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Multicriteria decision aid in financial management

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Abstract

The financial decisions of an organization are usually included in the context of optimization. Concerning a long-term period, there are decisions related to the optimal allocation of funds, and decisions related to the optimal financial structure. In the short-term case, the decisions are related to the optimization of stocks, cash, accounts receivable, current liabilities, etc. The financial theory analyzes these decisions, mainly from an optimal point of view. The optimal character of such decisions has led researchers to propose operations research techniques to solve the problems that are inherent in such decisions. This paper examines the contribution of multicriteria analysis in solving financial decision problems in a realistic context. The paper also includes an extensive bibliography on the subject. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Finance; Investment analysis; Multicriteria analysis; Decision support; Applications

1. Introduction

The financial decisions of an organization (i.e. firm, bank, insurance company, etc.) are usually considered in the context of optimization. Concerning the case of a firm and for a long-term period, two types of decisions are encountered: decisions related to the optimal allocation of funds, and decisions related to the optimal financial structure. In the short term, the decisions are mainly related to the management of working capital, and they refer to the optimization of stocks, cash, accounts receivable and short-term

debts. The financial theory analyzes these decisions (short and long terms), but always from an optimization perspective (for example, theory of capital cost, portfolio theory, options theory, etc). This perspective has led some researchers to propose techniques of operations research to solve financial decision problems. The classical modeling of decision problems in operations research consists in formulating an optimization (maximization or minimization) problem under specific constraints. In fact, it is a best choice problem.

However, recently, these financial problems have been examined from a more comprehensive and more realistic perspective, which overcomes the restrictive framework of optimization (Zopounidis, 1990, 1995). For example, in capital budgeting decision making, Bhaskar and

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McNamee (1983) pose the following questions: (a) In assessing investment proposals, do the decision makers have a single objective or multiple objectives? (b) If decision makers do have multiple objectives, which are those and what is the priority structure of the objectives? In another similar study, Bhaskar (1979) states that the microeconomic theory has largely adopted a single objective function, which is the principle of utility maximization for the consumer unit and profit maximization for firms. Bhaskar (1979) presents three categories of criticism regarding the use of the single objective function principle for firms: (a) there exist alternatives to the profit maximization approach which are based on equally simple hypotheses and which can better explain reality (e.g. maximization of stockholder's wealth); (b) the profit maximization or any other equally simple hypothesis is too naive to explain the complex process of decision making; (c) the real-world firms do not have suitable information to enable them to maximize their profits. Furthermore, several other theories of the firm have been postulated which have proposed different objectives than that of the traditional microeconomic theory. One can cite the revenue maximizing model (cf. Baumol, 1959), the manager's utility model (cf. Williamson, 1964), the satisficing model (cf. Simon, 1957) and the behavioral models (cf. Cyert and March, 1963).

On the basis of the above remarks it is possible to distinguish three main reasons which have motivated a change of view in the modeling of the financial problems.

1. Formulating the problem in terms of seeking the optimum, financial decision makers (i.e. financial analysts, portfolio managers, investors, etc.) get involved in a very narrow problematic, often irrelevant to the real decision problem.
2. Financial decisions are taken by humans (i.e. financial managers) and not by models; the decision makers get more and more deeply involved in the decision making process and, in order to solve problems, it becomes necessary to take into consideration their preferences, their experiences and their knowledge.
3. For financial decision problems such as the choice of investment projects, the portfolio selection, the evaluation of business failure risk,

etc., it seems illusory to speak of optimality since multiple criteria must be taken into consideration.

In this paper, our basic aim is to examine the contribution of the multicriteria analysis in studying and solving financial decision problems. Section 2 presents the methodological framework of multicriteria analysis. The multicriteria character of some financial problems is given in Section 3. Finally, some discussion and the advantages that resulted by the application of multicriteria analysis in the field of financial management are given in Section 4, along with future research directions on the implementation of multicriteria analysis in financial institutions and firms.

