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MULTI-CRITERIA DECISION-MAKING METHODS FOR COMPLEX MANAGEMENT PROBLEMS: A CASE OF BENCHMARKING

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ABSTRACT

Because multi-criteria decision-making methods have already turned out to be applicable in business practice, they are given special attention among several approaches that help decision makers solve complex problems. The author offers a critical overview of these methods, together with an evaluation of adequate computer programs. Moreover, the multi-criteria method for benchmarking of environmentally oriented business processes is developed and presented with a real-life case from the Slovene enterprise in the processing industry. The approach is delineated into steps. In this method, the analytic hierarchy process technique is used; together with other decision-making tools, it is suitable for benchmarking in order to help in decision-making about business process reengineering and selection of new production processes.

KEYWORDS: decision, decision – making methods, management, benchmarking

JEL classifications: D81, M13

THE CRITICAL QUESTIONS ADDRESSED, RESEARCH AIMS AND METHODOLOGY

Effective decision-making in a world of growing complexity requires us to apply systems/systemic/holistic thinking (to diverse this type of thinking vs. un-systemic/traditional thinking see [15]). Systems thinking, management science with the emphasis on decision-making analysis (quantitative and qualitative methods), the modern trade theory, the theory of the firm, computer science, and management concepts (like environmental management, knowledge management) give broader theoretical foundations for practical business applications in the fields like business process re-engineering, product (and service) design and development, strategic planning, project management, risk assessment, marketing planning and strategies, total quality management, resource allocation, vendor selection, human resource management, and others.

Among several approaches to solving complex management problems, the emphasis in this article is given on the *multi-criteria decision-making methods* since they enable a complex, integrated and logical framework that allows for interaction and interdependence among factors, structured hierarchically or like a network to deal with dependence and feedback. Moreover, they enable consideration of all dimensions of the so-called sustainable performance: economic, environmental, ethical and social dimension. Put into groups, they are introduced and discussed considering their basic advantages and disadvantages, convenience in problem solving, applicability for different types of problems, the types of the obtained results (to avoid over-simplifications and over-complications), and even the participants' knowledge and preparedness for group working. We also introduce our experience in some software products' applicability.

In the multi-criteria decision-making method that is given special attention in this article, we consider not only ecologically most acceptable manufacturing, but also other criteria that are relevant to the goal - benchmarking of environmentally oriented business processes. The purpose of our research work is to develop and apply a tool for benchmarking of environmentally oriented business processes in order to achieve business process excellence. Since improvements of business processes are important not only for multinationals because of global competition and quality awards, but are necessary also for survival of small and medium sized enterprises, the objectives of this article are to analyze and evaluate environmentally oriented business processes in an enterprise, to identify their weaknesses, to suggest improvement measures and to develop a method in order to help in decision-making about business process re-engineering and selection of new production processes. The following methodology has been adopted in order to accomplish the stated objectives of the research: reviewing literatures, studying the possibilities of the business processes performance in the sample enterprise, reviewing various reports of these business processes, interviewing managers and experts in the sample enterprise and preparing a questionnaire survey on environmentally oriented business decision-making, performed in the Slovene processing industry. In this research, the Analytic Hierarchy Process (AHP) technique (see [10]) is used to determine the critical success factors, to build the hierarchical model for benchmarking, to establish the importance of some critical success factors, to obtain the final values of environmentally oriented business processes and to analyze the sensitivity of these results.

In a real-life case where this method is used for benchmarking of environmentally oriented business processes, special attention is given to the criteria (critical success factors) determination, the assessment of their importance and to the alternatives' (business processes') data: we consider preferences and survey findings on the environmental impact of business processes in the sample enterprise, survey findings on environmental management in the Slovene processing industry [5], and eco-balances [1].

The applicability of the presented method for benchmarking of business processes is discussed. Some possibilities of future researching are introduced as well.

