Bulgarian Journal of Agricultural Science, 20 (No 5) 2014, 1008-1017
Agricultural Academy

ASSESSMENT OF MULTIFUNCTIONAL AGRICULTURE: APPLICATION OF SELECTED MULTI-CRITERIA METHODS IN CASE OF SLOVENIA

K. PAZEK[1*], C. ROZMAN[1], D. MAJKOVIC[1], J. TURK[1], M. KLJAJIC[2], A. SKRABA[2], A. BOREC[1], P. SIMONIC[3] and J. PRISENK[1]
[1] *University of Maribor, Faculty of Agriculture and Life Sciences, 2311 Hoce, Slovenia*
[2] *University of Maribor, Faculty of Organizational Sciences, 4000 Kranj, Slovenia*
[3] *University of Ljubljana, Faculty of Arts, 1000 Ljubljana, Slovenia*

Abstract

PAZEK, K., C. ROZMAN, D. MAJKOVIC, J. TURK, M. KLJAJIC, A. SKRABA, A. BOREC, P. SIMONIC and J. PRISENK, 2014. Assessment of multifunctional agriculture: application of selected multi-criteria methods in case of Slovenia. *Bulg. J. Agric. Sci.*, 20: 1008-1017

The aim of this paper is to employ the use of multi-criteria analysis in quantification of the multifunctional agriculture (MFA). For this purpose, two methodological approaches are used and compared: Analytical-Hierarchical Process (AHP) for group decision making and multi-attribute utility theory (MAUT), under the assumption that MFA in Slovenia exist, while its level vary through regions/farms. The results showed that organic farms yielded with the highest final priority assessment with respect to the concept of multi-functionality.

Key words: multifunctional agriculture, Analytical-Hierarchical Process (AHP), multi-attribute utility theory (MAUT)

Introduction

Agricultural activity, beyond its primary function, can also provide a broad array of valuable amenities, such as shaping the landscape, providing environmental benefits such as land conservation, the sustainable management of renewable natural resources and the preservation of biodiversity, contribution to the socio-economic viability of many rural areas. As such, many authors provided the subject of multifunctional agriculture (review of definitions, assessment issues, modeling approaches). Apart from the discussion on the state and definitions of multi-functionality, the debate on its assessment as well as of related issues is present in the recent literature. Yrjölä and Kola (2001) introduced the cost-benefit analysis (CBA) as a method that can be used to evaluate the effects of non-market goods, produced by agriculture on the total welfare of society. Cost benefit analysis measures the economic changes due to changes in the use of resources. The agriculture is thus feasible if benefits estimated with a CBA are higher than estimated costs. Since the multi functionality consists of non market goods produced by agriculture, the CBA can provide solely partial information on all benefits and costs that emerge through agricultural production at farm, regional or state levels.

In this light, Rossing et al. (2007) provide a review of modeling approaches used for the analysis of the impacts of multi-functional agriculture comparing 15 different integrative modeling cases. They argue when discussing multifunctionality of agriculture (MFA), that public goods provided by agricultural activities, do not accrue automatically as inevitable outcome of any type of farming. They vary widely due to farming practices, farm size, location, and interaction among these. In this light, Häni et al. (2003) present a tool called "Response-Inducing Sustainability Evaluation" (RISE), which allows assessment at the farm level. It is system-oriented and offers a holistic approach for advice, education and planning. The model covers ecological, economic and social aspects by defining 12 indicators for Energy, Water, Soil, Biodiversity, Emission Potential, Plant Protection, Waste and Residues, Cash Flow, Farm Income, Investments, Local Economy and Social Situation. The tool RISE was tested and used to evaluate very different farms in three countries. The results are considered relevant with regard to the objective stated. Tanaka and Wu (2004) evaluate quanti-

Corresponding author: karmen.pazek@um.si

tatively the effect of three policies (payments for cropland retirement, fertilizer use taxes and payments for crop rotations) on agricultural land by estimating two logit models of land use decisions. Further, Hall et al. (2004) review the evidence of consumer demands for non market goods and consider the methodologies used for eliciting public preferences regarding the policy tradeoffs that are likely to characterize the agricultural reform debate. The search for optimal agri-environmental policy, which would guarantee the proper level of payment for such non-tradables, is needed (Randall, 2007; Moran et al., 2007). For this purpose, the latter authors show usage of multi-criteria method in comparison to choice experiments as survey methods. The rationale for multi-criteria methods (e.g. Analytical Hierarchical Process - AHP) usage in comparison to monetary valuation methods is often justified in the sense that the first one attempts to take into consideration the multiple dimensions of an observed problem in a balanced matter, enables inclusion of non-monetary criteria into analysis (Majkovič et al., 2005), and provides broader information for policy decision making (Clark et al., 2000; Moran et al., 2007). Further, Hall et al. (2004) extensively discuss the potential of multi-criteria methods (MCA) in combination with economic analysis and review the evidence of consumer demand for non market goods. Beside the usage of AHP (as one of the most commonly applied multicriteria decision making techniques) in presented context, the method is widely recognized in numerous types of decision problems (Pažek et al., 2006; Byun, 2001; Lai et al., 1999; Liberatore and Stylianou, 1994).

