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Evaluation of AHP software from a management accounting perspective

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Received 27 January 2011
Revised 1 June 2011
Accepted 24 August 2011

Abstract

Purpose – Due to the increasing complexity of decision environments, suitable multi-criteria methods are gaining importance for the decision support function in management accounting. The analytic hierarchy process (AHP), a well-known and established OR method for solving complex decision settings, is accompanied by the ongoing development of suitable software solutions. Especially for practical issues, software support can reduce barriers to applying AHP and can enhance acceptance by managers. For this reason, five heterogeneous software products are evaluated from a management accounting perspective. The paper aims to discuss these issues.

Design/methodology/approach – Based on the increasing relevance of AHP and the major changes in the field of AHP software solutions, the study of Ossadnik and Lange was replicated, with modifications. Five leading software products that use AHP were selected and evaluated with regard to their quality for solving decision problems. Pairwise comparisons were generated and integrated into an AHP-based decision model. The relevant criteria contained in this model were developed from the international standard norm for software evaluation.

Findings – In addition to revealing the necessity for further research on the development of appropriate software for multi-criteria decision problems, the result also shows that, under certain assumptions, "Make It Rational" is the preferred software product.

Practical implications – Originating from different demands, the evaluation reveals the strengths and weaknesses of various software solutions for practical purposes.

Originality/value – This study shows that characteristics of software products using AHP vary, enabling users to select an appropriate software solution.

Keywords Management accounting, Analytic hierarchy process, Decision support systems, Software evaluation

Paper type Research paper

1. Introduction

Suitable operations research (OR) methods are required to face the increasing complexity in today's practical decision environments that deal with multiple criteria. OR enables various sciences, including management science and its sub discipline management accounting, to achieve a quantitative basis with formalized models and useful solution processes. Suitable multi-criteria methods are becoming increasingly important for the decision support function in management accounting. Amongst others, the analytic hierarchy process (AHP) (Saaty, 1980, 2001) has become a well-known and established OR method for solving complex decision settings. Its design, and the discussion thereof, is accompanied by the ongoing development of suitable software solutions. For practical issues in particular, software support can reduce barriers for practitioners to applying AHP and can enhance acceptance by managers. Evaluations of the latest software products using AHP have yet to be published.

Journal of Modelling in Management
Vol. 8 No. 3, 2013
pp. 305-319

1746-5664
DOI 10.1108/JM2-01-2011-0007

Based on the increasing relevance of AHP and the major changes in the field of AHP software solutions, a former study by Ossadnik and Lange (1999) was replicated and modified. In the study, three software solutions using AHP were evaluated with regard to their quality for solving decision problems. Pairwise comparisons were therefore generated and integrated into an AHP-based decision model. In this study, the same method was used to evaluate five of the latest software products. The relevant criteria contained in this model were again derived from the international standard norm for software evaluation.

Section 2 deals with the special importance of decision support in management accounting. The framework of our study is then briefly described in Section 3, followed by an evaluation of AHP software, with criteria, assessments and results, in Section 4. In Section 5, the necessity for further research on the development of appropriate software for multi-criteria decision problems is highlighted, followed by the concluding Section 6.

2. Decision support in management accounting

Management accounting is an academic discipline that focuses on the support of planning, decision making and control by defining performance measures, providing relevant performance data and practicing continuous improvement by systematic performance management. The association for accountants and financial professionals in business (IMA) defines management accounting, moreover, as:

> [...] a profession that involves partnering in management decision making, devising planning and performance management systems, and providing expertise in financial reporting and control to assist management in the formulation and implementation of an organization's strategy (IMA, 2008).

As a consequence, a fundamental function of management accounting, apart from allocating costs and providing (financial) information for planning, control, performance measurement and continuous improvement, is to provide relevant information to help managers make better decisions (Drury, 2009). Compared to previous decades, considerable changes in the area of responsibility of a management accountant have to be identified. Contemporary management accountants act as strategists and internal consultants by putting forward strategies and recommendations to enable managers to make decisions (Anastas, 1997).

Originating from these definitions, it can be concluded that the provision of relevant information for management decisions to be taken is one of the fundamental tasks of management accounting. As an object of research, as well as a task for practitioners, decision support is one of the most important functions of management accounting.

Since OR provides a variety of multi-criteria decision making (MCDM) methods for evaluating alternatives in complex decision settings, Management Accounting can obtain a quantitative basis and achieve good practical solutions. In return OR has to develop new methods for solving newly structured problems emerging from surrounding disciplines.