MULTI-CRITERIA DECISION-MAKING METHODS AND APPROPRIATE SOFTWARE

A group of decision analysis that is distinguished by applicability in several social fields, characterized by different levels of the problems that are to be identified, structured and solved (personal, business, economic: micro and macro, political, technical, environmental, ethical, etc.) is described as multiple criteria decision analysis. Multi-criteria decision-making (also called multiple objective problems) describes the set of approaches where more (than one) criteria are taken into consideration. These approaches can help individuals or groups in researching important complex decision-making problems. They should be used when intuitive decision-making is not enough for several reasons: because of the conflicts among criteria or because of disagreement among decision makers about relevant criteria or their importance and about acceptable alternatives and preferences. Conflicts can appear in individual and group business decision-making, too.

Let us emphasize the main characteristics that distinguish single- from multi-criteria decision-making. The main goal of single-objective decision-making (and optimization) is to find the "best" solution, which corresponds to the minimum or maximum value of a single objective function. Single-objective approaches put the decision-making burden on analysts; namely, decision makers must express preferences beforehand and then one optimization solution is obtained for one optimization model. Considering Savić [20], the responsibility for decisions is much easier placed on analysts by using single-objective approaches, especially when the role of supporting decisions and decision-making is misunderstood. However, multi-objective approaches allow for the responsibility of defining problem (goal, criteria and alternatives), its structuring, assigning the criteria's importance and expressing the preferences to alternatives, and even verifying the sensitivity of their judgements to be placed on decision maker.

Although single-objective optimization identifies a single optimal alternative, it can be used within multi-objective framework, e.g. so that in the simulations obtained optimal values are included**.**

The results of the multi-criteria decision-making should not be understood as the final ("right") answers in the problem solving process. Multi-criteria analysis can not be justified within the optimization paradigm frequently adopted in traditional OR/MS (see [2]). The appropriate ("objective") analyses can not relieve decision makers of the responsibility of making difficult judgements. It is an aid to decision-making which seeks to integrate objective measurement with value judgement and to manage subjectivity. The last one is evident particularly in the choice of criteria and in determining of their weights. In this work we introduce some of the methods of multi-criteria decision analysis (MCDA) because they have already turned out to be applicable in business practice. To their applicability in solving complex problems contribute the following facts:

- The MCDA methods do not replace intuitive judgement or experience and they do not oppress creative thinking; their role is to complement intuition, and to verify ideas and support problem solving.
- In multi-criteria decision-making we take into account multiple, more or less conflicting criteria, in order to aid decision-making.
- In this type of decision-making process we structure the problem.
- Users can compare different methods and assess their convenience in problem solving. The most useful approaches are conceptually simple, transparent and computer supported.
- The aim of multi-criteria decision making is to help decision makers learn about the problem, express their judgements about the criteria importance and preferences to alternatives, confront the judgements of other participants, understand the final alternatives' values and use them in the problem solving activities.

The process of multi-criteria decision making can be realized from identification of a problem, through problem structuring – model building, expressing judgements, to the creation and analysis of activities that can solve a problem.

In some environments decision makers are not able to co-operate in group decision-making, they do not want to search for compromise solutions, they are not prepared to express their judgements consistently, or they need ad hoc solution. In such cases, they are recommended to express their preferences beforehand. The multiple conflicting goals can be included in the models for goal programming. In the available literature, this technique is included in multi-criteria decision-making because it has been developed to handle multiple criteria situations within the general framework of linear programming whereby the objective function is designed to minimize the deviations from goals (for an application see [4]). Goal programming seeks allowable decisions that come as close as possible to achieving specified goals. However, these models should be understood more as a tool in searching for optimum than as a tool in searching for the most preferred solution with respect to different criteria.