2. The methodological framework of multicriteria analysis

Multicriteria analysis, often called multiple criteria decision making (MCDM) by the American School and multicriteria decision aid (MCDA) by the European School, is a set of methods which allow the aggregation of several evaluation criteria in order to choose, rank, sort or describe a set of alternatives (i.e. investment projects, financial assets at variable revenue, financial assets at fixed revenue, dynamic firms, etc.). It also deals with the study of the activity of decision aid to a well-identified decision maker (i.e. individual, firm, organization, etc.).

The development of multicriteria decision aid (hence we use this term in the text) began 27 years ago. Its principal objective is to provide the decision maker with tools that enable him to advance in solving a decision problem (for example, the selection of investment projects for a firm), where several, often conflicting multiple criteria must be taken into consideration.

2.1. Methods

The specialists in the field distinguish several categories of methods in MCDA. The boundaries between these categories are, of course, rather

fuzzy. Roy (1985) proposes the following three categories of methods: (1) unique synthesis criterion approach disregarding any incomparability, (2) outranking synthesis approach, accepting incomparability and (3) interactive local judgment approach with trial–error iterations. In this paper, the classification proposed by Pardalos et al. (1995) is adopted. It distinguishes four categories: (1) multiobjective mathematical programming, (2) multiattribute utility theory, (3) outranking relations approach and (4) preference disaggregation approach.

- The multiobjective mathematical programming is characterized by the fact that an action (or alternative) α is represented by a vector of real variables (x_1, x_2, \dots, x_l) . The set D of feasible solutions is generally defined by a set of continuous and differentiable constraints [in multiobjective linear programming the set D is defined using linear constraints:

$$D = \{x \in R^l / A \cdot x \leq b, x \geq 0\},$$

where A is a matrix $m \times l$ and b is a vector-matrix $m \times 1$. The selection of vector x is based upon the consideration of several numerical criteria C^1, C^2, \dots, C^m , which are continuous and differentiable functions of x (linear or non-linear). It is possible to distinguish three different methods inside this approach: (1) the efficient solutions procedure, (2) the goal programming, (3) the compromise programming.

A synthesis of the studies realized on this category of methods can be found in the works of Spronk (1981), Zeleny (1982) and Vincke (1992).

- The multiattribute utility theory (MAUT) is an extension of the classical utility theory. It seeks to give a representation of the preferences of a decision maker by means of a utility function $u(\underline{g})$, aggregating several evaluation criteria:

$$u(\underline{g}) = u(g_1, g_2, \dots, g_n),$$

where \underline{g} is the vector of the evaluation criteria g_1, g_2, \dots, g_n .

In other words, the problem is to choose the action a^* which maximizes the utility function of the decision maker: $u[\underline{g}(a^*)] = \max_a \{u[\underline{g}(a)]\}$, where $\underline{g}(a)$ is the vector of the performances of an alternative a on the set of evaluation criteria \underline{g} .

The criteria (attributes) can be certain or probabilistic (each $g_i(x)$ is associated with a probability distribution). In general, it is possible to decompose a multicriteria utility function in real functions u_1, u_2, \dots, u_n concerning the independence of criteria. Thus, different utility function models are obtained. The most studied form of utility function, from a theoretical point of view, is the additive form:

$$u(g_1, g_2, \dots, g_n) = u_1(g_1) + u_2(g_2) + \dots + u_n(g_n),$$

where u_1, u_2, \dots, u_n are the marginal utilities defined on the scales of criteria. For the study of the condition of independence in utility between criteria (substitution rate), one can refer to Keeney and Raiffa (1976). The latter and Zeleny (1982) present syntheses of works on the construction of multicriteria utility functions both, under certainty and under uncertainty.