Navrud (2000) agrees that MCA has an important role as the valuation technique, although recommends also monetary valuation as necessity if decisions are to remain relevant to economic efficiency. The AHP is also employed by Rezaei- Moghaddam and Karami (2007). In addition to these methodological approaches, the expansion of assessment techniques is presented by Buysse et al. (2007), who introduce normative, positive and econometric mathematical programming into MFA research and suggest that the importance of the link between farms and policies in the general framework of model based policy analysis justifies the use of farm level programming models. The farm level approach is also applied by Randall (2007) who described some strategies for systematical assessment of non-commodity outputs and suggested some principles for effectively implementing MFA policy at farm level.

In our previous research we described multi-functionality of agriculture as a phenomenon with short description of possible assessment techniques (Majkovič et al., 2005). However, in this paper an attempt is made to employ the AHP (Analytical Hierarchical Process) for group decision making and MAUT (Multi Attribute Utility Theory) in order to conduct quantitative assessment of the degree of MFA on several conventional and organic modeled farms. The paper is organized as follows: first we present detailed description of methodology, including theoretical features of both methods. This is followed by the results and discussion. Main findings and final remarks conclude this article. Both methods applied indicate that the degree of multi-functionality is the most explicit in the case of organic farms.

Methodological Framework

The presented methodological framework for the multi-criteria assessment of multifunctional agriculture lies within the application of Analytical Hierarchical Process (AHP Model) for group decision making and multi attribute utility theory (MAUT model) in case of Slovenia. The first approach is based on a Saaty's Analytical Hierarchical Process, while MAUT technique is one of the common methodological approaches in MCDA.

The AHP model

The Analytical Hierarchal Process (AHP) is best illustrated by Saaty (1980). The AHP is a decision support tool, which can be used for solving complex decision problems. It uses a multi-level hierarchical structure of objectives, sub-objectives, and alternatives (Triantaphyllou and Mann, 1994). The AHP method determines the priorities of each alternative with the assigned weight for each alternative by analyzing the judgmental matrices using the advanced mathematical theory of eigen values and eigenvectors. It interprets the eigenvector associated with the largest eigen value as the priorities that indicate the importance of each alternative in accomplishing the objective. AHP combines both subjective and objective judgments in an integrated framework based on ratio scales from simple pair-wise comparisons. Saaty (1980) developed the following steps for applying the AHP:

Define the problem and determine its goal: the problem in this case is to assess the level of multifunctionaly at farm level.

Structure the hierarchy from the top (the objectives from a decision-maker's viewpoint; $i = 1, \dots, m$ objectives) through the intermediate levels (criteria/attributes on which subsequent levels depend) to the lowest level (Figure 1).

Criteria description and data sources

For the assessment of multifunctional agriculture, the group of experts determined hierarchical structure of the observed problem and provided pair-wise comparison for each of the level in the hierarchy (Figure 2). The main criteria with corresponding sub criteria were used in evaluating the sample model farms - alternatives against the assessment of multifunctional agriculture, which was the main MCDA goal. The hierarchical structure consists out of following criteria: production criteria, special food products, preservation of natural resources, environmental criteria and social criteria.

Quality of food can be defined in different ways, and the criteria included in the concept of quality can depend on the aspect from which the quality is studied and/or perceived. Practically all food chain actors are participating in the valuation of food quality. The producers commonly give preference to technical use-attributes, such as increased yield, suitability for mechanical harvesting, suitability for industrial preparation, as well as resistance against insects and diseases and to economical parameters (production costs, product prices, etc.). The wholesale dealer and the retailer may give preference to visual attributes, in spite of the fact that the product must meet requirements imposed by different public and/or private standards (e.g. GlobalGap, BRC, IFS,…). Government officials are involved in regulations concerning production of sufficient food quantities and health aspects. Consumers are interested in many aspects related to food quality, such as taste, freshness, appearance, nutritional value, food safety, special food products, and ethical aspects of food production. Discussions about food in consumer organizations and among consumers have increasingly included environmentally sound production in the concept of high quality food production, too. In many rural regions, tourism is accepted as a natural part of the socio-economic fabric juxtaposed with agriculture (Fleischer and Tchetchik, 2005). Tourist farms represent an increasingly significant rural diversification option for chronically unstable agriculture-based economies (Fennell and Weaver, 1997). Agrotourism activity as one of indicators of the growing importance of the viability of rural areas is increasing substantially in the last decade and is an important feature in the concept of multifunctional agriculture (Majkovič et al., 2005). However, there are very attractive in important some others and additional supply alternatives too (i.e. recreation). Furthermore, the biodiversity of rural landscape and natural resources can additionally attract tourists (Kramberger et al., 2005; Kaligarič et al., 2006). On the other side, the overgrowing process of agricultural land is becoming the serious problem. Most frequent reasons stated for expansion of overgrowing areas are usually inconvenient natural conditions, socio-economic and political circumstances. Thus the efforts by cultivating of agricultural land and engagement against overgrowing process and understanding the background of this concept are of particular importance in environmental function and multi-