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One of the most widely applied sets of multi-criteria methods is multi-attribute value (or utility) theory (MAVT or MAUT) (for a detailed description see [2]). From the late 1960's of the last century this set of methods has been developing by not only management scientists, mathematicians, psychologists, but also the practitioners in management, economic, environmental and public fields. The need to include different scientific, professional fields in the development of these methods results from the need to manage the complexity. It has been improved to SMART (a simplified multi-attribute rating approach) and other approaches (for example SWING, SMARTER). One decade later developed the Analytic Hierarchy Process (AHP) method (see [16], [17], [18]) excels by widely applicability, too, and is distinguished by the scales used, the methods used to express the judgements about the criteria importance and preferences to alternatives, and the manner of transforming these judgements into numerical values. The holistic approach (as the opposite of a linear and piecemeal approach) used in this method in which all criteria of the problem are structured in advance in a multilevel hierarchy is completed with the interaction and dependence of higher-level elements on lower-level elements in the form of feedback structure that looks like a network – the Analytic Network Process (ANP) is the generalization of the AHP to dependence and feedback [19].

The use of the discussed methods would lead to over-complications when decision makers do not need so detailed results as they are obtained with these methods. Namely, some decision problems do not require the alternatives' ranking with respect to their final values; often it is good enough to find out which of them is the most preferred. Therefore, the so-called "outranking" approaches that focus on pair-wise comparisons of alternatives, and are thus generally applied to discrete choice problems, have been developed since 1970's of the last century. The most widely applied are ELECTRE in more variants and PROMETHEE (for details see [21]). Further, interactive methods as another set of multi-criteria approaches emphasize dialogues with the decision-maker who reacts to the first solution provided by the first computation step by giving extra information about his/her preferences. The dialog must be one of the principal investigation tools. These methods are especially applicable when a complete preference model is not constructed a priori and when alternatives need improvements (for details see [21]).

Software products for multi-criteria decision making that have been paid much attention among experts in different practical business fields (because of user capabilities, availability of graphical elicitation techniques, the possibility to transform subjective judgements into objective measures) are as follows:

- HIPRE 3+ and its web-version Web-HIPRE [11]. According to our experience it is especially applicable for the methods based on ordinal and interval scale: SMARTER, SMART, SWING, and for the measurement of alternatives' values with respect to each attribute by value functions, although it supports also the AHP method in the sense of pair-wise comparisons, and the direct measurement of alternatives' values;
- Expert Choice [9]. According to our experience it is especially applicable for the AHP method that is based on a ratio scale, although it supports the measurement of alternatives' values with respect to each attribute by value functions and direct method;
- Logical Decisions for Windows [14]. According to our experience it is especially applicable for problems where the alternatives' describing is of special value; utility functions do the conversion different levels on each measure into common units; further, AHP or Adjusted AHP can also be used for this purpose; weights can be

assessed with Tradeoffs, by direct entry, the SMARTER and the SMART method, weight ratios and the AHP;

- Super Decisions -- the software for decision-making with dependence and feedback -- is the software that goes beyond Expert Choice (as well as the Analytic Network Process goes beyond the Analytic Hierarchy Process), by dealing with the outcome of influences.

BENCHMARKING OF BUSINESS PROCESSES

Improvements of business processes can be facilitated by benchmarking which concentrates on the importance of business processes. Numerous definitions of the concept benchmarking can be found in the literature (see [3], [7], [13]). In terms of object of study, benchmarking can be classified as follows:

- process benchmarking: used to compare operations, work practices and business processes,
- product benchmarking: used to compare products or services,
- strategic benchmarking: used to compare organizational structures, management practices and business strategies. It posses some similarities to process benchmarking (see [3]).

Benchmarking can be defined as a process of continuously measuring and comparing a business processes against other business processes in order to achieve business process excellence. Following Finnigan [8], process benchmarks are used to plan for business process improvement. In the available literature it is reported that the role of benchmarking in business process re-engineering and selection of new production processes is increasing. Since global competition is rising with more and more national economies becoming liberalized and globalized, it is an imperative that a technique like benchmarking, that is recognized as a catalyst for improvement and innovation, should find a place with manufacturers to reach a level of world-class status. Dey [7] concluded that benchmarking has become one of the most popular business management tools. Liang [13] concluded that benchmarking has gained increasing acceptance as a technique that enhances business process re-engineering efforts within organizations, e.g. in product introduction process, in an electronics company and in the cosmetics industry.