- The outranking relations approach was developed in Europe with the elaboration of the ELECTRE (ELimination Et Choix Traduisant la REalité) methods. The concept of outranking in ELECTRE methods is due to Bernard Roy, who is the founder of these methods. The outranking relation allows to conclude that an action $\alpha \in A$ (discrete set) outranks an action $b \in A$ if there are enough arguments to confirm that α is at least as good as b , while there is no essential reason to refute this statement. In the ELECTRE methods, the aggregation of criteria requires the definition of the notion of preference and indifference thresholds, and the notion of concordance and discordance. In fact, α outranks b if there exists a sufficient majority of criteria for which α is better classified than b (concordance) and if the unfavorable deviations for the rest of the criteria (discordance) are not too high. Thus, this modeling can bring into evidence the cases of incomparability when the multicriteria evaluation of two actions is very differentiated. A detailed presentation of all outranking methods can be found in the works of Vincke (1992), Roy and Bouyssou (1993) and Schärflig (1996).
- The approach of the disaggregation of preferences is often used in MCDA as a mean for modeling the preferences of a decision maker

or a group of decision makers. This approach uses regression methods. The introduction of regression methods in MCDA is based on the development of the social judgment theory. Multiple regression can, in general, detect, identify or “capture” the judgment policy of a decision maker (i.e. disaggregation of the preferences). This one, particularly if it is in relation with a certain number of past decisions, might be the expression of a global preference. The approach of multiple regression is quite close to MAUT; their differences involve the procedure through which the marginal utilities $u_i(g_i)$ and the weights p_i will be determined. For example, for the additive utility function:

$$u(\underline{g}) = \sum_i p_i u_i(g_i)$$

the marginal utilities $u_i(g_i)$ and the weights p_i are obtained by direct interrogation of the decision maker (aggregation methods) in MAUT, and by indirect interrogation of the decision maker (disaggregation methods) in the multiple regression approach. The main drawback that prevents the closeness of the two approaches is related to the linearity of the models proposed by multiple linear regression. A rather exhaustive bibliography of the methods of the disaggregation of preferences can be found in the works of Jacquet-Lagrèze and Siskos (1983) and Pardalos et al. (1995).

2.2. Decision aid activity

Concerning the activity of decision aid, Roy (1985, 1996) proposes a methodology of systematic intervention of multicriteria analysis in the decision process. In brief, this methodology comprises four levels.

- Level I Object of the decision and spirit of recommendation or participation.
- Level II Analyzing consequences and developing criteria.
- Level III Modeling comprehensive preferences and operationally aggregating performances.

- Level IV Investigating and developing the recommendation.

It is important to emphasize that these four levels do not necessarily follow one another in the aforementioned order. The activity of decision aid does not necessarily constitute a sequential process; feedback due to the interaction between the decision maker and the analyst is possible. This general methodology has contributed to the development of several multicriteria methods, which have been applied successfully to real cases. Among these methods, one could mention the ELECTRE methods developed by Bernard Roy and his collaborators (Roy and Bouyssou, 1993; Roy, 1996), the PROMETHEE and GAIA methods (Brans and Vincke, 1985; Brans et al., 1986; Brans and Mareschal, 1994), the Analytic Hierarchy Process (AHP) method (Saaty, 1980), multiobjective/goal programming approaches (Lee and Chesser, 1980; Spronk, 1981), as well as preference disaggregation methods (the UTA method, the UTADIS method, etc.; cf. Jacquet-Lagrèze and Siskos (1982, 1983) and Zopounidis and Doumpos (1998)).

3. Multicriteria character of some financial problems

The operational research techniques were the first to be used in the solution of some financial problems. Ekeland (1993) wonders “why finance, rather curiously, has remained so long away from the techniques of operational research (i.e. optimization techniques), except for those concerning portfolio selection models”. According to the same author, the Capital Asset Pricing Model (CAPM) is a static optimization model based on the principle according to which, the best portfolio (i.e. optimal portfolio) is the one which maximizes the expected return for a given level of risk, in the period of time considered. For Ashford et al. (1988), the techniques of operational research can be applied to working capital management as well as to the evaluation of investment projects. Among the techniques used for the management of working capital, one could mention:

- inventory control for the management of stocks;
- dynamic programming, linear programming, stochastic programming and visual and interactive techniques of simulation for the management of cash;
- the Markov process and the discriminant analysis for the management of accounts receivable;
- dynamic programming, linear programming and stochastic programming for the management of short-term debts (current liabilities).

