Chapter 2
Multi-Criteria Decision Analysis for Strategic Decision Making

Gilberto Montibeller and Alberto Franco

Abstract In this chapter we discuss the use of MCDA for supporting strategic decision making, particularly within strategy workshops. The chapter begins by exploring the nature of strategic decisions and the characteristics of the strategic decision making process. Specifically, we examine the technical issues associated with the content of strategic decisions, and the social aspects that characterise the processes within which they are created. These features lead us to propose a number of adaptations to the standard MCDA approach if it were to be used at a more strategic level. We make suggestions on how to implement these proposals, and illustrate them with examples drawn from real-world interventions in which we have participated as strategic decision support analysts.

2.1 Introduction

A strategic decision has been defined as one that is “important, in terms of the actions taken, the resources committed, or the precedents set” [48] (p. 126). Strategic decisions are “infrequent decisions made by the top leaders of an organisation that critically affect organizational health and survival” [18] (p. 17). Furthermore, the process of creating, evaluating and implementing strategic decisions is typically characterised by the consideration of high levels of uncertainty, potential synergies between different options, long term consequences, and the need of key stakeholders to engage in significant psychological and social negotiation about the strategic decision under consideration.

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A recent trend within organisations is the employment of strategy workshops as an effective means to engage in the strategic decision making process and ensure the participation of key stakeholders in that process. A recent survey by Hodgkinson et al. [29] suggests, however, that Multi-Criteria Decision Analysis (MCDA) is hardly used for supporting strategy workshops. This is somehow surprising, as facilitated forms of MCDA [21] - where the model is created directly with a group of managers in a decision conference [59] - seem a perfect tool for supporting strategic decisions in a workshop setting.

We believe that discrete-alternative MCDA methods (using the taxonomy suggested by Wallenius et al. [85]) can be useful for supporting a strategy team tasked with designing and selecting high-value strategic options. However, its apparent lack of use in strategy workshops may be due to, we argue, some limitations in the MCDA approach, which may render it unsuitable for supporting strategic decisions and the workshop processes within which they are created, debated and evaluated. We thus propose a number of changes to the standard MCDA approach, so that it can be deployed as an effective strategic decision support tool. Such changes will require the consideration of both technical and social aspects of strategic decision making. The general purpose of this chapter is, therefore, to suggest these changes and produce a framework for using MCDA to support strategic decision making in strategy workshops. We illustrate these changes with examples drawn from real-world interventions in which we have been involved as strategic decision support analysts.

The remaining of the chapter is organised as follows. In the next section we examine the nature of strategic decisions and the main characteristics of strategic decision making. The discussion will lead to the identification of complex technical and social aspects associated with the provision of decision analytical support at the strategic level. The implications of these characteristics for MCDA interventions are then addressed in the two subsequent sections. The chapter ends with some conclusions and offers directions for further research.

### 2.1.1 Strategic Decisions and Strategic Decision Making

The popular view of strategic decisions is that they typically involve a high degree of uncertainty, high stakes, major resource implications, and long-term consequences [36]. This view is associated with the traditional conceptualisation of strategic decisions as the product of intentional attempts at rational choice, and context-setters for subsequent strategic action [18, 75].

One of the strengths of this traditional view is that it conceptualises the strategic decision making process in a way that is consistent with the reality faced by practising managers. This conceptualisation, however, has been criticised for assuming a rational and linear relationship between decisions and actions that has not been empirically proven (e.g. [49, 76, 77]). The fundamental point underlying this critique is that organisational decisions are not always decisive, in the sense that they
not always imply the presence of “commitment to act”. Intentionality and action are
difficult to trace and correlate empirically. Sometimes decisions result in action, in
the form of a commitment of resources, sometimes they do not [47].

Notwithstanding the above criticisms, we believe like others (e.g. [41]) that the
view and quest of intentional decision making is an undeniable aspect of organisational
life. In our experience, managers act in accordance to the belief that strategic
decisions must be intentional acts and the result of a well-designed rational process.
Indeed that is the main reason that they look for our help as decision analysts. There
is, therefore, a clear role for Decision Analysis in these contexts, to support strategic
decision making.

In the section that follows, we will discuss both the technical and the social com-
plexities associated with strategic decisions and the processes which produce them,
respectively. Such articulation will allow us to identify the necessary conditions for
the effective deployment of MCDA at the strategic level.

2.1.2 Technical Complexity

From a decision analytical perspective, the two most troublesome challenges in dealing
with strategic decisions are the inescapable presence of high levels of uncertainty and decision complexity. Under these conditions, managers experience great
difficulty in choosing how they should act in response to the strategic decision with
which they are concerned.

Let us focus on the characteristics of uncertainty first. If an organisation is to
decide whether to launch a new innovative product into the market, the choice is
difficult because it may be hard to assess whether the new product would be suc-
cessful or not, given that the product has never been released before. This type of
uncertainty is known as “epistemic” [30], and refers to a lack of complete knowledge
about an organisation’s external environment and its impact on the performances of
potential strategies. What is often found in practice is that managers will see a way
out in terms of conducting various research activities (e.g. market research, proto-
type development) to reduce as much as possible the uncertainty.