The activity of benchmarking can be decomposed into several steps (see [3], [7]). The approach used in this study involves the following steps: define the business process's critical success factors, identify the business processes to be included in the analyses, analyze the business process performance and its sensitivity in order to determine strengths and weaknesses, and set performance goals for improvements.

In benchmarking of the environmentally oriented business processes it is important that we consider not only ecologically most acceptable manufacturing, but also other, different and conflicting criteria that are relevant to this complex goal. Saaty (see [16], [17], [18]) developed a practical systematic approach for dealing with complexity: the analytic hierarchy process is a methodology for structuring complexity, measurement on a ratio scale and synthesis [10]. Broad areas in which the AHP has been successfully employed include selection of one alternative from many, prioritization/evaluation, resource allocation, forecasting, public policy, total quality management, strategic planning, etc. (see [6]). Further, this method has already been applied for benchmarking. For example, AHP has previously been used for benchmarking logistic operations by Korpela and Tuominen [12],

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for benchmarking project management practices by Dey [7] and for the benchmarking of project evaluation by Liang [13].

A PRACTICAL CASE

In this article we present the method for benchmarking of environmentally oriented business processes with a practical case from the Slovene enterprise Termoplast Bistrica ob Dravi. In this enterprise, packaging for diary products is produced. The materials used are polypropylene (PP) which is generally considered environmentally more friendly, and polystyrene (PS) which is generally considered environmentally less friendly (see [1]). Special attention is given to the critical success factors - criteria that are selected according to the particularities of these practical business processes. We briefly describe different business processes - alternatives. The criteria weights were calculated according to the results of the research on environmentally oriented business decision-making that we performed in 79 enterprises of the Slovene processing industry during November and December 2001 (Research 1) [5]. The alternatives' input data were obtained by considering the managers' and experts' judgements on the impact of the business process with polypropylene and polystyrene materials on the environment that we performed in the enterprise Termoplast in 2002 (Research 2).

Step 1. Define the business process's critical success factors

Besides quantitative business results (the contribution and eventual progressive fixed costs, the consumed quantities of machine capacities, the consumed quantities of PP and PS materials and the cost of the waste disposal), other criteria that are relevant to the goal – benchmarking of environmentally oriented business processes – were determined by considering the results of Research 2. Making verbal judgements by using the intensities that are actually used in the AHP (1 – equal, 2 – from equal to moderate, 3 – moderate, 4 – from moderate to strong, 5 – strong, 6 – from strong to very strong, 7 – very strong, 8 – from very strong to extreme, 9 – extreme), top managers and experts from different enterprise business fields assessed and compared the importance of the impacts of business processes with PP and PS materials on the environment: air, water, waste on land, health, safety and working conditions, solid wastes, packing, transport, collecting and recycling of the post-customer waste after the product is used, the impact on the material and energy efficiency, the impact on the firm's goodwill as well as new market opportunities. The factors on which the impacts of the business processes with PP and PS materials were not assessed as equal (with numerical representation: not equal to 1) are considered as relevant to the goal and define the criteria – critical success factors. They are written in Figure 1.

Step 2. Identify the business processes to be included in the analyses

The following business processes were benchmarked:

- Business process 1 is the initial business process. Different possibilities of integrated environmental protection are included in particular parts of this business process. For example, all of the useless waste is disposed of, whereas all of the useful waste is processed, sold or disposed of.