Among the techniques used in the evaluation of investment projects, one could mention the simulation methods (Hertz, 1964) and those of mathematical statistics (Hillier, 1963) which take into consideration the risk factor. Simulation methods and linear programming (i.e. the LONGER program, cf. Myers and Pogue (1974)) are also used in financial planning (i.e. elaboration of investment and financing plans).

Under these circumstances, the solution of financial problems is easy to obtain. It is based on the fact that the problem is well posed, well-formulated regarding the reality involved and on an evaluation criterion (i.e. monocriteria paradigm). But in reality, the modeling of financial problems is based on a different kind of logic. In that case, their solution should take into consideration the following elements (i.e. multicriteria paradigm, cf. Roy (1988)):

- multiple criteria;
- conflict situation between the criteria;
- complex evaluation process, subjective and ill-structured;
- introduction of financial decision makers in the evaluation process.

MCDA has already contributed in a significant manner to solving several financial problems such as venture capital investment, business failure risk, credit granting, bond rating, country risk, political risk, evaluation of the performance and viability of organizations, choice of investments, financial planning and portfolio management.

To justify the multicriteria character of financial problems, two financial decision problems are discussed in the succeeding subsections: the investment decision problem and the problem of portfolio management. In these two important fields of financial management, optimization tech-

niques have found numerous applications. Nevertheless, the subsequent discussion will demonstrate that such approaches are merely an oversimplification of real world situations, and it will illustrate the multidimensional character of these significant financial decision problems. Of course similar implications and conclusions could also be drawn for other fields of financial management (actually, the international literature provides very important case studies for the rest of the financial problems: Zopounidis (1990), Khoury and Martel (1993), Zopounidis (1995)). The selection of the two examined problems (investment decision and portfolio management), is made because they are among the most characteristic examples of financial problems whose multicriteria nature is often disregarded by financial researchers and practitioners through the application of oversimplified and unrealistic decision models.

3.1. *The investment decision*

The choice of investment projects entails an important decision for every firm, public or private, large or small one. In fact, considering its duration, its amount and its irreversible character, an investment decision is regarded as a major and strategic one. Therefore, the process of an investment decision should be conveniently modeled. If one considers that, in general, the investment decision process consists of four main stages: perception, formulation, evaluation and choice, the financial theory intervenes only in the stages of evaluation and choice (cf. Colasse, 1993). With its empirical financial criteria (i.e. the payback method, the accounting rate of return) and sophisticated ones, based on discount techniques (i.e. the net present value, the internal rate of return, the index of profitability, the discounted payback method, etc.), the financial theory proposes either a ranking from the best to worst when there are many alternative investment projects or an acceptance or refusal if there is only one investment project. Although the tools of the financial theory should be improved so that they could take into account time, inflation and risk (i.e. analytical methods, simulation methods, game theory, CAPM, etc.), there are still

problems concerning the evaluation and selection of investment projects. Among the most important ones, one could mention the restriction of the investment concept in a time series of monetary flows (i.e. inflows, outflows), the choice of the discount rate, the conflicts between financial criteria (i.e. net present value versus internal rate of return), etc. According to the financial theory, the discount rate (sometimes called rate of return) plays the role of acceptance or rejection rate (a cut-off rate) of an investment project in the case where the criterion of internal rate of return is used. Thus, one can see that the investment decision of a firm depends on one variable only, which is the discount rate. As far as the conflicts between criteria are concerned, one often ascertains that the criteria that are supposed to express the goal of the profitability of projects, could lead to divergent rankings (for example, the net present value and the index of profitability or even the net present value and the internal rate of return). Consequently, the financial approach of investment decision seems limited and unrealistic. It is limited because it remains in the stages of evaluation and choice, and it is unrealistic because it is based only on financial criteria.