Another source of uncertainty, which is frequently associated with strategic deci-
sions, is about organisational values. This happens when there is doubt about what
strategic objectives, or policy values, should guide the decision or choice of action.
Managers need then to undertake activities designed to clarify organisational goals
and objectives, or policy guidelines.

A major source of decision complexity is the inter-relationship among choices.
Strategic decisions involve different levels of granularity. For example, the strategic
decision of entering into a new market will require a major allocation of resources
across different parts of the organisation such as marketing, finance, operations, re-
search and development, etc. This in turn will lead to the consideration of other
strategic choices associated with the primary strategic decision. Such consideration
must include an exploration of the interrelationship among these choices. The chal-
Challenge for managers is thus to overcome the cognitive burden associated with evaluating a large set of interconnected strategic decisions, and to devote a substantial amount of time working to achieve a holistic and satisfactory strategic focus.

Consequently, if MCDA is to be used for tackling strategic decisions, it must be able to provide support for dealing both with uncertainties about the environment and organisational values and also with decision complexity.

### 2.1.3 Social Complexity

Having discussed two key technical challenges of strategic decisions, which makes them particularly demanding for decision analysis, we now move on to discuss those aspects associated with the processes that produce them. We will offer below a view of strategic decision making as a socio-discursive process, drawing on the interpretive and strategy-as-practice perspectives of strategic decision making (e.g. [16, 35, 41, 87]).

We posit that strategic decisions are socially produced and reproduced mental frameworks through which managers make sense of their strategic concerns and so are able to act upon them. This conceptualisation is consistent with Laroche’s [41] ideas of decisions as “social representations”; Weick’s [87] view of decision making as a retrospective sense making process; and Eden’s [16] notion of strategy as a social process. The strategic decision making thus provides the cognitive structure within which strategic change takes place in organisations. Under this view, the reality of strategy and change is “socially constructed” [9] in the form of strategic decisions.

Where does the process of producing and reproducing strategic decisions take place? Discursive studies of strategic decision making have strongly (and persuasively) argued that strategic decisions are discussed and debated through different communication channels, e.g. written reports, minutes, speeches, letters to shareholders, or informal conversations (e.g. [27]). Nonetheless, there are other modes of communication within which strategic decision making takes place, such as strategy workshops (e.g. [29]). It is this latter mode of strategic decision making practice which is of interest to the decision analyst.

Strategy workshops typically involve a group of managers representing key organisational stakeholder groups that come together to impose a structure to a decision problem which they perceive as “strategic”. Participants bring to the workshop their individual mental frameworks of the issues constituting the problem, how these interrelate, and their perceived implication in relation to the strategic choices open to them. Differences in interpretations of the issues are possible, which in turns creates cognitive conflict. To resolve the conflict, participants engage in negotiation in order to produce a shared mental framework of the strategic decision. However, the negotiation process can be hindered by cognitive limitations. Research on individual and group decision making has vividly shown how cognitive biases and dysfunc-
tional dynamics can produce ineffective and sometimes catastrophic decisions (e.g. [34, 83]).

Furthermore, the internal negotiation process among members of the managerial team does not take place in a political vacuum and political conflict is also possible. Managers will compete to instil their own mental frameworks ([20, 32]). It has been argued that successful agreements regarding strategic decisions may depend on the willingness of managers to engage in open dialogue if the choices they face are not to be dictated by means other than an overt exercise of power (e.g. [33, 62]).

Episodes of strategic decision making such as strategy workshops then involve processes of psychological and political internal negotiation, where issues of decision structuring, group dynamics and power become critical in building up momentum for strategic action [17]. Traditionally, the focus of decision analysis has been the individual decision maker. However, the now well established management practice of conducting strategy workshops requires a shift in emphasis by decision analysts from the individual to the group, as done in decision conferencing [59].

We contend that the presence or absence of decision analytical assistance might be expected to make a difference to the effectiveness of strategic decision making process, particularly when it takes place within collective fora such as strategy workshops. However, our foregoing discussion suggests that certain adaptations to the methods, tools and processes of decision analysis are required if it is to be effectively applied in such a context. Our suggestions are presented next.

2.2 MCDA for Strategic Decision Making: modelling content

In this section we focus on the technical aspects of modelling strategic decisions using MCDA and suggest ways of tackling these.

2.2.1 Tackling Uncertainty with Future Scenarios

In traditional decision analysis, the standard way of analysing decisions under uncertainty is to represent options and uncertainties as a decision tree and then select the option with the highest expected value (for details, see [11]). For example, if two mutually exclusive options $a_1$ and $a_2$ are being considered, their mono-criterion outcomes may vary due to events 1 and 2, respectively (see Figure 2.1). If option $a_1$ were implemented, event 1 could generate either outcome $o_{1,1}$ (with a probability $p_{1,1}$) or outcome $o_{1,2}$ (with probability $p_{1,2}$). The probabilities of outcomes should sum up to one (e.g.: $p_{1,1} + p_{1,2} = 1$). The option with the highest expected value $EV$ should be selected: $EV(a_i) = \sum p_{i,j} \cdot o_{j,i}$, where $j$-th is the event index.