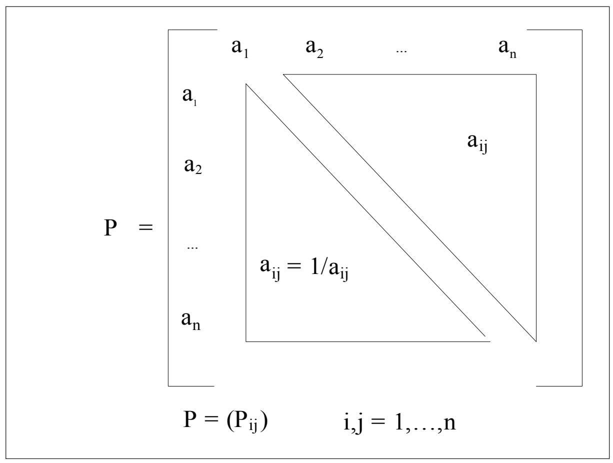

Fig. 2. Pair-wise comparison matrices P = (a_{ij})

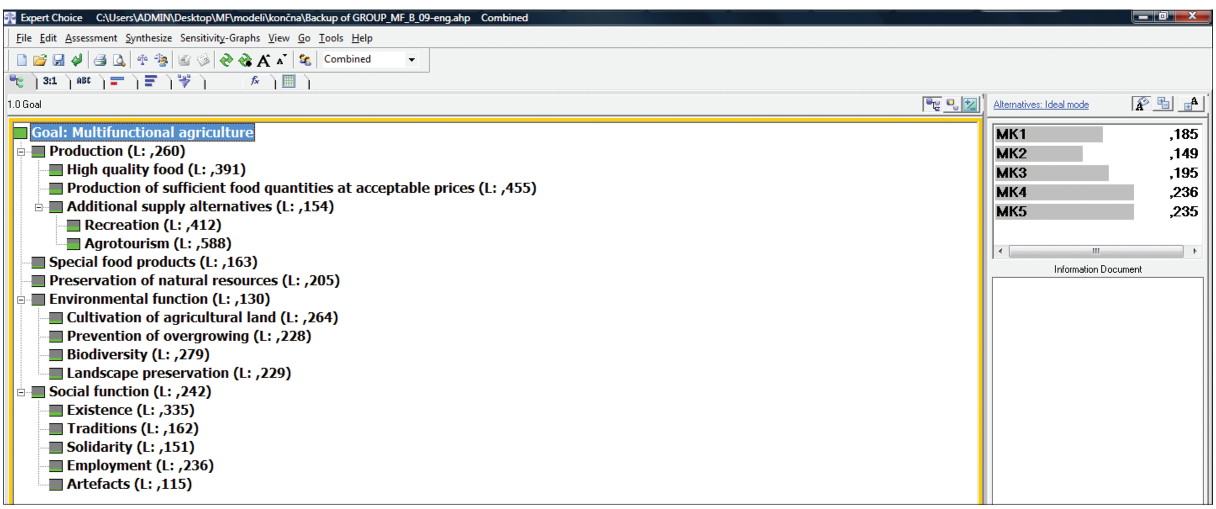

Fig. 1. The AHP criteria tree structure for assessment of multifunctional agriculture at farm level

functionality assessments. The social function in multifunctional agriculture plays an important role, especially in the processes of rural differentiation. Social representations (i.e. existence, traditions, solidarity, employment and artefacts) are powerful tools to 'align' local actors around a common objective and to 'enrol' outside actors (tourists, consumers, citizens) in their project. However, rural areas are not the existence base only for farmer, there are also involved other social groups. The farm lifestyle presents in the environment further development of special social groups. Tradition is usually connected with social and individual memory that is linked to the specific natural and cultural environment – i.e. diachronic. Solidarity criteria arise from the connection process between people and the same natural and/or cultural environment – usually between the people, who share the same living space. Employment and working places are described as liberalistics supplement that is connected with the social stratification and profesionalization process. The last subcriteria, artefacts, are defined as all handicraft, arts, culinary, music,…etc. products.

The economic function attributes were assessed analytically using farm simulation systems developed by Pažek et al. (2006). The assessment of non-numerical attributes was performed by expert focus groups. Focus groups are group interviews, based on discussion between several people where the moderators try to "focus" on predetermined perspective/subject. The results can be used as self contained (they serve as principal sources of data) or as a supplementary source. The widespread methodological approach, based on dynamic interaction, is often used in studying food consumption patterns (McGee et al., 2008; Meinert et al, 2008; Barcellos et al., 2010), medicine and pharmacy research (Lehoux et al, 2006; Huston and Hobson, 2008), etc. Xenarios and Tziritis (2007), who use focus group and content analysis in combination with MCDA, describe focus group technique as a qualitative research method which encapsulates the principles of Stakeholder Analysis in a qualitative manner, for the accentuation and incorporation of social preferences in the decision making process. The detailed explanation on assessment of attributes is given in Table 1:

Table 1
The criteria assessment

Attribute	Assessment / Indicator
Production - economic function	Financial results / calculated with KARSIM 1.o simulation model
Special food products	Expert assessment / Focus group
Preservation of natural resources	Expert assessment / Focus group
Environmental function	Expert assessment / Focus group
Social function	Expert assessment / Focus group
Production - economic function	
High quality food	Expert assessment / Focus group
Production of sufficient food quantities at acceptable prices	Yield, Data
Additional supply alternatives	Expert assessment / Focus group
Additional supply alternatives	Expert assessment / Focus group
Recreation	Expert assessment / Focus group
Agro-tourism	Expert assessment / Focus group
Environmental function	
Cultivation of agricultural land	Expert assessment / Focus group
Prevention of overgrowing	Expert assessment / Focus group
Biodiversity	Expert assessment / Focus group
Landscape preservation	Expert assessment / Focus group
Social function	
Existence	Expert assessment / Focus group
Traditions	Expert assessment / Focus group
Solidarity	Expert assessment / Focus group
Employment	Expert assessment / Focus group
Artefacts	Expert assessment / Focus group

The next step is to construct a set of pair-wise comparison matrices (size n x n, Figure 1) for each of the lower levels with one matrix for each element in the level immediately above by using the relative scale measurement (for each objective i, compare the j = 1, …, n alternatives and determine their weights a_{ij} with respect to objective i).

There are n x (n - 1) judgments required to develop the set of matrices in previous step. Reciprocals are automatically assigned in each pair-wise comparison ($a_{ij} = 1/ a_{ij}$). The judgments were performed by the expert group with the use of a special AHP questionnaire (Figure 1). During group brainstorming sessions the expert focus group was asked to perform pairwise judgments of relative importance of attributes using questionnaires with Saaty scale (Figure 3).

Hierarchical synthesis is now used to weight the eigenvectors by the weights of the criteria and the sum is taken over all weighted eigenvector entries corresponding to those in the next lower level of the hierarchy (the final alternative weights (priorities) W_j with respect to all the objectives by $W_j = a_{1j}w_1 + a_{2j}w_2 + \ldots + a_{mj}w_m$).

Having made all the pair-wise comparisons, the consistency is determined by using the eigenvalue, λ_{max}, to calculate the consistency index, CI as follows: $CI = (\lambda_{max} - n) / (n - 1)$, where n is the matrix size. Judgment consistency can be checked by taking the consistency ratio (CR) of CI. The CR is acceptable, if it does not exceed 0.10.

The alternatives are then ordered by the W_j,with the most preferred alternative having the largest W_j. The AHP decision support software Expert Choice 2000TM (EC) allows us to enter the data for each alternative into the Data Grid, where individual objectives can be entered directly. In this case the intensities or possible qualitative values of decision attributes at the lowest level in the hierarchy are compared in the pair wise comparison matrix (and not the alternatives). This feature enables the usage of the same scales for criteria as in the MAUT model. The data (attribute/criteria values) is then entered for each alternative. The use of the Data Grid combines the power of the hierarchy and the pair-wise comparison process. This procedure can be particularly useful with large number of alternatives to be evaluated; there is no need to compare alternatives in the pair-wise manner; the values are put directly into the Data Grid and priorities are calculated based on pair wise comparison of intensities. Alternatives priorities are established relatively to each covering objective by using ratio scaled rating intensities (scales).

The AHP allows group decision making, where group members can use their experience, values and knowledge to break down a problem into a hierarchy and solve it by the AHP steps. Brainstorming and sharing ideas and insights (inherent in the use of Expert Choice in a group setting) often leads to a more complete representation and understanding of the issues. The group of expert provides the judgments. The group may decide to give all the group members equal weight, or the group members could give them different weights that reflect their position in the project. In this case the aggregation of members' decisions in a group is generally carried out by employing geometric means or arithmetic means to average the assessed weights from different members.

