# A MULTIFUNCTIONAL COMPARISON OF CONVENTIONAL VERSUS ALTERNATIVE OLIVE SYSTEMS IN SPAIN BY USING AHP

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## 1 Introduction

Over the last decades organic farming (EU Reg 2092/1991 and later amendments) and integrated production (regulations in some countries, such as Spanish Reg "Real Decreto" 1201/2002) are spreading as the major alternatives to conventional/chemical farming in the EU, reacting against a set of problems related to environment, food quality and sustainability of agriculture. Andalusia, the leading olive producing area in the world, located at the south of Spain, is not an exception. In this diffusion process it is implicitly or explicitly assumed that aforesaid alternative methods are more valuable than conventional one and therefore their spreading is a desirable public objective. Although partial studies, usually focusing on one or few criteria, about the environmental, economic, etc. performances of conventional vs. alternative farming techniques is increasing, little information is available from a multicriteria and holistic perspective according to the multifunctional role expected of agriculture.

Some authors have recently suggested that a useful approach to environmental and social making-decision problems might be to move away from neoclassical economics orthodoxy and towards Multi-Criteria Decision-Making (MCDM) Theory (Hernández and Cardells, 1999). The Analytic Hierarchy Process (AHP) (Saaty, 1977, 1980) is an interactive MCDM methodology with an increasing impact at both theoretical and practical level (e.g., www.expertchoice.com). AHP enables the inclusion of multiple criteria, stakeholders and decision-makers, in uncertain - lack of information - and high risk - what is at stake – scenarios, and the quantification of qualitative, subjective and intangible information. Although these characteristics make AHP a potentially useful tool for the multifunctional assessment of agricultural systems, its application in this field has not been found in the literature.

In this context, the main objectives of this article are (1) to present AHP as a powerful methodology to effectively achieve a wide comparative multifunctional assessment of agricultural systems, and (2) to apply it to the conventional, organic and integrated olive systems in Andalusia, on the basis of experts' knowledge, to determine the accuracy of the hypothesis about the superiority of the two alternative farming methods over the conventional technology they hope to replace.

## 2 AHP: fundamentals and application to the olive comparison

AHP (Saaty 1977, 1980) suggests an analysis and synthesis process for decision-making which consists of a series of steps as shown below. In order to implement AHP, Expert Choice software (Forman et al., 1983), among others, can be used.

### *2.1. Definition and analysis of the problem*

The resolution of a decision-making problem chiefly involves prioritizing a set of alternatives according to their performances with respect to a set of criteria or objectives[1]. AHP suggests breaking the problem down into smaller parts, that is, its analysis and structuring by means of the construction of a decision hierarchy model. Objectives must be as independent from each other as possible. Moreover, all relevant objectives in the problem should be included and irrelevant ones should be excluded.

In our application, the overall objective (goal) is to determine which of the three analyzed alternatives has a greater overall value for society being more desirable in the medium/long term in the average conditions of Andalusia. Building of the model (Figure 1) has been based on different information and sources[2]. Briefly, the meaning of the proposed objectives is:

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[1] An objective is a criterion with an improvement direction. E.g., when selecting a car, a criterion could be "petrol consumption" and an objective could be "low petrol consumption".

[2] Chiefly the CAP and national agricultural regulations [Cork Declaration of the European Conference on Rural Development (CEE, 1996), "2000 Agenda" (EU Reg 1251/99 to 1268/99) specially EU Reg 1257/99 about rural development and Spanish Regulation "Real Decreto 4/2001" about agri-environmental funding, among others], a

I. Economic objectives relative to farmers and their social framework, including: (I.1) Income of farm in the medium-long term, counting land, entrepreneur, salaries, loan interests and taxes; (I.2) Stability of income over time, related to sustainable demand, stability of prices, diversification of risk, etc.; (I.3) Autonomy from institutional subsidies; (I.4) Independence from external inputs, of another economic sectors or regions; (I.5) Trade and sale opportunities, related to efficient distribution channels and existence of a real demand.

II. Technical objectives, including: (II.1) Total factor productivity; (II.2) Harvest growing success prospects, or minimization of the risk associated with a contingent loss of production usually related biological and agronomic conditions of the cultivation; (II.3) Olive oil quality, according to five criteria (based on Woodward et al., 1989): authentic, functional, biological, nutritional and organoleptic quality; (II.4) Farmers work health conditions, essentially related to contact with some dangerous substances.