Within the discipline of management accounting, OR is an essential methodical support. Particular mention should be given to the question of which problems can be solved by management accounting and which problems require application of OR methodology. We therefore intend to improve the implementation of OR methods in the environment of the tools available to management accounting. In an MCDM context, management accounting and OR share the multi-phase decision process at different positions (Figure 1). Management accounting helps managers to prepare their decision making and to realize these decisions, plus feed forward control. OR concentrates on the provision and theoretical basis of an appropriate MCDM method. Once a method has been selected, it can be implemented in the decision process by management accounting.

An evaluation of MCDM/MAUT literature by Wallenius *et al.* (2008) for the period from 1970 to 2007 reveals a steady growth in the number of publications in the MCDM/MAUT field since the early 1990s. Furthermore, the AHP was the most significant research object in the entire study, since it was dealt with in the majority of the publications. The use of AHP is widespread in several academic disciplines, as the analysis of the AHP literature shows (Vaidya and Kumar, 2006; Siphani and Timor, 2010).

Most decision problems dealt with by management accounting have a limited number of alternatives. We assume, therefore, that they correspond to a multiple attribute decision making (MADM) problem. The field of applying MADM methods depends on a variety of individual factors. If management is faced with the fundamental choice of setting up an engagement in a new industry, more qualitative factors, such as the infrastructure and the need for suitably qualified personnel, are crucial to the decision in addition to investment costs. These are causally relevant aspects of financial performance. Recognizing the causal relevance of non-monetarily dimensioned indicators for achieving monetarily dimensioned goals, the view of management accounting has changed. It now implies the integration of more than one non-monetary criterion in decision-making systems. Traditional decision making in management accounting was characterized by only one criterion, which was regularly monetarily dimensioned. Today, management accounting has to cope with complex control tasks by constructing means-end relations – using cause-effect relationships – to define programs of strategic action.

Against this background, AHP has become one of essential MADM methods used by academics in management accounting for educational purposes. AHP has therefore managed to become a common tool in management practice, e.g. for helping a company to implement balanced scorecards (Clinton *et al.*, 2002; Searcy, 2004; Pan, 2006; Jovanovic and Krivokapic, 2007). Particularly in strategic management accounting, AHP is a common approach for multi-criteria decision settings (Ossadnik, 1998; Cheng and Li, 2001; Naesens *et al.*, 2007; Tian *et al.*, 2009). Even though the AHP structure, with its hierarchy levels, would be appropriate to the intuitive way in which managers solve problems, there is a certain reluctance in the case of management accounting practitioners to use formalized procedures and quantitative modeling. In this situation, the availability of AHP software solutions is clearly advantageous

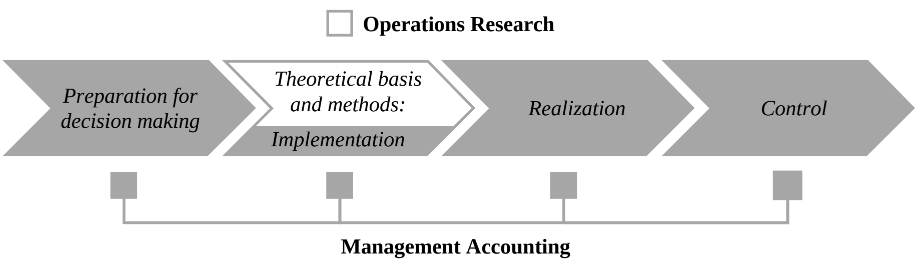

Figure 1. Multi-phase decision process

to practitioners (Cheng *et al.*, 2002). If they became more aware of the software support available, AHP would be more popular amongst them.

For management accounting, it would be preferable if problems suitable for applying AHP were supported by a standard software product. This leads us to consider the quality of alternative software products. After an introduction to the framework of the study, features of alternative software products will then be presented using a sample AHP application.

3. Framework

Our study was driven by the increasing importance of AHP in the field of management accounting. The first evaluation of AHP software was performed over a decade ago by Ossadnik and Lange (1999); the focus of this study is now on how these software products have developed. Back then, we evaluated the quality of three software solutions (*AutoMan*, *ECPro*, and *HIPRE 3 +*) using AHP to solve decision problems. The criteria for the constructed model were derived from the international standard norm "Information technology – Software product evaluation – quality characteristics and guidelines for their use" (ISO/IEC 9126, 1991). As a result of the subjective judgments and the assumed weights, ECPro turned out to be the preferred software, followed by *AutoMan* and *HIPRE 3 +* . Later on, the successor product of ECPro, Expert Choice, was analyzed and evaluated by Ishizaka and Labib (2009).