If multiple criteria are considered in the evaluation, usually a multi-attribute utility function is employed to aggregate the partial performances; the option selected is the one with the maximum expected utility (for details see Keeney and Raiffa.
EV(a_i) = \sum p_{1,i} o_{1,i}
EV(a_2) = \sum p_{2,i} o_{2,i}

\text{Outcome}

\begin{align*}
\text{Outcomes:} & \quad o_{1,1} \quad p_{1,1} \\
& \quad o_{1,2} \quad p_{1,2} \\
& \quad o_{2,1} \quad p_{2,1} \\
& \quad o_{2,2} \quad p_{2,2} \\
& \quad o_{2,3} \quad p_{2,3}
\end{align*}

\text{Decision node = \square, Chance node = \bigcirc}

\text{Fig. 2.1 Traditional decision analysis with decision trees}

For example, if there were three criteria (C_1, C_2 and C_3) for assessing the performances of the two options depicted in the previous example, each k-th criterion would have a x_k attribute, measuring the performance of options, an associated u_k partial utility function and a w_k weight, as shown in Figure 2.2. If an a_i-th option were implemented, there would be three outcomes from each branch of the j-th event node: o_{i,j,k}. Partial utility functions (u_k) then convert partial performances into partial utility; and an overall utility function can then be calculated for each a_j-th option: U_{i,j}(a_i) = f[w_k, u_k(o_{i,j,k})]. The option with the highest expected utility should be selected: EV(a_i) = \sum p_{i,j} U_{j,i}(a_i).

\text{Fig. 2.2 Traditional decision analysis with a multi-attribute utility function}

There are three main assumptions in this type of analysis. The first is that the outcomes from a chance node should be mutually exclusive (i.e., only one of them will happen) and collectively exhaustive (i.e., they cover all possible outcomes that may happen in the future). These two conditions make the sum of the probabilities...
of outcomes equal to one. The second assumption is that it is possible to obtain, in a reliable way, accurate probabilities of outcomes. The third assumption is the use of the expected value rule as a way of selecting the best alternative. We believe that these three assumptions are difficult to hold in strategic decisions.

Let us first analyse the need for a collectively exhaustive set of outcomes. As we discussed earlier, decision makers have to confront epistemic uncertainty, where there is lack of knowledge about the parameters that characterise a phenomenon. Epistemic uncertainty plays a major role in strategic decision making. In particular, most strategic decisions are one-off enterprises with very long term consequences, which makes quite difficult to determine all possible future outcomes. Consequently, it is impossible to assure that the set of outcomes is really exhaustive.

The assessment of reliable probabilities, the second assumption in traditional decision analysis, is also problematic in strategic decisions. Again the inescapable presence of epistemic uncertainty plays an important role here. As historical data is either not available or of little use in forecasting the long-term future, these probabilities are usually provided by experts. Such estimates are difficult to be “accurate”, both because of the unavoidable presence of biases during the probability elicitation processes [37] and the impossibility of knowing the likelihood of events in the long term [64, 44]).

With respect to the third assumption, the expected value rule only makes sense in repeated gambles, where the expected value provides a weighted-average outcome. But in one-off gambles, it has shown to be a poor guide for choice (see Benartzi and Thaler [8] and the discussion by Lopes [45] and Luce [46]). Again, strategic decisions are by nature unique and most of them one-off, so it may not be always appropriate to use the expected value rule.

On the other hand, since the 1980s scenario planning has been suggested as an alternative way of considering uncertainty in strategic decisions, instead of traditional forecasting. The idea is to construct a small set of possible future scenarios that describe how the main uncertainties surrounding the problem would behave (e.g., interest rates, prices of commodities, demographic trends). Each scenario presents a coherent story that may happen in the future and is used to explore how different strategies would perform under such circumstances (for details see [71, 72, 82]).

Once scenarios are developed and suitable strategies are devised, a table can be built - which describes qualitatively the outcomes of each strategy under each scenario. For example, Table 2.1 presents the scenarios and strategies for a decision that we supported recently: the strategic direction of an insurance broker in England. The directors of our client company were near retirement and wanted to consider five strategies for the organisation. Three scenarios were developed and the qualitative outcomes of each strategy, under each of these scenarios, were assessed (for details see [52]).

Another advantage of using such scenarios is that scenario planning has been widely employed in practice, and seems to be a tool which managers are comfortable to work with [71, 82]).