III. Sociocultural objectives, including: (III.1) Direct local employment generation in the food and agriculture sector; (III.2) Indirect local employment in parallel sectors such as rural tourism; (III.3) Social justice in the rural areas, or fair distribution of this employment; (III.4) Presence of agriculture in problematic or disadvantaged regions, where oliviculture could be the unique alternative to avoid depopulation; (III.5) Compatibility of the practices with the background and previous values of farmers and rural society; (III.6) Recreational use of the agricultural and rural environment associated with their visual and other intrinsic characteristics.

IV. Environmental objectives, which refer to: (IV.1) Less soil erosion, related to advance of desertification and abandon of agriculture; (IV.2) Soil fertility, related to the agronomic quality of soil, which depends on soil structure and low levels of pollution/contamination; (IV.3) Rational use of irrigation water, related to the moment of irrigation, quantity and quality of

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pre-test to five experts and multiple specific references in the literature.

water; (IV.4) Less water contamination of both underground and surface waters caused by the application of inputs during farming; (IV.5) Less atmospheric pollution associated with farming, including pollution caused by the manufacturing of inputs; (IV.6) Biodiversity, which can be measured as the numbers and variety of different living beings present, including diversity of the olive tree, wildlife, micro-fauna, beneficial fauna, domestic animals and wild flora.

### *2.2. Evaluation of the model*

Subsequently, for each node of the hierarchy tree, the local priorities or weights ($\omega_L$) of the sub-nodes or alternatives (or elements, in general) that depend on it must be assessed, in terms of importance, preference or likelihood[3]. These priorities are calculated on the basis of ratios between them ($\omega_{L(i)}/\omega_{L(j)}$). These ratios are usually obtained from experts' or decision makers' judgments about the relative performance, stated by simple pairwise comparisons, of the subnodes or alternatives with respect to their parent node. Pairwise comparisons are justified due to the humans' skill to compare pairs of things rather than a set of things all together (Forman and Selly, 2001). It is possible to compare elements on three scales: (1) numerical: e.g., element *i* is 2.5 times more important than *j* with respect to their parent node, that is, $\omega_{L(i)}/\omega_{L(j)}=2.5$; (2) graphical: length of two bars represent the relative importance of the two elements; or (3) verbal: in a scale ranging from equal ($\omega_{L(i)}/\omega_{L(j)}=1$) to extreme preference ($\omega_{L(i)}/\omega_{L(j)}=9$) of a element vs. the other. On the basis of these ratios, a comparison matrix ($\hat{A}$) for the node can be constructed, with elements $a_{i,j}=\omega_{L(i)}/\omega_{L(j)}$:

[3] In AHP, the standardization of local weights in the nodes is usually imposed, that is, in every node it must be satisfied: $0 \leq \omega_{L(i)} \leq 1$, and $\sum_{i=1}^{n} \omega_{L(i)} = 1$, where $\omega_{L(i)}$ is the local weight of an *i* element with respect to its parent node, and *n* is the number of elements depending on it.

(1)
$$\hat{A} = \begin{pmatrix} 1 & \omega_{L(1)}/\omega_{L(2)} & \omega_{L(1)}/\omega_{L(3)} & \cdots & \omega_{L(1)}/\omega_{L(n)} \\ & 1 & \omega_{L(2)}/\omega_{L(3)} & \cdots & \omega_{L(2)}/\omega_{L(n)} \\ & & 1 & \cdots & \omega_{L(3)}/\omega_{L(n)} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ \text{inverse} & & & & \\ \text{elements} & & & \cdots & 1 \end{pmatrix}$$

It is possible to demonstrate (e.g. Saaty, 1994; Forman and Selly, 2001) that local weights of the elements can be calculated by solving for the eigenvector of the system of equations:

(2)
$$\hat{A} * \varpi_L = \lambda * \varpi_L$$

where $\varpi_L$ is the vector of local weights and $\lambda$ is the maximum eigenvalue. It can be proved that $\lambda \geq n$ and the difference $\lambda - n$ is an indicator of the inconsistency of the judgments at the comparison matrix.