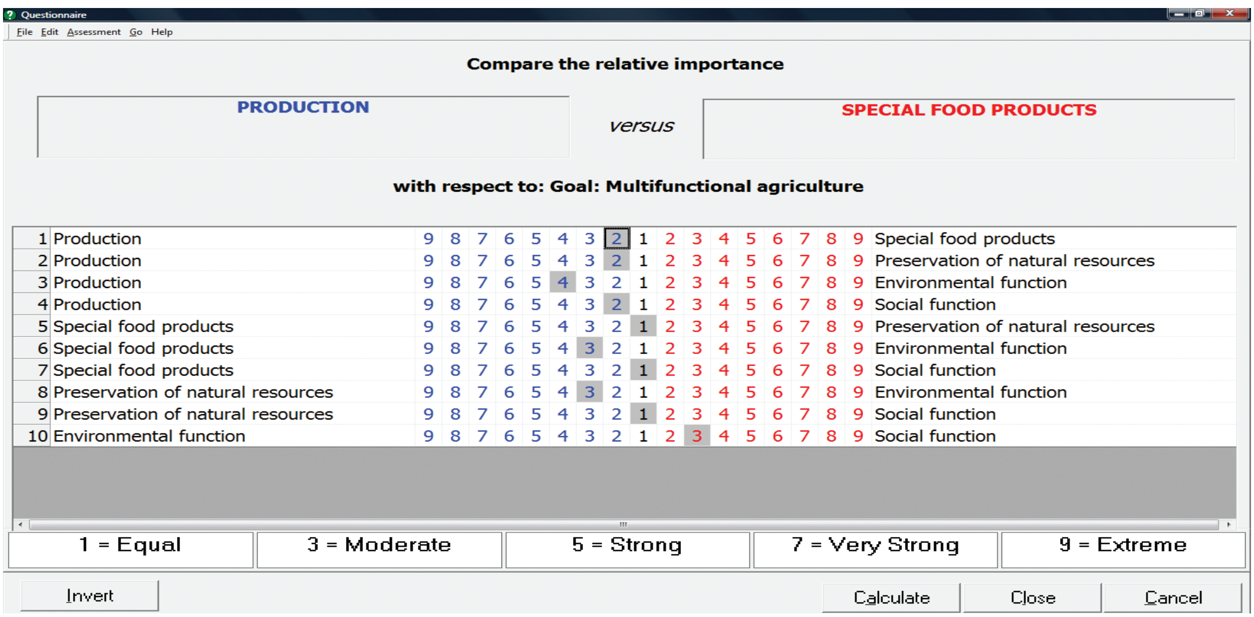

Fig. 3. Pair-wise assessment of criteria priority

MAUT model

The second approach for MCDA used in the research is the multi-attribute utility theory (hereinafter MAUT). MAUT is based on the computation of a value function, usually expressed as an additive linear model in the following form:

$$V(a) = \sum_{i=1}^{m} u_i(a) = \sum_{i=1}^{m} w_i v_i(a) \qquad (1)$$

where:

V(a) – value function;

$u_i(a)$ – partial value function;

w_i – weight of attribute i;

v_i – value of attribute i;

m – number of attributes.

For the computation of a value function, every attribute must be expressed in a numerical way. This means that some kind of classification is conducted for non-numerical attributes. For instance: if we deal with a criterion that can obtain the values 'unimportant', 'important' and 'very important', we must define a corresponding numerical scale. In this case the value 'unimportant' could be described by one and the value 'very important' by five. The hierarchy is basically the same as in the AHP decision model described in previous section. For the multi – attribute problem assessments the group of expert provided assessments using the arbitrary judgment based on focus group survey data (the judgment value between 1 and 5, where:1 = unimportant, 2 = average important, 3 = important, 4 = more important, 5 = very important).

The survey consists out of five main questions (that represents at the same time the basic attributes) which are immediately performed from the hierarchical structure for the multifunctional agriculture assessment. Using the hierarchy presented in Figure 1 in the first phase the importance of basic criteria were assessed within the judgments value between 1 and 5 (i.e. "How important is food production from multifunctional aspect?"). In the next step each individual basic criteria were divided into sub critera according to the hierarchical structure. The assessment of individual sub criteria was provided by the expert/focus group again by the arbitrary judgment values between 1 and 5 (i.e. "How important is production of high quality food from multifunctional aspect?", etc).

However, before the final value function is computed the process of arbitrary judgment normalization must be applied:

$$W_i = \left(\frac{1}{h}\right)\frac{\sum_{i=1}^{h} a_i}{\sum_{i=1}^{n} a_i} \qquad (2)$$

where:

W_i – average weight of attribute i

h – number of experts (number of survey)

a_i – individual arbitraty judgment (1…5) of attributes importance i

n – number of attributes

The MAUT model is built in an Excel 2003 spreadsheet environment.

Case study

By the application of MCDA approaches a lack of data on regional (national) level appeared. The data insufficiency has an important influence by decision of model application on a selected model farms. However, the sample farms are identified and selected according to:

- definition of farm production type based on cluster analysis (the data source: Agency of the Republic of Slovenia for Agricultural Markets and Rural Development (Vučko, 2005)
- results from national research project "Some chances to stimulate farm competitiveness in the highland region of south-east Slovenia activating the utilized areas (L4 – 3245 (B))
- definitions of farm type, based on farm production system (conventional, integrated, organic).

The selected model farms in Slovenia were considered to apply the AHP Expert Choice and MAUT decision model. The selected sample farms and their characteristics are presented in Table 2.

Results and Discussion

The results confirm our previous research results (Pažek et al., 2005; Pažek et al., 2006; Rozman et al., 2006) that the AHP based on Expert Choice model and utility function assessment (MAUT) present very detailed, but in general similar rankings of sample model farms with respect to the level of multifunctionality. However, it should be mentioned here that there are some differences in AHP and MAUT priorities for each criteria. The relative importance weights of aggregate attributes derived from AHP (as results of pair-wise comparisons) and MAUT are different, yet both methods result in the same ranking of criteria priority (Table 3).

The identified sample model farms (MK1 – MK5, Table 2) were evaluated with multi-criteria decision models (AHP and MAUT). The AHP (EC) results shows that the favourable farming system from multifunctional aspect is organic farming (MK4 = 0.496 and MK5 = 0.493), followed by integrated (MK3 = 0.461) and conventional farming system (MK1 = 0.428 and MK2 = 0.310).