The current method of procedure is similar to that used in the evaluation of Ossadnik and Lange (1999). Our research procedure provides a three-step multi-criteria evaluation involving application of AHP.

In the first step, an overview of software solutions is generated. The sought-after software products have to support management decisions by applying AHP. After compiling a list, five of the currently available software solutions are selected.

To prepare for the next step, the international standard norm ISO/IEC 9126 is used to initially pre-check the five software solutions. Although this standard is still binding, it will be replaced by the new standard norm ISO/IEC 25000 in future years. In step two, we introduce the relevant criteria in a hierarchic evaluation model. The criteria of this model are again derived from the international standard norm for software evaluation ISO/IEC 9126 "Software engineering – Product quality" (ISO/IEC 9126, 2001). The hierarchical structure of the model – reflecting the real decision problem – which splits the overall goal (software selection) into various components, enables AHP to be applied.

The third and final step is to evaluate the five software solutions within this modified model using Saaty's AHP scale (Saaty, 1980, 2001) and to present the resulting ranking of the alternatives.

4. Evaluation of AHP software

4.1 Selection of AHP software

The following show the available software products that support the application of AHP.

Software with AHP application

Software products enabling application of AHP:

- AHP calculation software by CGI.
- Choice results.

- Decision lens.
- Easymind.
- Edufox/questfox.
- Expert choice (Version: 11.5).
- HIPRE 3 + .
- INPRE and ComPAIRS.
- Logical decisions (Version: 6.20.12).
- Make it rational.
- Right choice DSS (Version: 2.1.9.21).
- Super decisions (Version: 2.0.8).

For the evaluation, software solutions were used that are not only undergoing a permanent development process, but that are also affordable for the evaluation purpose. Under these premises, expert choice, logical decisions, make it rational, right choice DSS and super decisions were selected. Two restrictions, or rather particularities, apply with regard to this selection. Super decisions is not yet available for sale, but is considered to be a beta product, freeware for educators and researchers. Make it rational is available as a hosted edition (web application) and a server edition. The hosted edition was evaluated in this study.

4.2 Derivation of relevant criteria from ISO/IEC 9126-1 and model construction

General criteria have to be considered when evaluating software. The first part of the international standard norm ISO/IEC 9126 *Software engineering – Product quality – Part 1: Quality model* provides the foundation for our software evaluation. The scope of the international norm ISO/IEC 9126 is to provide starting conditions for the further individual refinement and description of the quality of software. It must be mentioned, however, that neither valid objective nor quantitative evaluation criteria exist.

In 2005, ISO/IEC 9126 was superseded by ISO/IEC 25000 *Software engineering: software product quality requirements and evaluation (SQuaRE): Guide to SQuaRE* Nevertheless, ISO/IEC 9126-1 is still obligatory since the relevant new sub-standards ISO/IEC 25010: "Quality model" and ISO/IEC 25020: "Measurement reference model and guide" are still under revision.

ISO/IEC 9126-1 classifies software quality in a structured set of suggested characteristics, as shown in Figure 2 (ISO/IEC 9126-1, 2001).

External and internal quality requirements form the overall objective of the model, which classifies the quality of software in a structured set of characteristics and sub-characteristics as follows. External quality requirements specify the required level of quality from the external point of view. They embody requirements derived from user quality needs, including quality in use requirements. External quality is the sum of software characteristics from an external perspective. Internal quality requirements, however, itemize the level of required quality from an internal viewpoint. Internal quality requirements are applied to specify features of interim products. Internal quality is the total of characteristics of software products from an internal point of view.

The functionality characteristic of the quality model is thereby defined as the "capability of the software product to provide functions which meet stated and implied