Two features distinguish scenarios created with scenario planning from the way that uncertainty is modelled in traditional decision analysis (event nodes). The first
<table>
<thead>
<tr>
<th>Strategy</th>
<th>Direct future</th>
<th>Symbiotic future</th>
<th>Network-based future</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maintain existing business</strong>&lt;br&gt;Continue with current business, with marginal increase in profit, sell in 5–7 yrs</td>
<td>Remain in control</td>
<td>With compliance, broker is viewed as a strong partner by insurers</td>
<td>Joining network would relinquish control of business</td>
</tr>
<tr>
<td></td>
<td>Competition more difficult</td>
<td>May obtain higher sales price in 5 yrs</td>
<td>Increased power for price &amp; products</td>
</tr>
<tr>
<td></td>
<td>Reduced profits</td>
<td>Better working relationships and easier business</td>
<td>Can’t deal directly with insurers - only through network</td>
</tr>
<tr>
<td></td>
<td>No real future unless environment changes</td>
<td></td>
<td>% of turnover given to network</td>
</tr>
<tr>
<td></td>
<td>May be difficult to realise full worth if sold in 5 yrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Grow existing business</strong>&lt;br&gt;Increase current business and find areas for diversification</td>
<td>Find other products to sell</td>
<td>Renewed enthusiasm</td>
<td>As above</td>
</tr>
<tr>
<td></td>
<td>Gain a few key clients</td>
<td>Less competition with insurers</td>
<td>Purchase power of network may allow more growth &amp; diversification</td>
</tr>
<tr>
<td></td>
<td>May be difficult to sustain growth</td>
<td>Competing mainly with other brokers</td>
<td></td>
</tr>
<tr>
<td><strong>Buy another business</strong>&lt;br&gt;As above by control retained by SIB, Gain larger market share</td>
<td>Remain in control</td>
<td>Remain in control</td>
<td>As above with a larger company</td>
</tr>
<tr>
<td></td>
<td>Should be easy to find a company but may not be able to compete on purchase price</td>
<td>Could increase strength &amp; market share</td>
<td>In control of new company but still constrained by network</td>
</tr>
<tr>
<td></td>
<td></td>
<td>More negotiation power with insurers for better products</td>
<td>More profits due to increase volume of trade</td>
</tr>
<tr>
<td><strong>Merge with another business</strong>&lt;br&gt;Find broker with complimentary competences, Control of business to be negotiated</td>
<td>Loss of control - culture clashes</td>
<td>May be difficult to find company to purchase</td>
<td>As above but with a larger company</td>
</tr>
<tr>
<td></td>
<td>With brokers selling up, may be difficult to find appropriate company</td>
<td>Loss of control - culture clashes</td>
<td>More loss of control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Could make broker stronger</td>
<td></td>
</tr>
<tr>
<td><strong>Sell immediately</strong>&lt;br&gt;Gain compliance &amp; sell entire business before enforced regulations</td>
<td>May be difficult to negotiate best price or</td>
<td>Insurers may not be so keen to purchase if they need brokers as a sales force</td>
<td>Uncertain about sales price</td>
</tr>
<tr>
<td></td>
<td>Could negotiate better price as more companies compete for purchase</td>
<td>Could sell to another broker for increased market share</td>
<td>No future job unless secured with purchaser</td>
</tr>
<tr>
<td></td>
<td>No future job unless secured with purchaser</td>
<td>No jobs for Directors</td>
<td></td>
</tr>
</tbody>
</table>
one is that some scenarios may be quite extreme, with a very small possibility of occurrence. While this can be accommodated in a decision tree, with low-probability events, it is our opinion that its structure may inhibit the consideration of extreme cases (not to mention that it tends to produce a low overall utility, given the typically low probability attached to the outcome). Considering an extreme scenario also lead managers to think about how robust the strategy they are assessing is. This may support the creation of new, more robust, strategies and make managers think about the future without merely extrapolating present trends.

The second feature that distinguishes scenarios from outcomes of events in a decision tree, is that the scenarios are not, necessarily, mutually exclusive and exhaustive. This means that one should not attach a probability of occurrence to each scenario. Indeed, most scenario planning proponents are strongly against the use of probabilities in appraising scenarios, as they should not be considered as either states of nature or predictions [70] but, instead, as learning tools [13] to explore the future.

In our own experience of providing strategic decision support to organisations, scenario planning has proved to be a powerful tool to increase awareness about future uncertainties and enhance creativity in thinking about possible strategies. However, the literature on scenario planning is limited in discussing how to identify/design high-quality strategies from a scenarios analysis. It also does not address the need of appraising these strategies taking into account multiple organisational objectives, which we will discuss next.

2.2.2 Considering Multiple Objectives

There is ample evidence in the management literature of the pervasiveness of multiple and conflicting objectives in strategic decision making (e.g. [18]). The fact that strategic decisions typically involve the consideration of multiple strategic objectives suggests the adoption of MCDA as the evaluation tool for strategic choices.

The popularity and advantages of scenario planning, combined with the power of evaluation of MCDA, provides a potent set of decision-support tools for strategic decisions [52]. Indeed, since the 1980s there are suggestions of considering the use of MCDA with scenario planning. Most papers use multi-attribute value analysis, such as Phillips [58] and Goodwin and Wright [25]. However other MCDA methods can also be employed, such as Durbach and Stewart’s [14] suggestion of using goal programming with scenario planning. It is also possible to imagine the use of outranking methods such as those advocated by Roy [66], but we are not aware of any published paper adopting this approach.