### ***2.3. Group decision-making***

Decision-making frequently involves the participation of different agents which opinions are often conflicting. Different methods to aggregate individual preferences have been proposed in AHP (e.g., Ramanathan and Ganesh, 1994), being the Aggregation of Individual Judgments (AIJ) the most spread one. According to it, once the individual comparison matrices of all the decision agents in a particular node ($\hat{A}_1$, $\hat{A}_2$, …, $\hat{A}_N$) are known, it is possible to calculate in this node an aggregated comparison matrix ($\hat{A}_{Gr}$) for the group, which elements would be:

(3)
$$(a_{i,j})_{Gr} = \sqrt[N]{\prod_{n=1}^{N} (a_{i,j})_{Ind\_n}}$$

where $(a_{i,j})_{Ind\_n}$ is the judgment of the individual $n$ and $N$ is the number of individuals pertaining to the group. Once $\hat{A}_{Gr}$ is calculated in a node, it is possible to obtain the local priorities of the sub-nodes or alternatives for the group according to equation (2), by substituting $\hat{A}$ for $\hat{A}_{Gr}$.

Usually, heterogeneity of responses is obviated and just the mean opinion is analyzed. Here we propose some indexes to deal with heterogeneity among different group of decision agents and performances of the alternatives, and improve the decision process:

- Relative Global Agreement Index (RGA) among different groups of decision agents in a node, defined as:

(4)
$$RGA = \frac{G}{\sum_{\forall g}\left(\frac{\sum_{i=1}^{n}\frac{\left|\omega_{L(i),g}-\omega_{L(i),m}\right|}{\omega_{L(i),m}}}{n}\right)}$$

where $G$ is the number of decision groups, $g$ is a particular decision group, $\omega_{L(i),g}$ is the mean local priority of the $i$ element with respect to its parent node for the $g$ group, $\omega_{L(i),m}$ is the mean local priority of the $i$ element for the G groups and $n$ is the number of child sub-nodes or alternatives of the node. It is a measure of the variance of the opinions of individual groups with respect to the mean of all groups. The greater the RGA Index in a node, the greater the consensus among all groups.

- Relative Similarity of Performance Index (RSP) in a node, defined as:

(5)
$$RSP = \frac{1}{\left(\frac{\sum_{i=1}^{n}\frac{\left|\omega_{L(i),m}-\omega_{h(n)}\right|}{\omega_{h(n)}}}{n}\right)}$$

where $\omega_{h(n)} = 1/n$, being $\omega_{h(n)}$ the hypothetical totally uniform priorities in the node. It is a measure of the uniformity of the importance of the elements depending on the node according to the mean opinion of all the decision groups. The greater the RSP Index, the more similar the performances of the elements.

Series of RGA (RSP) Indexes, including aforesaid local priorities and final priorities all together, which will be defined in the next section, have been segmented in three divisions by means of the percentiles $P_{1/3}^{RGA}$ and $P_{2/3}^{RGA}$ ($P_{1/3}^{RSP}$ and $P_{2/3}^{RSP}$), defining the low, medium and high agreement (similarity) degrees. It is very important to underline that these segments are exclusive and different for every AHP model and they are used to cluster agreement and similarity in relative terms, that is, according to the assessment of all the nodes for a particular AHP model.

In our case study, tests were conducted on 20 experts in the analyzed olive-producing systems, on the basis of in-depth personal interviews. Experts were prestigious scientists mainly from Universities and Research Centers of Andalusia. Scientists instead of other stakeholders (farmers, consumers, policy makers, etc.) were chosen due to the scientific and technical nature of the criteria. Moreover, when lack of available information is the rule, as it is the case, experts' methods can be the unique alternative to make a decision in a reasonable period. Results obtained with AHP usually corroborate those obtained with other more time and resource consuming methods (Forman and Selly, 2001). Experts have been clustered into three types – organic, integrated and conventional – according to their professional relationship with a particular growing technique, to test the hypothesis that their opinions are related to their professional field of interest. In any case, experts were compelled to avoid subjective opinions and to think in the best options for society as a whole. An analysis of individual judgments have been avoided because each expert usually just responds to the issues s/he have reliable knowledge but not the rest. Our objective was to have judgments of at least 3 experts in all the nodes of the hierarchy for each type of experts: finally 8 conventional, 4 organic and 8 integrated experts were interviewed. The judgments of every type of experts have been aggregated using the geometric mean method (Eq. 3). In a similar way, the mean opinion of the three types of experts has been calculated as: $(a_{i,j})_m = \sqrt[G]{\prod_{g=1}^{G} (a_{i,j})_g}$, where $(a_{i,j})_g$ is the judgment of the group $g$ and $G$ is the total number of groups (in our application, G=3).