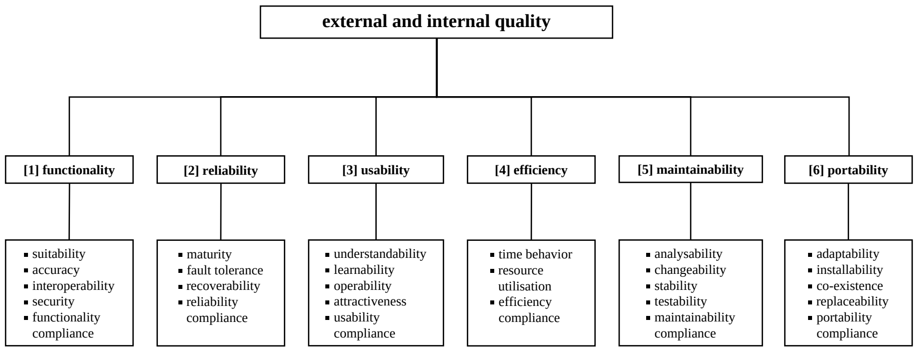

Figure 2.
Criteria for software quality

needs when the software is used under specified conditions." Reliability is the "capability of the software product to maintain a specified level of performance when used under specified conditions." Usability is the "capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions." Efficiency is the "capability of the software product to provide appropriate performance, relative to the amount of resources used, under stated conditions." Maintainability is described as the "capability of the software product to be modified. Modifications may include corrections, improvements or adaptation of the software to changes in environment, and in requirements and functional specifications", whereas portability is the "capability of the software product to be transferred from one environment to another." All suggested characteristics have to be individually specified to ensure the principle of preferential independence (Keeney and Raiffa, 1993).

When referring to the criteria of external and internal quality within the modified model introduced below, the focus of consideration is on the external quality from a user's point of view. The hierarchy based on ISO/IEC is very general from a management accounting perspective. Originating from this lack of concreteness, this standard norm is used only as a starting point to develop the management accounting criteria. The transitions in the derivation process are shown in Figure 3.

Having derived the criteria relevant to management accounting, an evaluation model with a hierarchical structure is created (Figure 4). Owing to the clear hierarchical structure of the model, the five AHP software solutions can be evaluated with AHP as the evaluation method. The efficiency criterion related to ISO/IEC – composed of time behavior, resource utilization and efficiency compliance – is not included in our hierarchy. We did not expect any measurable valuation differences for such "small" software products; instead, we expected all of the selected software products to be working efficiently for our purpose. Furthermore, a partial pretest of ISO/IEC efficiency also suggested that the criterion could be disregarded in our model, to avoid an unnecessarily high level of complexity.

The modified model consists fundamentally of two levels. Choice of a suitable AHP software is the overall goal, followed directly by the two control criteria, i.e. performance quality and costs. Within a sub-hierarchy each criterion is further divided into sub-criteria, as explained in the evaluation process. The five AHP software products make up the bottom of our hierarchy.