The calculation of utility function (Table 4) gives the following sample model farms rankings: organic suckling cows breeding (MK 4 = 5.73), organic sheep breeding (MK3 = 5.64), integrated field crop production system (MK 3 = 4.99), followed by conventional intensive milk production (MK 1 = 4.81) and conventional cattle breeding (MK 2 = 4.14) (Table 5).

The results demonstrate that organic both analyzed organic farms yielded with the highest priority assessment with respect to the multi-functionality. This can be explained with higher assessments of the criteria Environmental function as

Table 4
Group AHP assessment for selected sample model farms (non- normalized results)

Sample model farm	AHP priorities (considering multi-functional criteria)	Ranking
MK1	0.428	4
MK2	0.310	5
MK3	0.461	3
MK4	0.496	1
MK5	0.493	2

Table 2
Sample model farms (MF1 – MF5) for the multifunctionality assessment

Sample model farm	Farm production type	Description	Production system
MK 1	Milk – intensive production	40 milking cows, 45 ha of arable land	Conventional
MK 2	Cattle breeding	60 animals, 45 ha of arable land	Conventional
MK 3	Field crop - intensive	60 ha of arable land; Crop rotation: wheat, maize, sugar beet, potato, green manure	Integrated
MK 4	Suckling cows	9 ha of grassland, 6 suckling cows	Organic
MK 5	Sheep breeding	32 ha of grassland including 3 ha of extensive grassland orchard	Organic

Table 3
MAUT and group AHP criteria priorities

Criteria	Average weight/ priority (VATK)	Average weight/ Group AHP	Difference
Production - economic function	0.23	0.26	0.03
Special food products	0.18	0.163	0.017
Preservation of natural resources	0.21	0.205	0.005
Environmental function	0.16	0.13	0.03
Social function	0.22	0.242	0.022
High quality food	0.39	0.391	0.001
Production of sufficient food quantities at acceptable prices	0.39	0.455	0.065
Additional supply alternatives	0.22	0.154	0.066
Recreation	0.44	0.412	0.028
Agro-tourism	0.56	0.588	0.028
Cultivation of agricultural land	0.26	0.264	0.004
Prevention of overgrowing	0.24	0.228	0.012
Biodiversity	0.27	0.279	0.009
Landscape preservation	0.24	0.229	0.011
Existence	0.26	0.335	0.075
Traditions	0.19	0.162	0.028
Solidarity	0.17	0.151	0.019
Employment	0.22	0.236	0.016
Artefacts	0.15	0.115	0.035

well as Preservation of natural resources (Table 4 and Figure 4). Together with the defined weights in both AFP and MAUT model the last contributed to better assessment of both organic farms.

An important feature of using MCDM is the ability to "drill-down" through the tree structure of the model, look at data and assessments at the lower level of the model, and see how they contribute to the overall assessment. This is very important for better understanding and justification of the assessment process. Furthermore, such analysis can be easily and comprehensively visualized using various charts. As an example, Figure 4 shows the values of partial utility functions for each criteria at the first level of the hierarchy. The ideal assessment is achieved when the line is at the edge of the pentagram. In this way, weak points can also be identified:

Concluding Remarks

The system for assessments of multifunctional agriculture (AHP and MAUT model) takes into consideration different independent objectives and enables precise ranking of each analyzed farming system scenario. Each simulated scenario is additionally assessed with the use of multi criteria models based on AHP and MAUT methodology where simulation result and focus group assessments represent the information source for multi criteria analysis. The model was tested on five selected sample model farms with different farming system (conventional, integrated and organic). Both applied methodological decision tools revealed similar farm assessment results under assumed model input parameters.

Despite the deficiencies observed (such as the problem of assessment of non-numerical criteria), we found that the approach fulfilled most of our expectations and revealed con-

Table 5
Utility function assessment considering multifunctional criteria for selected sample model farms

		MK1	MK2	MK3	MK4	MK5
	Final assessment	4.81	4.14	4.99	5.73	5.64
	Ranking	4	5	3	1	2
	Average weight	MK1	MK2	MK3	MK4	MK5
Production - economic function	0.23	6.68	5.51	7.47	2.9	2.51
Special food products	0.18	2	2	2	5	5
Preservation of natural resources	0.21	5	5	5	8	8
Environmental function	0.16	4.05	4.05	4.05	8.82	8.82
Social function	0.22	5.52	3.73	5.52	5	5
Production - economic function	Average weight					
High quality food	0.39	10	10	10	5	5
Production of sufficient food quantities at acceptable prices	0.39	6	3	8	1	0
Additional supply alternatives	0.22	2	2	2	2.56	2.56
Additional supply alternatives	Average weight					
Recreation	0.44	2	2	2	2	2
Agro-tourism	0.56	2	2	2	3	3
Environmental function	Average weight					
Cultivation of agricultural land	0.26	5	5	5	10	10
Prevention of overgrowing	0.24	1	1	1	10	10
Biodiversity	0.27	5	5	5	10	10
Landscape preservation	0.24	5	5	5	5	5
Social function	Average weight					
Existence	0.26	5	5	5	5	5
Traditions	0.19	5	5	5	5	5
Solidarity	0.17	5	5	5	5	5
Employment	0.22	10	2	10	5	5
Artefacts	0.15	1	1	1	5	5