MCDA, on the other hand, contributes in a very original way to the investment decision process. Initially, it intervenes in the whole process of investment, from the stages of perception and formulation to the stages of evaluation and choice. Concerning the stages of perception and formulation, MCDA contributes to the identification of possible actions (i.e. investment opportunities) and to the definition of a set of potential actions (i.e. possible variants, each variant constituting an investment project in competition with others). This set of projects can be global, fragmented, stable or evolutionary. Then, it is necessary to choose a reference problematic which is well adapted to the investment decision problem (i.e. choice, sorting, ranking).

- Choice problematic $P.\alpha$: helps in choosing the best investment project or in developing a selection procedure for investment projects.
- Sorting problematic $P.\beta$: helps in sorting investment projects according to norms or in building an assignment procedure for investment projects.

- Ranking problematic $P.\gamma$: helps in ranking the investment projects according to a decreasing preference order or in building an ordering procedure for investment projects.

Concerning the stages of evaluation and choice, MCDA offers a much more realistic methodological framework than the financial theory, by introducing in the study of investment projects both quantitative and qualitative criteria. Criteria such as the urgency of the project, the coherence of the objectives of the projects with those of the general policy of the firm (Evrard and Zisswiller, 1982), the social and environmental aspects should be taken into consideration in an investment decision. Therefore, MCDA contributes through the identification of the best investment projects according to the problematic chosen, the satisfactory resolution of the conflicts between the criteria, the determination of the relative importance of the criteria in the decision making process, and the revealing of the investors' preferences and system of values. It is very interesting to mention that many authors have already used MCDA methods in the evaluation of investment projects (list non-exhaustive): ELECTRE II and ORESTE methods (Danila, 1980); MAUT methods (Evrard and Zisswiller, 1982); multiobjective mathematical programming (Lin, 1978; Bhaskar, 1979; Khorramshahgol and Okoruwa, 1994); the AHP method (Kivijärvi and Tuominen, 1992); PROMETHEE method (Ribarovic and Mladineo, 1987; Zopounidis, 1993a).

Finally, in order to examine if the firms apply in reality multiple criteria in their investment decisions, we present the results of the empirical study of Bhaskar and McNamee (1983). The two authors, by studying large United Kingdom companies, have shown that most companies appear to have more than one objective when an investment is being appraised (96%). The most common number of objectives that companies had was eight. Concerning the objectives priority, most companies (77%) had profitability as the primary objective. The next most important objective was company's growth. Other criteria less important than the two above but, which play a role in the investment decisions are the risk, the liquidity, the environment, the age of assets, the flexibility, the

depth of skills, etc. With these empirical results an answer has been given to the questions posed in the introduction by the two authors.

3.2. *The portfolio management*

In the field of portfolio management it is possible to cite the pioneering work of Harry Markowitz (1952), the founder of the classical approach of the portfolio management, that developed the mean–variance optimization model (M-V). According to Ekeland (1993), the problem of portfolio choice in the M-V model is a multicriteria one, because the investor will try simultaneously to maximize the return and minimize the risk; but determining the acceptance level of risk, one comes back to maximize the return, which is a classical monocriteria problem. After this bicriteria, and even more the monocriteria (i.e. market model, CAPM) portfolio choice consideration, the development of multifactor models has been started where there are more types of risk and not only market risk (Ross, 1976). Thus, the problem of portfolio selection becomes multidimensional. The necessity of having multidimensional methods (i.e. statistics and econometrics) for the selection of stocks has been presented by specialist researchers in finance (cf. Jacquillat, 1972). The multidimensional nature of risk in portfolio management has also been demonstrated by specialist researchers in multicriteria analysis. One refers to the works of Zeleny (1977, 1982) and Colson and Zeleny (1979) on the “Prospect Ranking Vector (PRV)” method. Today an arsenal of multidimensional and multicriteria methods such as factor analysis, goal programming, AHP, ELECTRE, MINORA, ADELAIS, etc. have been already applied in the field of portfolio management (cf. Ho and Paulson, 1980; Lee and Chesser, 1980; Saaty et al., 1980; Martel et al., 1988; Colson and de Bruyn, 1989; Martel et al., 1991; Zopounidis, 1993b; Khoury et al., 1993; Hui and Kwan, 1994; Zopounidis et al., 1995b; Hurson and Zopounidis, 1995, 1997).