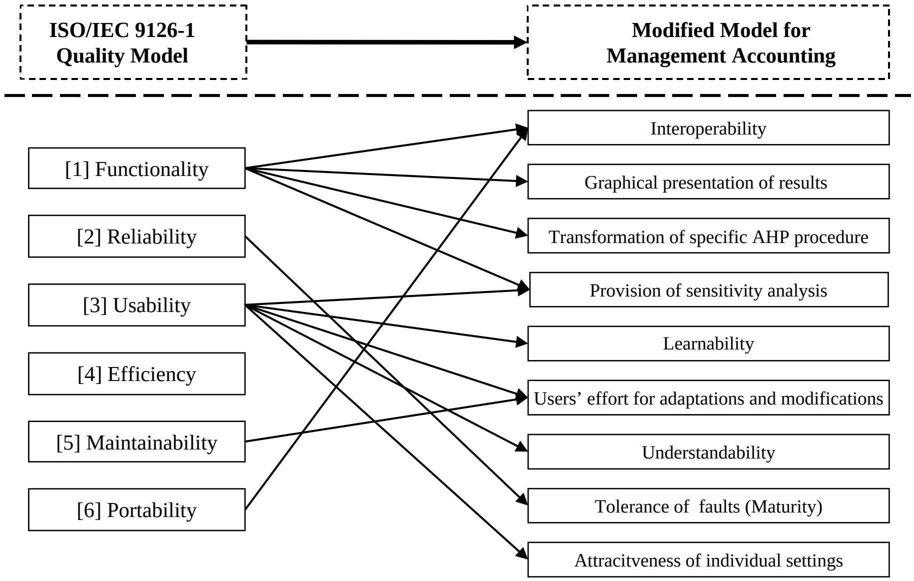

Figure 3.
Transitions in the derivation process

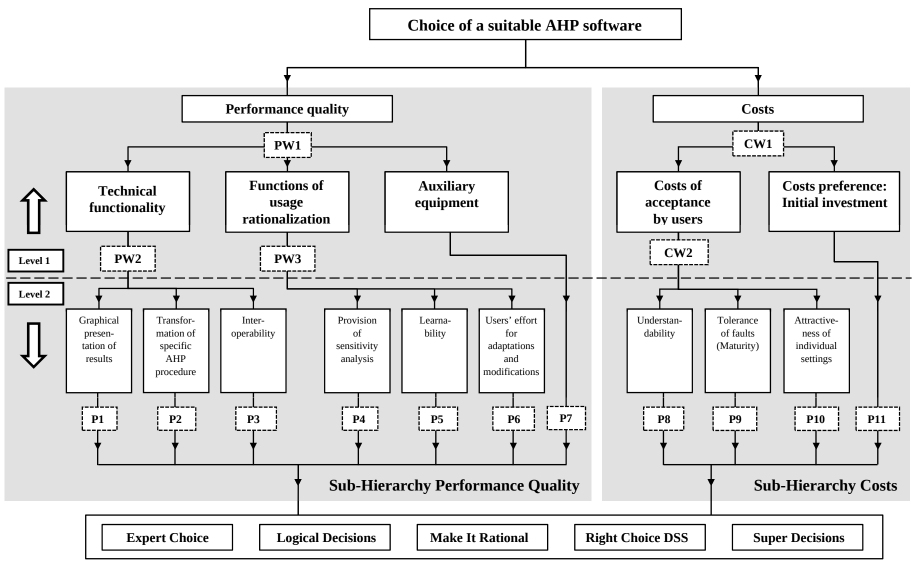

Figure 4.
Modified model for AHP software evaluation

At model level 1, weights PW1 to PW3 and CW1 to CW2 stand for the comparisons between the derived criteria located between the overall goal (choice of suitable AHP software) and the alternatives (the five software products). P1 to P11 on level 2 represent the pairwise comparisons of the alternatives with regard to the higher-level (covering) criteria.

4.3 Assessments and results

The following subsection deals with the assessment of the evaluation prior to presenting the results at the end. To evaluate the software products, we constructed a multi-criteria standard problem (purchase of a high-tech machine) to be handled by the different software products.

Regarding the judgments at level 1, the single matrices representing the judgments on Saaty's 1 "equal importance" to 9 "extreme importance" scale are listed below. In the tables, C.R. stands for consistency ratio. The higher the consistency ratio, the more inconsistent the pairwise judgments were. Theory suggests that if the consistency ratio for the matrix is not smaller than 0.1, the ratios should be adjusted to make them more consistent. In our evaluation, there was no need for additional adjustments.

The local priorities of the criteria are shown at the bottom of each table, providing evidence of their importance. The priorities in our study are derived by the principal eigenvalue method (Saaty, 1977, 1980). A comparative study for other methods for deriving priorities was undertaken by Ishizaka and Lusti (2006).

Since we performed the pairwise comparisons by the authors' mutual agreement, the local priorities can be considered to be the results of a "one-person" assessment (unipersonal decision making). There was therefore no need to aggregate the results with the support of a group decision rule, as would be the case in an evaluation situation with a multipersonal structure (Chwolka and Raith, 2001; Escobar and Moreno-Jiménez, 2007; Huang *et al.*, 2009).

The top goal – choice of a suitable AHP software – is divided into the two control criteria performance quality and costs. Costs and performance quality are evaluated equally important from our perspective according to a standard Benefit (B)-Costs (C)-approach. The inverting of the costs sub-hierarchy has already been performed within the judgments illustrated by the single matrices.

In our study, performance quality consists of technical functionality, functions of usage rationalization and auxiliary equipment (Table I). It was pointed out in the assessment that technical functionality was the most important aspect in the study, followed by functions of usage rationalization. Although it is always nice to have auxiliary equipment, it is much less relevant than the other criteria.

Technical functionality was subdivided into graphical presentation of results, transformation of the AHP procedure as well as interoperability (Table II). Since the AHP software was tested, the transformation of the procedure was the most important criterion within the comparison.

Table I.
Performance weighting 1: performance quality

	PW1: performance quality		
C.R. 0.024	Technical functionality	Functions of usage rationalization	Auxiliary equipment
Technical functionality	1	2	5
Functions of usage rationalization		1	4
Auxiliary equipment			1
Local priority	0.570	0.333	0.097

The criterion functions of usage rationalization was split into provision of sensitivity analysis, learnability and users' effort needed for modifications (Table III). Learnability was the most important criterion in the study.

The criterion costs is split into costs preference: initial investment and cost of acceptance by users (Table IV). The costs of acceptance by users are of moderate importance in the study, compared to the costs preference: initial investment.

The costs of acceptance by users consist of understandability, the tolerance of faults (maturity) as well as attractiveness of individual settings (Table V). Understandability is most important from a management accounting point of view.

Figure 5 shows the modified model in a vertical hierarchy. The weights for PW1, PW2, PW3, CW1 and CW2 have already been included.

Subsequently, the pairwise comparisons of the software alternatives at level 2 with regard to the higher level criteria are represented.