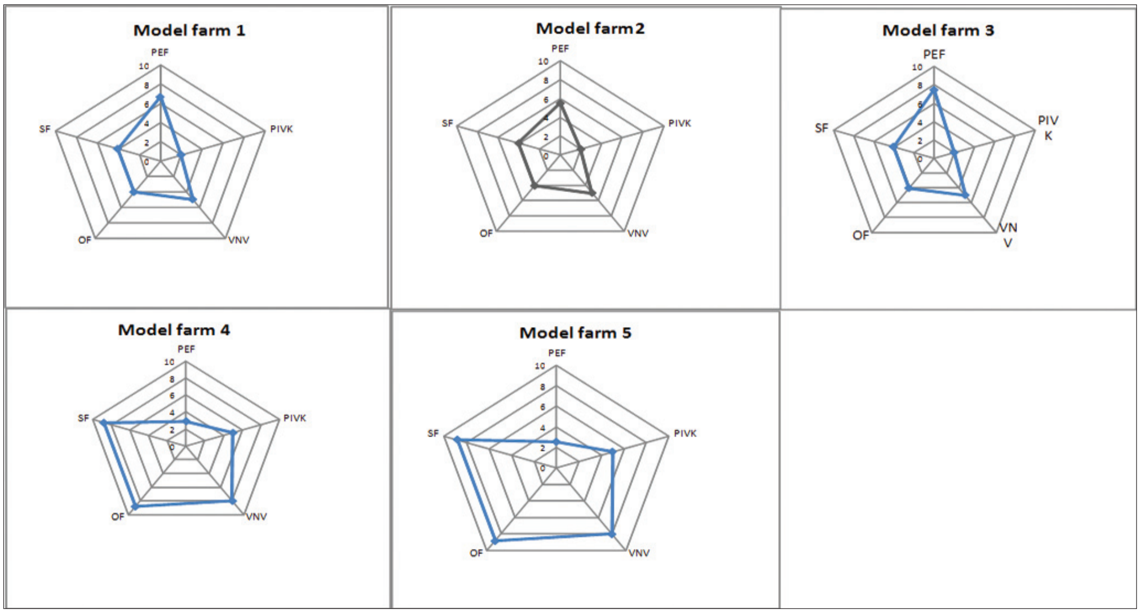

Fig. 4. The use of both approaches can bring additional information into the decision-making framework (where PEF – Production economic function, SF – Social function, VNV - Preservation of natural resources, OF – Environmental function)

siderable advantages in comparison with other approaches. In particular, we emphasize the use of the AHP pair-wise comparison matrices, which are suitable in a field where judgment prevails, thus making it difficult to give numeric answers. This kind of model is comprehensible to a wide range of users in the evaluation process.

The presented combined methodological framework for the analysis of farming system scenarios from multifunctional aspect could provide additional information support, bring additional clarity to decisions, and could therefore play an important role in the further development of farming, in particular as assistance and advice for agricultural policy makers.

Acknowledgments

This research was funded by ARRS program V4-0101 (B).

References

Barcellos, **M. D., J. O. Kügler**, **K. G. Grunert**, **L. Wezemael**, **F. J. A. Pérez-Cueto**, **Ø. Ueland and W. Verbek**e, 2010. European consumers' acceptance of beef processing technologies: A focus group study. *Innovative Food Science & Emerging Technologies*, **11** (4):721-732.

Buysse, J., G. Van Huylenbroeck and L. Lauwers, 2007. Normative, positive and econometric mathematical programming as tools for incorporation of multifunctionality in agricultural policy modeling. *Agriculture, Ecosystems and Environment,* **120**: 70-81.

Byun, D., 2001. The AHP approach for selecting an automobile purchase model. *Information & Management*, **38**: 289-297.

Clark, J., J. Burgess and C. M. Harrison, 2000. I struggled with this money business: respondent's perspectives on contingent valuation. *Ecological Economics,* **33**: 45-62 (Bg).

Expert Choice, Inc., 1994. *Expert Choice software and manual,* 4922 Ellsworth Ave., Pittsburgh, PA 15213, USA.

Fennell, D. and D.Weaver, 1997. Tourist Farms and Ecotourism in Saskatchewan, Canada. *Journal of Rural Studies,* **13**: 467-475.

Fleischer, A. and A. Tchetchik, 2005. Does rural tourism benefit from agriculture?,*Tourism Management*, **26**: 493-501.

Hall, C., A. McVittie and D. Moran, 2004. What does the public want from agriculture and the countryside? A review of evidence and methods. *Journal of Rural Studies,* **20**: 211-225.

Häni, F., A. Stämpfli and T. Keller, 2003.Sustainability assessment of farms with the model RISE. *Agricultura,* **2**: 7-11.

Huston, S.A. and E.H. Hobson, 2008. Using focus groups to inform pharmacy research. *Research in Social and Administrative Pharmacy*, **4** (3): 186-205.