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- Business process 2 includes some additional possibilities for an integrated approach to environmental management. Environmental degradation is decreasing with waste recycling that is part of the production process. Eco-balances show that - taken together - the effect of the substitution of PS products with PP ones on the environment is favorable [1]. Business process 2 includes also market research for environmentally friendly materials and products, the substitution of PP and PS materials, the minimum quantity of the environmentally friendly PP material that has to be purchased if they want to purchase PS material in the future, and the changes being made to existing PS products.
- Business process 3 is – in comparison with Business process 2 - completed by investment into the capacities for PP final products' production and therefore by the substitution of production processes.
- Business process 4 includes investment into the capacities for PS final products' production.

The hierarchical model for this problem is structured in Figure 1.

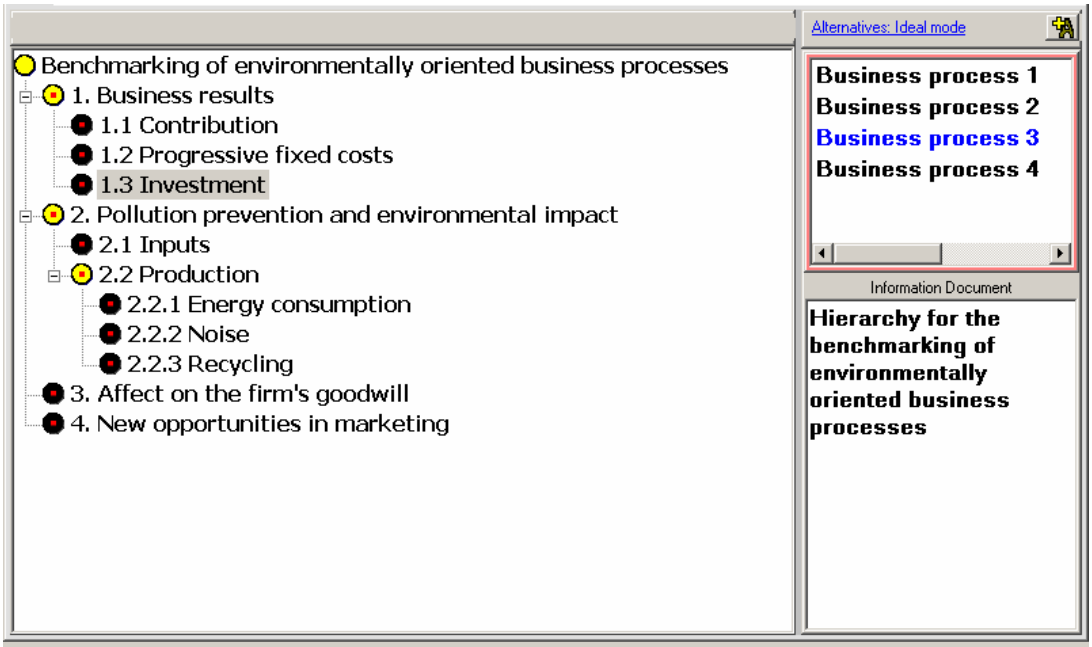

Figure 1 The problems' structure

Step 3. Analyze the business process performance and its sensitivity in order to determine strengths and weaknesses

By deriving weights and collecting data, analysts and decision makers form the information basis for the business processes' analysis. 'Business results', 'Pollution prevention and environmental impact', 'Affect on the firm's goodwill' and 'New opportunities in marketing' are defined as general criteria. We determined the importance of these criteria with respect to goal by considering the research results on the causes for environmental activities in the enterprises of the processing industry (Research 1) [5]. Further, emphasizing current business decision-making, the enterprise's financial experts assessed the importance of the secondary sub-criteria ‘Contribution’, ‘Progressive fixed costs’ and ‘Investment’ with respect to the criterion ‘Business results’ by graphical assessment. Transformed into verbal /numerical/ assessment, the judgements on importance are as follows: ‘Contribution’ is strongly more important /5/ than ‘Progressive fixed costs’, ‘Contribution’ is extremely more iportant /9/ than ‘Investment’, and ‘Progressive fixed costs’ are slightly to moderately more important /1.7/ than ‘Investment’. The importance of the secondary sub-criteria ‘Inputs’ and ‘Production’ with respect to the general criterion ‘Pollution prevention and environmental impact’ was determined by considering the research results on the importance of environmental management in business functions in the sample enterprises in the processing industry (Research 1) [5]. Considering the Research 1 results on environmental assessment fields [5], the importance of the tertiary sub-criteria ‘Energy consumption’, ‘Noise’ and ‘Recycling’ with respect to the secondary sub-criterion ‘Production’ was determined.