	PW2: technical functionality		
C.R. 0.069	Graphical presentation of results	Transformation of specific AHP procedure	Interoperability
Graphical presentation of results	1	1/5	4
Transformation of specific AHP procedure		1	9
Interoperability			1
Local priority	0.194	0.743	0.063

Table II.
Performance weighting 2: technical functionality

	PW3: functions of usage rationalization		
C.R. 0.052	Provision of sensitivity analysis	Learnability	Users' effort for adaptations and modifications
Provision of sensitivity analysis	1	1/6	1/4
Learnability		1	3
Users' effort for adaptations and modifications			1
Local priority	0.085	0.644	0.271

Table III.
Performance weighting 3: functions of usage rationalization

	CW1: costs	
C.R. 0.000	Costs of acceptance by users	Costs preference: initial investment
Costs of acceptance by users	1	3
Costs preference: initial investment		1
Local priority	0.750	0.250

Table IV.
Costs weighting 1: costs

Regarding the graphical presentation of results (P1), Expert Choice, Make It Rational and Right Choice have a greater scope. Make It Rational even offers an automatic report function.

All programs transform the AHP procedure (P2) successfully. Super decisions has a slight advantage because of its clearly arranged hierarchy view and more accuracy of rounding in the calculation, with up to six positions after the decimal point.

With respect to the interoperability (P3) criterion, make it rational has the most possibilities for exporting the results to other applications and, as an online application, is compatible with all operating systems. All other programs have only a few data export possibilities, which vary slightly. Expert choice has good import functions. With the exception of logical decisions, all software solutions are compatible with Windows 7.

Expert choice and super decisions, followed by right choice, provide the most comfortable possibilities for sensitivity analysis (P4).

Table V.
Costs weighting 2: costs of acceptance by users

	CW2: costs of acceptance by users		
C.R. = 0.042	Understandability	Tolerance of faults (maturity)	Attractiveness of individual settings
Understandability	1	3	8
Tolerance of faults (maturity)		1	5
Attractiveness of individual settings			1
Local priority	0.661	0.272	0.067

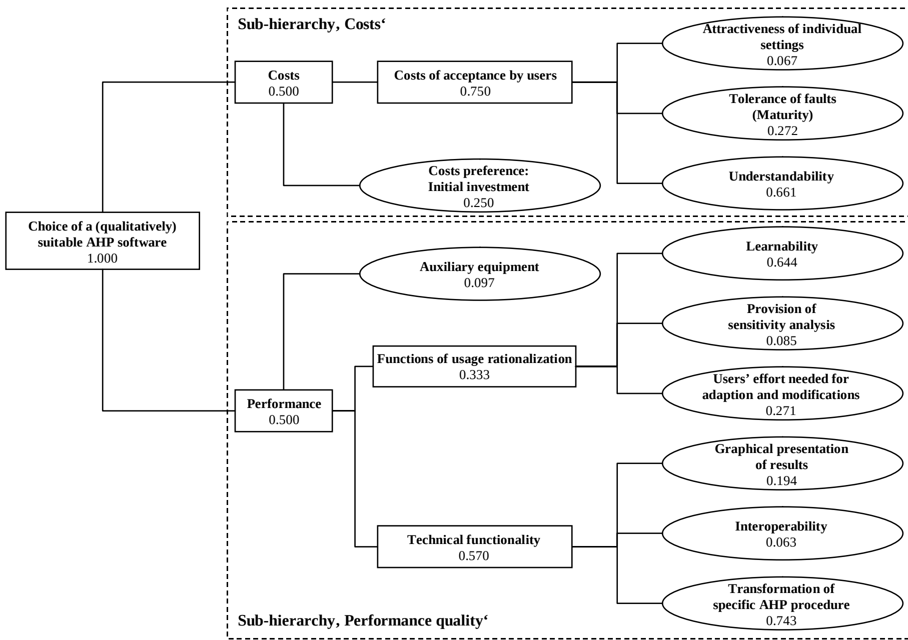

Figure 5.
Modified model with level 1 priorities

With regard to the criterion learnability (P5), make it rational and right choice have very intuitive handling. The programs can be operated after a very short initiation period. Above mentioned programs and expert choice have video tutorials. Right choice and super decisions are more complex and difficult to learn.

Adaptations and modifications (P6) of existing hierarchies, for example, are possible with all programs. From our point of view, they were easier to achieve with expert choice and right choice.

Regarding the auxiliary equipment (P7), such as help functions, tutorials and support, expert choice and super decisions were the leading software products.