Kaligarič, M., M. Culiberg and B. Kramberger, 2006. Recent vegetation history of the North Adriatic grasslands: Expansion and decay of an anthropogenic habitat. *Folia Geobotanica*, **41**: 241-258.

Kramberger, B., A. Gselman, A. Borec and M. Kaligarič, 2005. Periodische, sehr späte erste Mahd des seminatürlichen Dauergrünlandes als Massnahme zur Förderung der natürlichen Aussamung mit Betonung auf Wiesengräser.*Berichte über Landwirtsch*, **83**: 431-446.

Lai, V. S., R. P. Trueblood and B. K. Wong, 1999. Software selection: a case study of the application of the analytic hierarchical process to the selection of a multimedia authoring system. *Information and Management,* **36**: 221-232.

Lehoux, P., B. Poland and G. Daudelin, 2006. Focus group research and "the patient's view". *Social Science & Medicine*, **63** (8): 2091-2104.

Liberatore, M. J. and A. C. Stylianou, 1994. Using knowledge-based systems for strategic market assessment. *Information and Management,* **27**: 221-232.

Majkovič, D., A. Borec, Č. Rozman, J. Turk and K. Pažek, 2005. Multifunctional concept of agriculture: just an idea or the real case scenario? *Društvena istraživanja*, **14** (3): 579-596.

McGee, B. B., V. Richardson, G. S. Johnson, A. Thornton, C. Johnson, K. Yadrick, M. Ndirangu, S. Goolsby, D. Watkins, P. M. Simpson, E. Hyman, F. Stigger, M. L. Bogle, T. R. Kramer, E. Strickland and B. McCabe-Sellers, 2008. Perceptions of Factors Influencing Healthful Food Consumption Behavior in the Lower Mississippi Delta: Focus Group Findings. *Journal of Nutrition Education and Behavior*, **40** (2): 102-109.

Meinert, L., S. C. Christiansen, L. Kristensen, C. Bjergegaard and M. D. Aaslyng, 2008. Eating quality of pork from pure breeds and DLY studied by focus group research and meat quality analyses. *Meat Science*, **80** (2): 304-314.

Moran, D., A. McVittie, D. J. Allcroft and D. A. Elston, 2007. Quantifying public preferences for agri-environmental policy in Scotland: A comparison of methods. *Ecological Economics,* **63** (1): 42-53.

Navrud, S., 2000.Valuation Techniques and Benefit Transfer Methods: Strengths, Weaknesses and Policy Utility. In: Valuing Rural Amenities. Territorial Economy. *OECD,* 174 pp.

Pažek, K., Č. Rozman, A. Borec, J. Turk, D. Majkovič, M. Bavec and F. Bavec, 2006. The Use of multi criteria models for decision support on organic farms. *Biological Agriculture & Horticulture,* **24** (1): 73-89.

Pažek, K., Č. Rozman, J. Turk, M. Bavec and M. Pavlovč, 2005. Ein Simulationsmodell für Investitionsanalyse der Nahrungsmittelverarbeitung auf ökologischen Betrieben in Slowenien. *Bodenkultur,* **56** (2): 121-131.

Randall, A., 2007. A consistent valuation and pricing framework for non-commodity outputs: Progress and prospects. *Agriculture, Ecosystems and Environment,* **120**: 21-30.

Rezaei-Moghaddam, K. and E. Karami, 2007. A multiple criteria evaluation of sustainable agricultural development models using AHP. *Environment, Development and Sustainability*, **10** (4): 407-426.

Rossing, W. A. H., P. Zander, E. Josien, J. C. J. Groot, B. C. Meyer and A. Knierim, 2007.Integrative modelling approaches for analysis of impact of multifunctional agriculture: A review for France, Germany and The Netherlands.*Agriculture, Ecosystems and Environment*, **120**: 41-57.

Rozman, Č., K. Pažek, M. Bavec, F. Bavec, J. Turk and D. Majkovič, 2006. The Multi-criteria analysis of spelt food processing alternatives on small organic farms. *Journal of Sustainable Agriculture,* **2**: 159-179.

Saaty, T. L., 1980.The Analytic Hierarchy Process. *McGraw Hill*, New York.

Tanaka, K. and J. Wu, 2004. Evaluating the effect of conservation policies on agricultural land use: a site-specific modeling approach. *Canadian Journal of Agricultural Economics*, **52**: 217-235.

Triantaphyllou, E., and S. T. Mann, 1994. A computational evaluation of the original and revised analytic hierarchy process. *Computers Industrial Engineering,* **26** (3): 609-618.

Vučko, I., 2005. Direct payments and farm diversity in Slovenia. *M. Sc. Thesis, University of Maribor, Faculty of Agriculture*, 159 pp.

Xenarios, S. and I. Tziritis, 2007. Improving pluralism in Multi Criteria Decision Aid approach through Focus Group technique and Content Analysis. *Ecological Economics*, **62** (3-4): 692-703.

Yrjölä, T. and J. Kola, 2001. Cost-benefit analysis of multifunctional agriculture in Finland. Paper presented at: 77th EAAE Seminar / NJF Seminar No. 325, August 17-18, Helsinki.

Received April, 10, 2013; accepted for printing March, 10, 2014.