On a more theoretical level, Belton and Stewart [81] discussed the potential use of MCDA and scenario planning. Stewart [78, 79] presented several technical issues about this integration and provided a thoughtful discussion on how it could be made. Montibeller et al. [52] suggested a framework for conducting a multi-attribute value analysis under multiple scenarios, in the same way as Belton and Stewart [81], but
with an emphasis on robustness of strategies. It is this latter approach that we adopt here.

Let a set of $n$ strategic choices be: $A = a_1, a_2, ..., a_n$. There are $m$ criteria: $C_1, C_2, ..., C_m$; each $k$-th criterion measures the achievement of one strategic objective of the organisation. A model is built for each $s$-th scenario, which provides the overall evaluation of the $i$-th alternative under the scenario:

$$V_s(a_i) = \sum w_{s,k}v_{s,k}(a_i)$$

Where $w_{s,k}$ is the weight of the $k$-th criterion under the $s$-th scenario ($\sum w_{s,k} = 1$ for a given scenario) and $v_{s,k}$ is the value of the $i$-th alternative on the $k$-th criterion (scaled from 0 to 100). Notice that this model allows different weights for distinct scenarios, in order to reflect different future priorities.

For example, in supporting the decision of one of our clients on whether they should go ahead with a warehouse development in Italy, five strategic options were considered and two scenarios: the council would grant planning permission with a change of destination allowing the development, or it would not grant it (see details in [52]). The MCDA model, for each scenario, its weights and the performances of each strategy is shown in Figure 2.3; notice that there is no dominating option in all scenarios.

![Image](a) Change of Destination Scenario (b) No change of destination scenario

**Fig. 2.3** Evaluating strategies under different scenarios with MCDA
One important change that organisations may experience, when using MCDA for strategic decisions, is the use of a value-focused framework [39] to guide the decision making process. In this case, strategies are seen as means to the achievement of the organisation’s strategic objectives. This may help both in aligning the strategic vision of the organisation with its strategic objectives, and in better scoping the strategic choices it is considering (see [6]).

A key aspect in supporting strategic decisions using value-focused thinking is, therefore, the need to help the definition and structuring of these strategic objectives. As recent research has shown [10], people usually struggle to think about the fundamental objectives they need to consider in a decision. While managers have a deep understanding of their organisations, and think about what they want to achieve, our experience with management teams shows that they usually do not have a clear framework to think about decisions. Consequently, it is reasonable to argue that they invariably need support to define and negotiate the objectives considered as important and salient in a particular strategic decision context [17].

There are several tools that can be used for the structuring of objectives, such as means-ends networks [39], causal/cognitive maps [86, 7], post-it workshops with the CAUSE framework [81], affinity diagrams [54] and Soft-Systems Methodology [53]. We have used extensively cognitive maps - a network that represents ends decision makers want to achieve and means available to them, connected by links denoting perceived influence - to support the structuring of objectives and of value trees. This is a particularly useful tool, as the means-end structure permits the analyst to ladder-up the decision-makers’ values and find their fundamental and strategic objectives, helping to structure a value tree (for a discussion on how they can be used for such purpose see Montibeller and Belton [50]). There are several other applications of cognitive maps for this purpose reported in the literature, for instance, Belton et al. [7], Bana e Costa et al. [5], Ensslin et al. [19], Montibeller et al. [51].

For example, in one recent application we helped a team responsible for planning and performance (PP Team) of a British city council in identifying their strategic objectives. The process was aided by a cognitive map, part of which is shown in Figure 2.4, which was interactively developed with team members using the Group Explorer networked system (www.phrontis.com) (a set of laptops connected wireless) running along the Decision Explorer mapping software (www.banxia.com). These mapping tools allow team members to input and structure their ideas and objectives in “real-time”.

### 2.2.3 Identifying Robust Options

The early focus of traditional decision analysis was in providing a single solution, the one that maximises the expected value/utility. As we discussed before, this is a feasible aim, as long as the conditions required hold. In conditions of deep epistemic uncertainty, however, decision makers may be unable to define a set of exhaustive outcomes to events and/or attach realistic probabilities to them [42, 44]. Further-
Fig. 2.4 An excerpt from a cognitive map used to identify strategic objectives (in boxes)

more, if one is using scenarios and MCDA to assess the value that each of these strategies generates for the organisation under each scenario, it is not feasible to calculate an expected overall value for each strategy as probabilities should not be attached to scenarios.

Instead of maximum expected utility, scenario planning proposers have stressed the need for finding robust strategies [72, 82], those that perform relatively well across the scenarios. This call for robustness instead of optimality has also been made within the operational research field by Rosenhead [63, 64] and Lempert [42, 44, 43]. The multi-criteria community has also made calls for a focus on robustness instead of optimisation ([4, 28, 67, 84]).