As for understandability (P8), make it rational and right choice have very intuitive handling; expert choice is also easy to use, but it is sometimes not clear how to take the next step. Super decisions and logical decisions are more complex systems and are therefore not easy to handle. Commands were sometimes slightly difficult to locate in logical decisions application.

Tolerance of faults (maturity) (P9) – All programs were robust and able to intercept errors; in right choice, errors sometimes occurred, the causes of which were not apparent. Super decisions intercepts errors with one standard phrase, which makes it difficult to analyze the error.

With respect to the software products' attractiveness of individual settings (P10), make it rational and right choice appear to be very user-friendly because they are easy to learn and to handle. The software interface is appealing. The interface of expert choice is clearly arranged, too, but not as attractive as in the case of make it rational and right choice. Logical decisions does not appear to be very attractive because of its various settings (complexity).

To gain local priorities for the criterion costs preference: initial investment (P11) we used a two-level approach. At the higher level, we performed a general assessment of the preference between the sub-criteria software products "without initial costs" and software products "with initial costs". This induces preferential weights of 0.6 for software alternatives "without initial costs" and 0.4 for software alternatives "with" such costs. Among the software alternatives "with initial costs" (expert choice, logical decisions, make it rational and right choice) the price of each software product was then transferred to the AHP scale to determine the priorities (lower level). Super decisions – as an alternative being freeware (for educators and researchers) and thus not homogeneous to the alternatives "with initial costs" - was disregarded on that scale. In a second step we multiplied the priorities of the software products "with costs" with their higher-level factor. Due to that procedure, super decisions was the preferred product concerning the two-tier criterion costs preference: initial investment. Contrary to the other software products, the make it rational full version is a time license; for our evaluation purpose the costs of usage have been calculated for five years.

Rank reversals did not occur while confronting the evaluation results of all possible (incomplete) sets of four software alternatives at the lowest criteria level with the evaluation results of the complete set of five software alternatives.

Due to the highly subjective judgments, make it rational was found to be the preferred software alternative for management accounting purposes, followed by super decisions and right choice. The differences between programs are noticeable, but not extreme (Figure 6).

P1: Graphical presentation of results

C.R. = 0.000	EC 11.5	LD 6.20	M I R	RC DSS 2.1	SD 2.0.8
EC 11.5	1	3	1	1	3
LD 6.20		1	1/3	1/3	1
M I R			1	1	3
RC DSS 2.1				1	3
SD 2.0.8					1
Local priority	0.273	0.091	0.273	0.273	0.091

P2: Transformation of specific AHP procedure

C.R. = 0.000	EC 11.5	LD 6.20	M I R	RC DSS 2.1	SD 2.0.8
EC 11.5	1	1	1	1	1/2
LD 6.20		1	1	1	1/2
M I R			1	1	1/2
RC DSS 2.1				1	1/2
SD 2.0.8					1
Local priority	0.167	0.167	0.167	0.167	0.333

P3: Interoperability

C.R. = 0.030	EC 11.5	LD 6.20	M I R	RC DSS 2.1	SD 2.0.8
EC 11.5	1	2	1/2	2	2
LD 6.20		1	1/5	1/3	1/2
M I R			1	3	3
RC DSS 2.1				7	2
SD 2.0.8					1
Local priority	0.226	0.075	0.410	0.172	0.117

P4: Provision of sensitivity analysis

C.R. = 0.002	EC 11.5	LD 6.20	M I R	RC DSS 2.1	SD 2.0.8
EC 11.5	1	7	7	3	1
LD 6.20		1	1	1/3	1/7
M I R			1	1/3	1/7
RC DSS 2.1				1	1/3
SD 2.0.8					1
Local priority	0.379	0.051	0.051	0.140	0.379

P5: Learnability

C.R. = 0.062	EC 11.5	LD 6.20	M I R	RC DSS 2.1	SD 2.0.8
EC 11.5	1	4	1/3	1/3	3
LD 6.20		1	1/5	1/4	1
M I R			1	3	4
RC DSS 2.1				1	3
SD 2.0.8					1
Local priority	0.165	0.063	0.440	0.260	0.073

P6: Users' effort for adaptations and modifications

C.R. = 0.000	EC 11.5	LD 6.20	M I R	RC DSS 2.1	SD 2.0.8
EC 11.5	1	2	2	1	2
LD 6.20		1	1	1/2	1
M I R			1	1/2	1
RC DSS 2.1				1	2
SD 2.0.8					1
Local priority	0.286	0.143	0.143	0.286	0.143

