# 10. EVALUATION

## 10.1. Implementation of IMGP

When IMGP is implemented in practical capital budgeting and financial planning problems, it should be made clear to all actors that the method is not intended to provide an 'optimal' plan which may be forced upon the organization. It should be stressed that the method is primarily a tool to help one understand the decision problem. In addition, it can be used as a means of communication between the actors. If the method is used to select one or more investment plans, it can only be claimed that these plans are 'good', 'optimal', or 'efficient' (depending on the decision maker's choices) given the relations depicted in the model of the planning problem and given the set of goal variables defined by the decision maker. Once again, this stresses the fact that IMGP and similar methods are more a learning tool than a tool for optimization. With the help of these methods, the decision maker can gain more insight into the alternative plans available in the goals he is striving for, and into the possible effects of the modelled parameters.

In order to implement IMGP in practice, it is necessary to verify not only whether the characteristics of the problem at hand and its organizational setting meet the technical requirements for the procedure (cf. Chapter 6), but also whether its implementation is really desired and at least not counteracted by the participants involved in the decision problem. The importance of the latter can hardly be overstressed, as is suggested by various reports on applications of normative decision methods. For instance, managers may be quite reluctant to even mention their goals, let alone specify them in such a way that they can be incorporated within a multiple criteria decision model.

For a successful implementation it is necessary to overcome this type of resistance. In our opinion, the only way to get a method accepted is to inform all participants concerned about the aim, the assumptions and the operation of the method. One should try to avoid that either the decision maker or any of the other participants feel they are being manipulated by the method. For the same reason, the decision maker should be given every opportunity to change and rechange his mind and as a possible consequence, his earlier choice, during the interactive process. This implies that the computer programs should be designed to be as flexible as possible.

To stimulate the learning effects resulting from the use of interactive methods, the computer programs should be provided with options in order to get information on the values of instrumental variables, on shadow-prices of restrictions, and so forth.

Furthermore, we would like to advocate short response times between the choices of the decision maker on the one hand and the display of the consequences of these choices on the other hand. With short response times, it becomes feasible for the decision maker to sit at the terminal desk and to experiment with several combinations of the goal variables. It should be stressed, however, that short response times are beneficial but not strictly necessary for using these interactive procedures.

## 10.2. Main Advantages of IMGP

In this section we will summarize the main advantages of IMGP. Its possible disadvantages are discussed in the following section, together with some areas for further research. The present survey will be brief, as most of the items have already been discussed in detail in the preceding chapters.

As indicated by its name, IMGP is interactive. It thus has all of the advantages of interactive methods discussed in Section 5.1.

The class of problems for which IMGP can be used is quite large. In fact, IMGP can handle all those problems which can be handled by goal programming. As shown in Chapters 8 and 9, some technical problems that may occur in capital budgeting and financial planning with multiple goals can be tackled in a straightforward way. Because the assumptions about the decision maker's preferences are quite weak, IMGP can be used (depending on the needs of the decision maker), to generate a unique final solution, a series of efficient solutions, or a set of satisficing solutions.

IMGP is a relatively simple method, easy to understand for both decision maker and analyst. This is an important advantage in itself. Furthermore, the simplicity of the method implies that it can easily be computerized, and that the required computer is relatively short. This implies that it becomes feasible in terms of both time and costs to carry out many iterations within a short period. As explained in the preceding section, this feature of IMGP ensures that the decision maker can extensively benefit from the learning effects of using interactive methods.

The types of questions to be answered by the decision maker appear to be rather simple: (1) is the given solution acceptable or not? (2) which goal value needs to be improved? (3) how much at the least should this goal value be improved? (Optional) (4) do you accept the consequences of the proposed improvement of the value of the indicated goal variable? If the decision maker wishes to answer the third question, his answer need not be very precise, because he only has to specify 'a' lower bound for the size of the goal value improvement. In addition, the last question gives the opportunity to revise the answer on the third question. Finally, as already mentioned above, it is feasible to repeat some or all iterations of the interactive process several times.