The data about the criterion ‘Contribution’ were entered as values for each business process with Expert Choice [9]. The progressive fixed costs were classified in 7 classes and investments were classified in 5 classes and assigned scores by the enterprise’s financial experts. To obtain the data about the sub-criterion ‘Inputs’, the quantity of the consumed PP and PS materials in each business process, and eco-balances of the second generation were taken into consideration by following the eco-points for PP and PS (for more details about eco-points see [1]). The data about the sub-criterion ‘Energy consumption’ were obtained by following the consumed capacities of the machines in each business process, and the energy consumption per unit of the machines whose capacities were consumed. The data about the sub-criterion ‘Noise’ were obtained by following the consumed capacities of the machines in each business process, and the noisiness of the machines whose capacities were consumed. The data about the sub-criterion ‘Recycling’ were expressed with the within company recycling efficiency in each business process. This indicator was obtained as a ratio between the cost of the waste disposal and the contribution. When assessing the affect on the firm’s goodwill with respect to environmental burden in Research 2, managers and environmental experts in Termoplast expressed that the business process with PP is moderately more preferred /3/ than the business process with PS materials. The weight of the production with PP materials is therefore 0.75, and the weight of the production with PS materials is 0.25. For each business process, we summarized the products between the proportion of the production with PP materials with the corresponding weight, and the proportion of the production with PS materials with the corresponding weight. In this way, we obtained the data about the criterion ‘Affect on the firm’s goodwill’. Further, when assessing new opportunities in marketing with respect to environmental burden in Research 2, managers and environmental experts expressed that the business process with PP is moderately to strongly more preferred /4/ than the business process with PS materials. The weight of the production with PP materials is therefore 0.80, and the weight of the production with PS materials is 0.20. For each business process, we summarized the products between the proportion of the production with PP materials with the corresponding weight, and the proportion of the production with PS materials with the corresponding weight. Thus we obtained the data about the criterion ‘New opportunities in marketing’.

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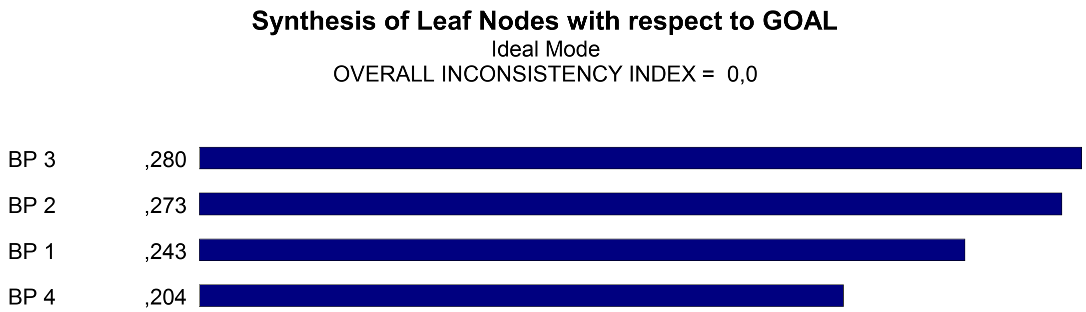

Figure 2 Final values of environmentally oriented business processes

Synthesizing this multi-criteria decision-making problem with Expert choice (see Figure 2) it can be concluded that Business process 3 (where not only the possibilities of integrated environmental protection and improvement are included, but also investment into the capacities for PP final products' production and the substitution of production processes are realized) is the alternative with the highest final value (global priority) among environmentally oriented business processes. It is followed by Business process 2 with the possibilities of integrated environmental protection and improvement, the initial Business process 1, and Business process 4 where investment in the production with PS materials that are generally considered environmentally less friendly is realized.