We suggested elsewhere [52] that if the analyst is using MCDA with multiple scenarios, two aspects should be of concern. The first one is the robustness of performances of a strategy across scenarios, which we denominated *inter-scenario robustness*. Thus a strategy that performs relatively well on all scenarios exhibits higher (inter-scenario) robustness than one that performs poorly on a given scenario. The second aspect is the spread of performances across scenarios, which we named *inter-scenario risk*. For example, in supporting the decision of the warehouse development in Italy, there was no dominating option, but there were more robust options as well as less risky ones, as shown in Figure 2.5.

One challenge of using the concept of robustness is that there are different ways of conceptualising it [28, 64]). A simple way, as we suggested in Montibeller et al. [52], is the use of the maximin rule. Another, suggested by Lempert et al. [44] and Lempert et al. [43] is the use of min-regret. (In both cases the analyst needs to normalise the scales under each scenario, to make them comparable - see also [61]). As it is well known, any of these rules is weaker than the expected value rule; but
the paradox is that the expected value does require the specification of probabilities of outcomes, which is not feasible if the analyst is using scenarios. In practice, we have found that the most helpful way for supporting decision-makers’ choices of strategies has been a visual inspection of the performances and spreads, with a focus on inter-scenario robustness and inter-scenario risk.

### 2.2.4 Designing Robust Options

Much of the focus of the MCDA literature has been on evaluating options, given a predefined set of alternatives. While this is an important aspect of many decisions, our experience is that most decisions - particularly at the strategic level - do not start with a well-defined set of options. As Keeney has emphasised [26, 39] the design of better options is a crucial aspect of a successful decision support.

In this regard, the decision analyst can help decision makers in: (1) identifying strategic options; and, (2) designing better ones. The identification of options is usually supported during the problem structuring phase. Again there are several tools that may help such as, among others, cognitive maps, the CAUSE framework [81], dialog mapping [12], and Keeney’s [39] probes for generating objectives.

We have been using extensively cognitive maps for the generation of options. For example, in the project developed for the city council mentioned before, for each strategic objective shown in Figure 2.4, we asked the group members to generate a list of options, which were then input, using their laptops and shown in the cognitive map projected on a public screen. In this way we had a brainstorming focused on achieving the strategic objectives of the organisation.

The second support an analyst can provide is in the design of better options. Indeed, one main advantage of using MCDA for supporting strategic decision making stems from the specification and achievement measurement of the organisation’s strategic objectives. In this way, it is easy to determine the weaknesses and strengths
of each strategy and the contribution of each strategic objective to the achievement of the overall objective. The analysts can then help their clients in thinking of ways to re-design options, improving their weaknesses and assessing the marginal value of such improvements; or in creating better strategic options, by combining positive features of other alternatives. Not only inter-scenario robustness should be an aim, but also inter-scenario risk, the latter being a concern about reducing the variability of performances of a given strategic option across scenarios.

For example, in the Italian warehouse development, we managed to improve an alternative that was the best performer in the “no-change of destination” scenario but quite weak in the other one (alternative With in Figure 2.5), by focusing on how to improve its performance in the latter scenario and coming up with a better marketing strategy to sell the land option. In this way we managed to both increase the inter-scenario robustness of the alternative as well as reduce its inter-scenario risk.

2.2.5 Designing and Appraising Complex Strategic Options

Almost invariably, the MCDA literature has focused on alternatives that are relatively easy to describe, e.g., the choice of location for an industrial plant or the selection of the right candidate for a job. At a strategic level, however, many times decision-makers are faced with far more complex strategic choices or policies that are composed by a large set of sub-options. A challenge in this type of problem is the cognitive burden involved in appraising holistically the performance of each policy and the time burden that may be required to evaluate a large set of options.

There are some methods that deal with this situation. The strategy generation table proposed by Howard [31] is a simple way of creating strategies from the combination of option under several dimensions. Another tool is the Analysis of Interconnected Decision Areas (AIDA) technique that is part of the Strategic Choice Approach developed by Friend and Hickling [24], where the links between several “decision areas” are represented, each one with several options, and whose compatibility is explored in order to generate a list of possible option portfolios. For example, in an intervention with a major international hotel company, we used AIDA to initially shape a strategic decision concerning how to tackle “cost of sale”, and produced a list of candidate interconnected strategic options, grouped in three areas (distribution, timing launch and scope level). This is shown in Figure 2.6, where the links between nodes represent incompatible combinations.

Another way of dealing with complex policies is to represent the problem as a portfolio problem, with decision areas which group options [60]. An MCDA model can then be built to assess the multiple benefits that each option generates, and software such as Equity (www.catalyze.co.uk) can then calculate the best portfolio of options, i.e. the one with the highest marginal benefit per unit of cost, given the organisation’s budget.
For example, in the city council intervention, each strategic objective in Figure 2.4 was transformed in an area of a portfolio, as shown in the bottom row of Figure 2.7 (two of those strategic objectives were not depicted in Figure 2.4). Each of those strategic objectives had a set of options that are “stacked” vertically above the respective area name. Each option was then assessed in terms of its overall benefit and implementation cost and the rank of non-dominated portfolios was identified (for details see [51]).

