keeney and Raiffa present the example of the objective "reduce sulfur dioxide emissions" to be measured by the attribute "tons of sulfur dioxide emitted per year". An attribute should always be measurable.

Simultaneously we aim to satisfy multiple objectives, whereas several alternatives are possible, characterized by several attributes. A potential alternative should be quantitatively well defined. An attribute is a common characteristic of each alternative such as its economic, social, cultural or ecological significance, whereas an objective consists in the optimization (maximization or minimization) of an attribute. We avoid using the term "Criteria". Indeed, this term creates much confusion as being used for objectives as well as for attributes.