The multicriteria nature of the problem of portfolio selection is well presented in a recent paper by Khoury et al. (1993). The authors study the problem of the international portfolio selec-

tion. According to them, the classical optimization model of portfolio selection used in a national context can have even more chance of being sub-optimal in a situation of international diversification. In fact, in an international context, the M-V model does not always constitute a suitable method because, it does not incorporate all the criteria that the portfolio managers and investors use in their stock investment decisions. For such decisions, the authors propose new criteria such as: the return of the last five years on a monthly basis, the standard deviation of the return calculated on the last five years, the total cost of transactions, the country risk (or political risk), the direct available coverage for foreign currencies and the exchange risk. The multicriteria methodology used (i.e. ELECTRE IS, ELECTRE III) has the advantage of offering the portfolio manager a large set of investment opportunities, and also gives him the flexibility of choosing the relative importance of the different criteria during the process of portfolio selection. Finally, the authors believe that the use of an optimization model under constraints changes the nature of the portfolio selection problem because a constraint does not play the same role as a criterion in all decision problems. To show this new direction of research in portfolio management, it is convenient to mention the special issue of the Canadian journal “*L'Actualité Economique*”, which is dedicated to the contribution of multicriteria analysis in the study of financial markets (cf. Khoury et al., 1993).

Concerning other financial problems which present a multicriteria character and on which MCDA methods have been applied, it is possible to provide a list of published works (non-exhaustive).

- Acquisitions of firms: Slowinski et al. (1997).
- Bankruptcy risk: Zollinger (1982), Zopounidis (1987), Andenmatten (1995), Dimitras et al. (1995), Slowinski and Zopounidis (1995), Dimitras et al. (1996, 1999), Zopounidis and Doumpos (1999).
- Country risk: Tang and Espinal (1989), Cosset et al. (1992), Oral et al. (1992), Cook and Hebner (1993), Clei (1994), Anastassiou and Zopounidis (1997), Doumpos et al. (1998).
- Evaluation of performance of organizations

- Insurance: Mareschal and Mertens (1993), Pardalos et al. (1997).
- Banks: Mareschal and Mertens (1990, 1992), Zopounidis et al. (1995a), Michalopoulos et al. (1998).
- Firms: Diakoulaki et al. (1992), Zopounidis et al. (1992), Jablonsky (1993), Mareschal and Brans (1993), Siskos et al. (1994), Lee et al. (1995), Bergeron et al. (1996), Zopounidis et al. (1992), Zopounidis and Doumpos (1998).
 - Financial planning: Vinso (1982), Eom et al. (1987–1988), Goedhart and Spronk (1995).
 - Venture capital: Siskos and Zopounidis (1987), Riquelme and Rickards (1992), Zopounidis (1994), Muzyka et al. (1996).

Most of these financial problems have been studied in the past using mainly multivariate statistical analysis techniques (factor analysis, discriminant analysis, logit and probit analyses, etc.). Although these techniques acknowledge the existence of multiple factors that affect financial decision making, they fail to comprise the decision makers' preferences, while often they fail to provide the support required (in some models the parameters do not have any physical or economic meaning). This fact led financial and operational researchers to the exploitation of the capabilities of alternative techniques. Among these alternative techniques, as the above list of studies indicates, MCDA has found several applications.