### 2.2.6 Considering Long Term Consequences

Most of the MCDA applications reported in the literature assess single-point outcomes, which try to represent the performance of an option if it were implemented. Particularly in strategic decision-making, however, considering long-term consequences is relevant and, many times, crucial.

One relatively simple way of considering long-term consequences in these cases is by applying time discounting, as in net present value (NPV) analysis (see also [80]). A key challenge of NPV analysis is always to define a suitable discount rate. In private companies this may be relatively straightforward, as it is linked with the cost of capital. However, the same cannot be said about public decisions, where the level of discounting is debatable - a large rate can make costs in the long-term future negligible and favour short-termism [23]. Another avenue, which has been recently suggested by Santos et al. [68] is the use of system dynamics models to simulate multiple responses of a system, given some policy as input. These responses can then be employed as the policy’s performances in a MCDA model.
A less technical way, but particularly suitable for strategy workshops, of considering long-term consequences, is the use of several MCDA models, each one concerning a particular time frame (for example, consequences after 5, 10 and 20 years). In this way the MCDA analysis can cover not only multiple-scenarios but also multiple-time frames. How to analyse the results from this kind of model is, however, still an open issue.

2.3 MCDA for Strategic Decision Making: Facilitating Process

The previous section discussed some ways to address the technical complexities associated with strategic decisions. This section will focus on designing decision support processes to tackle the social aspects associated with strategic decision making, and propose facilitated decision modelling as an effective means to provide that support. The focus of support will be at the group rather than the individual level, which is consistent with an increasing recognition of the importance of strategy workshops (e.g. [29]). Such strategy workshops, by definition, involve working with groups of diverse composition which are likely to include key organisational stakeholders.
2.3.1 Facilitated Decision Modelling

The term “facilitated decision modelling” will be used here to describe a process by which formal decision models are jointly developed with a strategy team, in real time, and with or without the assistance of computer support (Eden, 1990; Franco and Montibeller, forthcoming; Phillips 2007). We consider a decision model as “formal” if it represents a strategic decision problem either in terms of cause and effect relationships; or of relationships between decision choices and their (deterministic or uncertain) consequences. A formal decision model is amenable to analysis and manipulation, but not necessarily fully quantifiable.

A decision model produced in a facilitated manner is used by the strategy team members as a “transitional object” [16, 13]. It allows them to share their strategic concerns and increase their individual understandings of the strategic issues, appreciate the potential impact of different strategic choices, and negotiate strategic action that is politically feasible.

When members of a strategy teams participate in a facilitated modelling process, they engage in “conversations” [22] to exchange their understandings and views about the strategic decision that is being analysed. This process is a participative one, in the sense that team members are able to jointly construct the strategic decision, make sense of it, and develop and evaluate a portfolio of strategic options for the decision. This participatory process is supported by the decision analyst both as a modeller and a facilitator [2, 57].

Because interaction between the participants in the decision modelling process, and of the participants with the decision analyst, is needed to jointly build a decision model of the strategic situation, facilitated decision modelling is also an interactive process. Participants’ interaction with the model reshapes the analysis, and the model analysis reshapes the group discussion. Such interactive processes continue until the situation is satisfactorily structured and analysed, so that the group feels sufficiently confident in making commitments and implementing options.

Facilitated modelling is typically organised into group work stages, which roughly correspond to: structuring the decision problem and agreeing a decision focus; developing a model of organisational objectives; creating, refining and evaluating options; and developing action plans. However, the stages of facilitated decision modelling do not have to be followed in a linear sequence; rather, it is possible for the participants to cycle between the stages.

In terms of technology, facilitated decision modelling can be a relatively un sophisticated activity, conducted in a workshop format, and one which does not necessarily require software to support it [3]. Facilitated decision modelling can also be deployed with computer support. In this case, specialised software is used to support the processes [1, 56]. This kind of software enables fast model building and real time computing [3].

Some software, such as Group Explorer (www.banxia.com) and VISA Groupware (www.simul8.com/products/visagroup.htm), also allows participants to enter their views relating to a decision problem directly and anonymously into it. The system is then operated by the facilitator/modeller who manipulates and analyses
the data according to the wishes of the group. Once a decision model is built and stored in the system, several analyses can be performed “on-the-hoof”.

The preceding discussion makes it clear that facilitated decision modelling is different from standard decision analysis modelling. It requires a decision analyst able to support a group model-building process that must be participatory, interactive, staged, non-linear, adaptable, and supported by appropriate technology. At the same time, the facilitative decision modeller and his/her chosen modelling approach must be responsive to the dynamics of group work and the particularities of the situation at hand [57]. The next section explores further what is required to become a facilitative decision modeller.

### 2.3.2 Becoming a Facilitative Decision Modeller

As already stated, facilitated decision modelling requires the decision analyst to act as a facilitator during the group decision modelling and analysis process. This means that the decision analyst should be prepared to use general facilitation skills as part of his/her modelling work. Drawing from the general facilitation literature (e.g. [38, 74]) and the work of Schuman [73] and others (e.g. [57]), we consider below three fundamental facilitation skills required in facilitated decision modelling:

- **Active listening** requires the decision analyst to be able to clarify, develop, summarise and refine participants’ contributions by paraphrasing and/or mirroring what participants say; validating what they say without judging; asking them non-directive questions; gathering lists of their contributions; helping them to take turns; keeping track of the various discussion themes that may emerge simultaneously; balancing the discussion to avoid bind spots; and listening for the common ground.