Table 1 shows the local values of business processes with respect to the criteria on the lowest level, obtained by the ideal mode of the detailed synthesis. Studying them, the critical success factors which demand actions for improvements in the initial Business process 1 can be found. Business process 1 has the lowest local values with respect to 'Recycling' (whereas Business process 3 with the highest global value has the highest local value with respect to this criterion) and with respect to 'Contribution' (whereas Business process 4 with the lowest global value has the highest local value with respect to this criterion). On the contrary, Business process 1 has the highest local values with respect to 'Energy consumption', 'Noise', 'Inputs', 'Progressive fixed costs' and 'Investment' (with respect to each of these criteria, Business process 3 with the highest global value has the third local values and Business process 4 with the lowest global value has the lowest local values, too). With respect to 'Affect on the firm's goodwill' and 'New opportunities in marketing', Business process 1 has the third local values (whereas Business process 3 has the highest local value in both cases).

Decision makers can study the impact of changes in the criteria weights on the evaluation of business processes with different types of sensitivity analysis. For example, performance sensitivity graph in Figure 3 shows that Business process 1 has the highest overall value with respect to 'Production', where it has the highest local values with respect to 'Energy consumption' and 'Noise'; however, Business process 1 has the lowest local value and Business process 3 has the highest local value with respect to 'Recycling'. By dynamic sensitivity analysis it can be found out that the weight of 'Recycling' should be more than 0.615 to obtain the highest overall value of Business process 3 with respect to 'Production'.

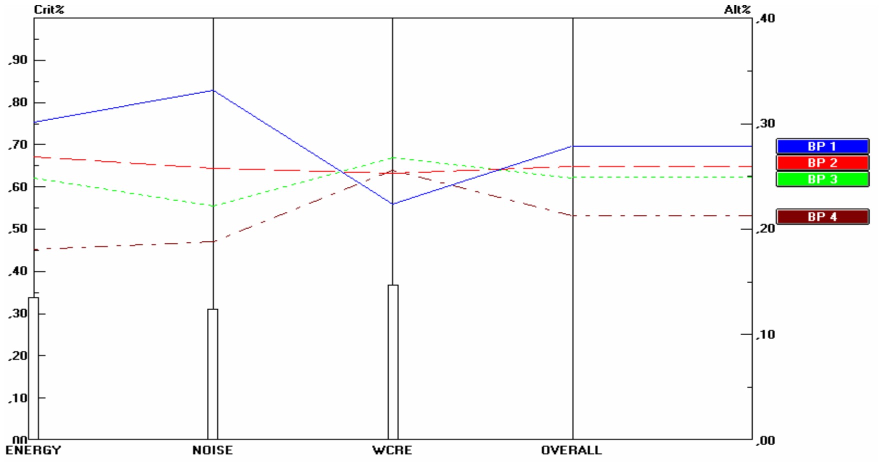

Figure 3 Performance sensitivity graph: environmental assessment fields with respect to 'Production'

*Table 1 Detailed synthesis results**

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
2. Pollution prevention and environmental impact = 0.357			
	2.2 Production = 0.206		
		2.2.3 Recycling = 0.074	
			BP 3 = 0.074
			BP 4 = 0.071
			BP 2 = 0.070
			BP 1 = 0.062
		2.2.1 Energy consumption = 0.069	
			BP 1 = 0.069
			BP 2 = 0.061
			BP 3 = 0.056
			BP 4 = 0.041
		2.2.2 Noise = 0.063	
			BP 1 = 0.063
			BP 2 = 0.049
			BP 3 = 0.042
			BP 4 = 0.036
	2.1 Inputs = 0.151		
		BP 1 = 0.151	
		BP 2 = 0.135	
		BP 3 = 0.128	
		BP 4 = 0.073	
3. Affect on the			