4. Concluding remarks

This paper has shown the contribution of the MCDA in financial decision making problems. In the past, the financial theory addressed all these problems in a very narrow framework, that of optimization. Some researchers took advantage of the optimal character of these problems in order to propose operational research techniques (i.e. classical or monocriteria modeling) for their solution.

Using as examples the investment decision problem and the problem of portfolio management, some basic arguments were discussed that could justify the necessity of considering financial decision making problems in a multidimensional context, using MCDA methods. Overall, the main

advantages that MCDA methods provide in financial management, could be summarized in the following aspects:

- *The possibility of structuring complex evaluation problems:* Problem structuring is one of the key issues in the application of MCDA methods. Thus, the use of such methods forces the financial managers to seek for a careful structuring of the examined financial problem, before proceeding to its solution.
- *The introduction of both quantitative (i.e. financial ratios) and qualitative criteria in the evaluation process:* The role of qualitative criteria in financial decision making is often vital. In fact, in some cases, the quantitative variables may be the result of some qualitative factors (e.g. the poor organization of a firm will affect its operating expenses and consequently its profitability ratios). However, the incorporation of qualitative criteria in the financial decision making process, through the classical optimization approach is difficult if not impossible. Instead, most MCDA methods do not make any distinction between quantitative and qualitative criteria, and they allow the incorporation of both types of criteria in the financial decision making process.
- *The transparency in the evaluation, allowing good argumentation in financial decisions:* MCDA methods are decision support oriented. They focus on the modeling of the decision maker's preferences, and they enable him/her to participate actively in the financial decision making process. In this way, through an iterative and interactive procedure, the decision maker gets familiar with the MCDA method used, as well as with the special features of the problem that he/she is facing. This direct intervention of the decision maker in the decision making process, provides him/her with all the necessary support that is required to argue upon the decisions taken.
- *The introduction of sophisticated and realistic scientific methods in the field of financial management:* Financial management except for its scientific interest, is also a field with significant practical interest. Actually, the methodologies and models that are developed should not only be scientifically sound and sophisticated, but

they should also be able to comprise the reality in order to be practically applicable. Of course MCDA methods are not the only sophisticated approach to study financial decision problems. Actually, several quite sophisticated optimization techniques have been proposed in financial decision making (Dahl et al., 1993a, b; Mulvey et al., 1997). However, such techniques are often based on specific assumptions that can hardly represent reality, while the weakening of these assumptions results in the development of complicated and computationally intensive models. On the other hand, MCDA methods combine successfully sophistication and realism, while in general, most of them are computationally tractable and easy to implement. Of course one could argue that sophistication and realism do not ensure effectiveness. Nevertheless, the results of several research studies applying MCDA methods in financial management show that these methods enhance the financial decision making process, while in many cases they are compared favorably to multivariate statistical analysis and optimization techniques.

In conclusion, MCDA methods seem to have a promising future in the field of financial management, because they offer a highly methodological and realistic framework to decision problems. Nevertheless, their success in practice depends heavily on the development of computerized multicriteria decision support systems. Financial institutions as well as firms acknowledge the multidimensional nature of financial decision problems (the results of the study by Bhaskar and McNamee (1983) that were discussed in Section 3.1, confirm this finding). Nevertheless, they often use optimization or statistical approaches to address their financial problems, since optimization and statistical software packages are easily available in relatively low cost, even though many of these software packages are not specifically designed for financial decision making problems. Consequently, the use of MCDA methods to support real time financial decision making, calls upon the development of integrated user-friendly multicriteria decision support systems that will be specifically designed to address financial problems. Examples of such systems are the FINEVA system

(Zopounidis et al., 1996), the FINCLAS system (Zopounidis and Doumpos, 1998), the BANK-ADVISER system (Mareschal and Brans, 1993), etc. The development and promotion of such systems is a key issue in the successful application of MCDA methods in finance.

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