- **Managing group dynamics** is perhaps one of the most fundamental skills for the facilitative modeller. Through active facilitative listening, the decision analyst must be able to sense when difficult group dynamics crop up during modelling, and treat them as group situations that must be handled supportively. A typical approach is for the decision analyst to help the group step back from the content of the ongoing discussion and talk about the process instead. This is usually achieved by, for example, encouraging more people to participate, acknowledging and handling out-of-context distractions, educating participants about how to handle anxiety in the group, and helping participants deal with any unfinished business. Difficult group dynamics also require the decision analyst to know whether, how and why to intervene during the modelling process.

- **Reaching closure** is a key skill that a facilitative decision modeller uses to help the group reach agreements about the way forward. This requires the decision analyst to identify when the group has reached a point, from “playing” with the decision model, at which closure on a proposal is needed and a requisite decision model has been achieved [55]. Depending on the particular organisational context within which the decision analysts is working, those with the power and authority
to make commitments for the implementation of particular courses of action must then decide whether the proposal needs further group discussion or whether a commitment about the way forward can be made.

In Figure 2.8, we have attempted to capture the main aspects of facilitated modelling discussed in this section. The figure suggests that the decision analyst interacts simultaneously in two “spaces”: as an analyst in the decision modelling space and as a facilitator in the group process space. In the former, s/he uses a particular decision methodology to inform model building and represents the decision problem as described by the group, using a decision model. Meanwhile, in the group process space, s/he facilitates the group (informed by the facilitation methods s/he is using), supports the group’s discussion and interacts with the group’s members. The group provides information that allows the facilitator to model the decision problem and, conversely, the model generates responses that support the group’s discussions about the issues they are dealing with. Two types of outcomes are provided by facilitated decision modelling: in the decision modelling space, there are model outcomes (such as performances of options, sensitivity analyses, etc.); in the group process space, there are group outcomes (such as commitment to the way forward, learning, etc.). The two spaces cannot be divorced from each other [15], as there will be cross-impacts from one space to the other (for example, conceptual mistakes in the decision model may generate meaningless model results, which then impact negatively on group outcomes, such as creating low commitment to action).

Fig. 2.8 Facilitated decision modelling (adapted from Franco and Montibeller, forthcoming)
2.4 Conclusions

Multi-Criteria Decision Analysis (MCDA) has been extensively used for supporting extremely complex decisions in both public and private organisations. We believe that there is an excellent opportunity for MCDA in supporting strategy workshops, given their prevalence nowadays. In these workshops, organisations shape their strategic vision, design strategic options and appraise strategic choices.

This chapter proposed a framework to employ Multi-Criteria Decision Analysis for supporting strategic decision making in strategy workshops. This framework comes from our practice, as decision analysts, in providing strategic decision support to a wide range of organisations, in Europe, North America and Latin America.

We suggested that there are two main aspects that have to be addressed by the decision analyst, if s/he wants to support strategic decision making processes. The first is related to content issues, in particular in dealing with epistemic uncertainty, multiple organisational objectives, complex policies and long-term consequences. We believe that the key aspect is to develop robust strategies against multiple scenarios. The second aspect concerns process issues, in particular being an active listener, dealing with group dynamics and helping the group to reach closure. Here the analyst has to facilitate the management team in making a strategic decision; and the key is to conduct, in an efficient and suitable way, facilitated decision analysis.

We recognise that further research has to be conducted on this topic, which could permit additional development of this framework. In particular, we suggest the following directions for further research:

- Robustness - more studies on robustness of strategic options under multiple scenarios is required; for example, about suitable operators and graphical displays for interacting with users/clients.
- Design of complex policies - structuring policies composed by options that are interconnected is an area almost unexplored, from a decision analysis perspective, and ideas from the field of problem structuring methods [65] may be relevant for this intent.
- Long term consequences - this is an open area for research by MCDA, and developments in other areas (e.g., cost benefit analysis) could be analysed and adapted to the context discussed here.
- Impact of facilitated decision analysis on the strategy process - there is already some systematic research about the impact of decision conferencing on group’s outcomes (e.g., [69]); but given the special nature of strategy workshops, it would be interesting to assess the impacts of the framework we are suggesting on their effectiveness, as well as the overall usefulness of the framework to increase our understanding of decision analytical support at the strategic level.

Concluding the chapter, we believe that supporting strategic decision making, particularly within a strategy workshop format, represents an important - but somehow neglected - area for research in Multi-Criteria Decision Analysis. Given the importance of strategic decision making for the survival of any organisation, further developments in this field could, therefore, not only bring opportunities for research
on the several challenges we highlighted here, but also have a real impact on MCDA practice.

References