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firm's goodwill = 0.314			
	BP 3 = 0.314		
	BP 2 = 0.293		
	BP 1 = 0.223		
	BP 4 = 0.221		
4. New opportunities in marketing = 0.178			
	BP 3 = 0.178		
	BP 2 = 0.162		
	BP 1 = 0.111		
	BP 4 = 0.110		
1. Business results = 0.150			
	1.1. Contribution = 0.115		
		BP 4 = 0.115	
		BP 3 = 0.105	
		BP 2 = 0.100	
		BP 1 = 0.089	
	1.2 Progressive fixed costs = 0.022		
		BP 1 = 0.022	
		BP 2 = 0.022	
		BP 3 = 0.016	
		BP 4 = 0.006	
	1.3 Investment = 0.013		
		BP 1 = 0.013	
		BP 2 = 0.013	
		BP 3 = 0.010	
		BP 4 = 0.003	

**Synthesis of Level 4 Nodes with respect to GOAL - Ideal Mode.*

Step 4. Set performance goals for improvements

Following the synthesis and sensitivity results in Step 3, we can determine the critical success factors which demand actions for improvements in the initial Business process 1: 'Recycling' (the alternative with the highest local value is Business process 3), 'Contribution' (the alternative with the highest local value is Business process 4), 'Affect on the firm's goodwill' (the alternative with the highest local value is Business process 3) and 'New opportunities in marketing' (the alternative with the highest local value is Business process 3). Studying the particularities of the business processes with higher local values with respect to these critical success factors, we can set performance goals for improvements. Although Business process 4 which includes investment into the capacities for PS final products' production has the highest local value with respect to 'Contribution' and the second local value with respect to 'Recycling', it has the lowest local values with

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respect to all other critical success factors. Therefore, the following performance goals for improvements are set:

- Include waste recycling in the production process.
- Substitute PS products with PP ones.
- Substitute PS materials with PP ones.
- Research the market for PP materials and products.
- Make changes to existing PS products.
- Invest into the capacities for PP final products' production and substitute the production processes.

CONCLUDING REMARKS AND POSSIBILITIES OF FUTURE RESEARCH

The necessity for applying benchmarking arises also from the changed management philosophies in organizations, caused by advances in computer technologies. The effectiveness of benchmarking depends on the use of tools for obtaining and analyzing information. The method presented in this article is supported by an adequate computer program for the AHP technique that is used for benchmarking of environmentally oriented business processes.

It can be concluded that the method presented in this article is applicable for benchmarking of business processes, especially in the processing industry. Since we consider the particularities of the business processes in the sample enterprise, the decision-makers' preferences, their judgements on importance, and practical data about the business processes in this enterprise, as well as the research results on environmental management in the enterprises of the Slovene processing industry and those found in eco-balances, it can be concluded that the AHP technique is appropriate in connection with other decision-making tools. They turned out to be very suitable for the business processes' benchmarking: the problem can be displayed in concepts of hierarchy where more hierarchies can be devised; we can take both the quantitative and the qualitative factors into consideration; they enable group decision-making where managers and experts can establish their priorities; pair-wise comparisons are successfully applied in the critical success factors determination, the assessment of their importance and in the data calculation for different business processes. Moreover, with the synthesis and the sensitivity analysis results we can identify the critical success factors which need improved performance. This approach can be completed with implement plans and monitor results.

Future research will be directed towards model structuring for this problem in other industrial branches. In our case, the method helps a medium-sized enterprise in short-term business decision-making regarding the evaluation of business processes. To use this approach in long-term or strategic decision-making process, the information basis should be improved by more criteria, e.g. knowledge related factors, the assessment of strategy, business moral and organizational culture, compared by industry related information.

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