Chapter 8
Problem Structuring and Multiple Criteria Decision Analysis

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Abstract  This chapter addresses two complementary themes in relation to problem structuring and MCDA. The first and primary theme highlights the nature and importance of problem structuring for MCDA and then reviews suggested ways for how this process may be approached. The integrated use of problem structuring methods (PSMs) and MCDA is one such approach; this potential is explored in greater depth and illustrated by four short case studies. In reflecting on these and other experiences we conclude with a brief discussion of the complementary theme that MCDA can also be viewed as creating a problem structure within which many other standard tools of OR may be applied, and could therefore also be viewed as a PSM.

Keywords  Problem structuring · Decision methodology · Case studies

8.1 Introduction

As the field of MCDA began to develop as a distinctive area of activity in the late 1960s and 1970s [6, 23, 42, 46, 53, 95] the initial focus was primarily on developing methods with relatively little attention to methodology or process, and to a large extent that emphasis remains strong. As the field became more established in the 1980s, consideration of both philosophical and methodological aspects of the use of MCDA started to grow [74, 84, 102] and increasing attention was paid to the structuring of MCDA models [13, 17, 98, 99]. In parallel with this, growing interest

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in the UK in so-called “soft” methods for operational research began to attract the attention of MCDA practitioners [7, 100] who recognized the potential of these approaches, in particular cognitive mapping [32], to support the MCDA process. The importance of problem structuring for MCDA is now widely recognised: the Manifesto for a New Era of MCDA by Bouyssou et al. [11] stressed the importance of understanding decision processes and broadening the reach of MCDA; Keeney [51] highlighted the need to pay attention to understanding values – in the sense of “what matters” to decision makers; issues relating to problem structuring in general and to value elicitation in particular were the focus of the article by Wright and Goodwin [101] and the associated comments [2, 5, 16, 27, 28, 40, 73, 88, 92, 97]; and the book by Belton and Stewart [8] is the first compendium of MCDA methods to afford significant attention to problem structuring.

We chose to quote Keeney [51, p9], of many possible authors, to reflect the concerns of many with regard to MCDA when he wrote:

Invariably, existing methodologies are applied to decision problems once they are structured ... such methodologies are not very helpful for the ill-defined decision problems where one is in a major quandary about what to do or even what can possibly be done.

He went on to articulate what could be interpreted as a need for problem structuring in the statement [51, p9]:

What is missing in most decision making methodologies is a philosophical approach and methodological help to understand and articulate values and to use them to identify decision opportunities and to create alternatives.

The importance of good problem structuring in any context is widely acknowledged. Dewey [30] wrote “It is a familiar and significant saying that a problem well put is half solved. To find out what the problem and problems are which a problematic situation presents to be inquired into, is to be well along in inquiry. To mistake the problem involved is to cause subsequent inquiry to be irrelevant or go astray.” The final sentence identifies what the statistician Kimball [55] labels as an error of the third kind – or solving the wrong problem – a concept which Mitroff and Featheringham [64] translate into domain of organisational problem solving and one which is widely recognised. In Belton and Stewart [8] we stress the importance of problem structuring both as a means of establishing the potential for MCDA and as an integral part of the MCDA process, as illustrated in Fig. 8.1.

The aim of this chapter is to provide an overview of current thinking and practice with regard to problem structuring for MCDA. We begin with a brief discussion of the nature of problems in general, of multicriteria problems in particular and what we are seeking to achieve in structuring a problem for multicriteria analysis. In Section 8.3 we outline the key literature which explores and offers suggestions on how this task might be approached in practice. Following on from this, in Section 8.4, we discuss the potential to provide integrated support, from problem structuring to evaluation, through the combined use of MCDA and one of the “problem structuring methods” (PSMs) described by Rosenhead and Mingers [83]. Section 8.5 reviews some of the practicalities of problem structuring for MCDA before a selection of case studies, illustrating the use of different processes and