P7: Auxiliary equipment

C.R. = 0.024	EC 11.5	LD 6.20	M I R	RC DSS 2.1	SD 2.0.8
EC 11.5	1	4	3	3	1
LD 6.20		1	1/3	1/3	1/4
M I R			1	1	1/3
RC DSS 2.1				1	1/3
SD 2.0.8					1
Local priority	0.336	0.062	0.133	0.133	0.336

P8: Understandability

C.R. = 0.038	EC 11.5	LD 6.20	M I R	RC DSS 2.1	SD 2.0.8
EC 11.5	1	4	1/3	1/3	3
LD 6.20		1	1/5	1/5	1/2
M I R			1	1	3
RC DSS 2.1				1	3
SD 2.0.8					1
Local priority	0.174	0.054	0.339	0.339	0.094

P9: Tolerance of faults (Maturity)

C.R. = 0.013	EC 11.5	LD 6.20	M I R	RC DSS 2.1	SD 2.0.8
EC 11.5	1	1	1	2	2
LD 6.20		1	1	2	2
M I R			1	2	2
RC DSS 2.1				1	1/2
SD 2.0.8					1
Local priority	0.248	0.248	0.248	0.110	0.146

P10: Attractiveness of individual settings

C.R. = 0.063	EC 11.5	LD 6.20	M I R	RC DSS 2.1	SD 2.0.8
EC 11.5	1	4	1/3	1/3	3
LD 6.20		1	1/4	1/4	1/3
M I R			1	1	3
RC DSS 2.1				1	3
SD 2.0.8					1
Local priority	0.179	0.057	0.329	0.329	0.105

P11: Costs preference: Initial investment

	EC 11.5	LD 6.20	M I R	RC DSS 2.1	SD 2.0.8
Local priority	0.016	0.104	0.153	0.127	0.600

Figure 6.
Single matrices of the pairwise comparisons of software alternatives P1 to P11

Notes: EC = Expert Choice; LD = Logical Decisions; MIR = Make It Rational; RC DSS = Right Choice; SD = Super Decisions; C.R. = Consistency Ratio

The dark gray bars in Figure 7 show the contribution of the cost criteria to the global priorities; the light gray bars stand for the performance criteria. If only the performance part of the model were considered, expert choice would be higher in the ranking.

Uncertainties in judgments were reduced by sensitivity analyses. Regarding the advantages of each product, expert choice is competitive due to its graphical presentations of results and the possibilities it offers for sensitivity analysis.

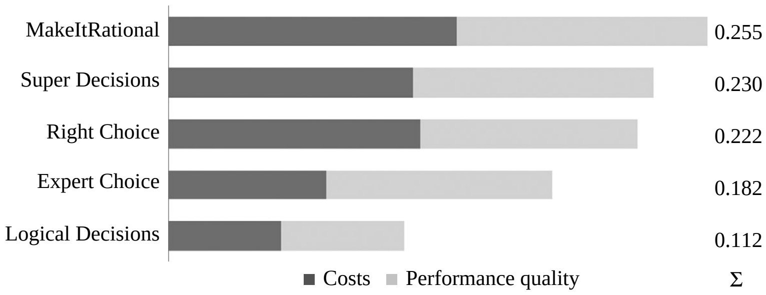

Figure 7.
Evaluation results

In spite of the complexity of logical decisions' and super decisions, they offer more possibilities that go beyond the pure AHP application.

Make it rational and right choice are convincing due to their very intuitive handling and surface attractiveness.

5. Areas for further research

For Management Accounting purposes, AHP software needs an improvement in the case of data export and import functions, followed by an improvement of graphical presentation of AHP analysis results. Furthermore, the modeling of group decisions will become more important in fields such as performance management where, for instance, strategic success factors relating to a company's strategy have to be selected by interdisciplinary teams.

Because of AHP's requirement for independence among criteria which cannot be always met, there is a need for software solutions that support the analytic network process (ANP). Application of ANP would make considering dependencies among criteria easier. Furthermore, it is not always possible to structure decision problems in a hierarchical manner. To date, super decisions is the only software product which enables the ANP to be applied.

6. Conclusion

AHP is relevant for solving management accountants' strategic decision problems. On the other hand, this OR method faces typical resistance by practitioners in the case of formulation and quantifying analysis models. An adequate decision support software was therefore considered as a possibility to boost the acceptance of AHP in practice. For this reason, five alternative software products were evaluated. On account of the vagueness of the international standard norm, we constructed specific criteria for quality evaluation from the management accountant perspective. Results of our evaluation reveal that the software make it rational seems to be the preferred product.

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