

Chapter 1

Operations Research in the Public Sector: An Introduction and a Brief History

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This Handbook is intended to provide the reader with an exposure to the methods and applications of operations research in the public sector. In this chapter we provide an overview of these applications and place them in a historical context. We have attempted to cover the major areas in which operations research and associated modelling activities are not only applicable, but also have shown evidence of application and – to various degrees – acceptance.

To accomplish this, however, our first obligation is to make an effort to explain what we mean by ‘operations research’ and ‘public sector’. These are terms that have evolved over the years according to the predilections of their practitioners, champions and critics, and have naturally been subject to the vagaries of historical events.

1. What is operations research?

Perhaps the most serviceable and wide-spread definitions of operations research have been promulgated by the Operations Research Society of America [ORSA, 1990] in its educational materials:

- (1) Operations research is a scientific approach to decision making.
- (2) Operations research is concerned with scientifically deciding how best to design and operate systems, usually under conditions requiring the allocation of scarce resources.

The British Operational Research Society in 1962 defined operational research (as it is called in the U.K.) to be the use of formal mathematical models to investigate ‘... complex problems arising in the direction and management of large systems of men, machines, materials and money in industry, business, government and defense.’

None of these definitions, unfortunately, are sufficiently specific to distinguish it from related fields. To complicate matters, the field of management science is so close to operations research that the main professional societies of these two disciplines – The Institute of Management Sciences, and The Operations Research Society of America – have all but merged; in this Handbook we make no distinction between the two.

Thus, a consensus definition of ‘Operations Research’ is, by all the evidence in the introspective articles that have appeared in *Operations Research* and *Management Science* since the mid 1950’s, still sorely lacking. Whether one means the term to be a professional designation, a label for a body of methods, an approach to problem solving or, as has been apocryphally suggested ‘the re-invention of applied economics by a bunch of physicists and chemical engineers’,¹ it seems almost easier to describe operations research by example than by formal definition.

Yet we do present here an attempt to distinguish between operations research and other related quantitative fields, even while bearing in mind Quade’s [1975] observation that ‘the distinctions among operations research, cost-effectiveness analysis, cost-benefit analysis, and systems analysis are rather arbitrary’. Yet there are differences, which we describe below.

Economics and operations research both attempt to quantify processes, and search for policies which will improve or optimize a specified output. In economics, however, the phenomena under consideration are exclusively those in which such entities as markets, personal predilections toward consumption, information gathering, etc. are the forces governing the behavior under study. Thus the system is usually restricted to goods, services and resources which are produced, consumed and exchanged. Mainstream economics is concerned with descriptive and/or predictive analysis of such systems; most economists *assume* that economic agents act optimally (or else they would be replaced in the market place by those who do).

Insofar as economics research focuses on determining the underlying characteristics of a process, the two are very similar. Operations research methods indeed are relevant in the study of economic systems. In fact, both Kenneth Arrow, a Nobel Laureate in economics, and George Dantzig, a winner of the National Medal of Science for his work in economics, are operations researchers. But there are some limitations to taking models and techniques originally developed to study economic behavior, and applying these to other fields. Maltz (Chapter 7) and Barnett (Chapter 3) provide some examples of this problem.

Systems Analysis has often been used to describe an analytic process devoted to ‘higher-level’ issues, wherein the ‘systems’ nature of an activity is thoroughly explored, rather than concentrating on the reductionist pieces needed for an operations research approach. It frequently implies taking a step back from the specifics of the situation and attempting to place it in a broader context.

¹ Indeed, Philip Morse and George Kimball, two undisputable founders of the field, were respectively a physicist and a chemist.