## 10.3. Some Disadvantages and Areas for Further Research

In this study we made the assumption that the model describing

the available alternatives, the set of goal variables and the relationships between goal variables and instruments is given or can be established without insurmountable difficulties. In many decision situations this assumption is rather strong. Moreover, because of the learning effects which result from the use of IMGP, the model may have to be revised during the interactive process. In its present form, IMGP can handle these revisions on an *ad hoc* basis only.

It was also assumed that the decision maker's preferences can be described, at least in principle, by means of the preference relations discussed in Section 6.1. However, decision situations may exist in which this assumption is not satisfied. This holds especially true when the single decision maker assumed in this study is replaced by a team of decision makers. In the latter case, it may be hard if not impossible to find a preference ordering (for the team as a whole) which has the properties of transitivity and completeness.

The fact that the decision maker may change his mind during the interactive process is, as such, certainly not a disadvantage. However, there is no formal guarantee that the decision maker will stop changing his mind.

Many of the topics discussed in this study offer possibilities for further research. With respect to IMGP, it might be interesting to investigate whether solution procedures other than the simplex method can be used within the IMGP framework. For instance, Spronk and Telgen [1980] proposed the use of the ellipsoidal method of linear programming. The use of non-linear programming methods constitutes another subject for further study. In addition, it would be interesting to know whether these methods could be used if the set of alternatives is non-convex. As suggested by the use of IMGP for the mixed integer financial planning model described in Chapter 9, at least some methods can be used to solve non-convex problems. However, to be more conclusive, much more study should be carried out in this direction.

The non-empirical computational analysis of multiple criteria decision methods is still a generally neglected subject, and therefore deserves more attention.

On a more practical level, it might be useful to search for possibilities to easify the calculatory steps in IMGP. One such possibility is the removal of redundant (goal) constraints, both before and during the interactive process (see Spronk and Telgen [1979]). As already mentioned in Section 10.1, one should try to make the response times between the decision maker's choices and the presentation of the results as short as possible. In this respect, quite satisfactory results have already been obtained (see Appendix 7b). Nevertheless, further improvements are certainly possible. The same holds for the optional access to different kinds of information (for which multi-level computer programs might be designed), and for the presentation of the results (for which graphical display techniques might be considered).

As discussed in Chapter 8, some technical problems may arise in capital budgeting and financial planning with multiple goals. By means of IMGP, most of these problems can be tackled. However, we feel that some of them need further attention. For instance, studying the problem of the (0,1) instrumental variables and that of large numbers of goal variables might yield valuable results. Furthermore, it should be realized that most of the problems described in Chapter 8 may occur simultaneously. This phenomenon is another area for further research.

Besides the rather technical subjects mentioned in this section, much work needs to be done with respect to the organizational setting of capital budgeting and financial planning in relation to the role of the kind of normative decision methods discussed here. Can these methods be used if there are several decision makers, possibly on different hierarchical decision levels? How can these methods best be implemented? Are there any consequences for the administrative

system?

Most of these questions are rather difficult to answer. Nevertheless, if the implementation of interactive methods in capital budgeting and financial planning is to be successful, these questions should not be ignored.

## 10.4. Concluding Remarks

The title of this study might suggest that our only purpose is to promote the use of IMGP in capital budgeting and financial planning. Although we feel that IMGP is relatively well-suited to handle these kinds of problems, we expect and hope that in the near future, new methods will be developed which are better suited to tackle capital budgeting and financial planning problems with multiple goals.

A more important purpose of this study is to stress the idea of considering capital budgeting and financial planning as decision problems involving multiple goals. Furthermore, we have tried to show that the way of thinking inherent in multiple criteria decision making offers new and promising tools to tackle these problems. Finally, it was stressed that, in general, normative decision methods cannot claim to offer 'the optimal solution for all your problems'. Instead, these methods can help the decision maker to understand his decision problem and, in some cases, help him to find a few solutions which might be considered relatively good. In our opinion, normative decision methods can only be helpful if their underlying assumptions do not deviate too much from the decision problem at hand. This was one of the reasons for developing IMGP, in addition to the already existing range of methods. We hope that our modest attempt to tackle capital budgeting and financial planning by means of multiple criteria decision methods will encourage others to follow.

## References

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