### *2.4. Synthesis of priorities*

Finally, alternatives must be prioritized, that is, ranked, on the basis of their performance with respect to the goal (global priorities, $\omega_{G(Aa)}$) or any intermediate node of the decision hierarchy (final priorities, $\omega_{F(Aa)}$) by weighted addition of the elements depending on it (see e.g. Saaty, 1994). In a similar way than for local priorities, it is possible to calculate RGA and RSP Indexes for the global or final priorities of alternatives in a node just by substituting $\omega_L$ for $\omega_G$ or $\omega_F$, respectively, on Eq. 4 and 5.

## 3 Results and discussion: performances of the olive systems

### *3.1. Global performances*

As shown in Table 1, at the goal level the three types of experts strongly agree (columns 7-8, RGA Index=18.11, Agreement degree=High) that the three alternative olive farming systems have a similar performance (columns 11-12, RSP Index=16.85, Similarity degree=High). However, organic olive-growing system stands out slightly as being a better overall agricultural system according to the mean opinion of the three types of experts (columns 2-4, $\omega_G$=0.363), followed by integrated one (0.333), and the conventional system being the worst option (0.304). Otherwise, the four main objectives of the model have a similar importance according to experts, that is, their similarity degree is high (columns 9-10, RSP Index=17.24, Similarity degree=High): local weights, $\omega_L$, of economic, environmental and technical criteria, in this order, are 0.269, 0.257, 0.253 and 0.221 (column 1, level 2). Moreover, there is a high degree of agreement among the experts regarding this issue (columns 5-6, RGA Index=18.67, Agreement degree=High).

### *3.2. Performances in the main criteria and the sub-criteria*

In the Figure 2 some information of the Table 1 has been summarized. The local priorities of the four main objectives are represented by the vertical bars above the name of the objective according to the left scale of the figure. The dashed lines at the top indicate the final priorities of the alternatives with respect to each objective, as well as global priorities of the alternatives with respect to the goal, according to the right scale. The organic olive system seems to be superior to the other two other alternatives in the four main objectives of the model and therefore at the goal level, always according to the mean opinions of the experts. The integrated farming system ranks second in the goal level and it is superior to the conventional system in all the main objectives with the exception of sociocultural ones where conventional system is superior.

With respect to the agreement among experts about the performances of the olive systems it is possible to highlight that the environmental objectives are the more conflictive items, with a low agreement degree in this criterion and, moreover, low or medium in its subcriteria (Table 1, columns 7-8). This divergence of opinions is in line with contradictory empirical evidence (Hansen et al., 2001). Also in the environmental sub-criteria are detected the more different performances of the three farming systems (columns 11-12). Moreover, in these issues is where the bias of the experts' opinions toward the techniques they are professionally linked with, appears more clearly. As an example, in the Figure 3 are shown the performances of the three farming systems according to the opinions of the three groups of experts. It can be observed that the organic experts valued organic olive alternative very positively and much higher than the integrated and conventional options. The integrated group, on the other hand, ranked the integrated olive system highest, followed by the organic option and then the conventional system. The opinion expressed by the conventional experts was similar to that of the organic experts but more restrained. However, despite the differences in opinion, they all appear to consider conventional olive-growing techniques as the least appropriate option to achieve the environmental objectives set. The superior environmental performance of the organic over conventional olive system is in accordance with previous studies (Cobb et al., 1999; Stolze et al., 2000; Pacini et al., 2004). The better environmental performance of organic versus integrated agriculture in Tuscany has been pointed out by Pacini et al. (2003).

With respect to the specific sub-criteria (see columns 2-4 in Table 1), organic olive is the more valuable alternative in almost all of them: income in the medium/long term[4], stability of this income over time and the independence from the supply of external inputs; all technical, sociocultural and environmental sub-criteria with the exception of productivity, compatibility with local sociocultural values and less soil erosion, respectively. Usually, the performance of the integrated olive system is between them of organic and conventional ones and conventional is the worse option. Exceptions to this rule are: autonomy from institutional subsidies, existence of trade and sale opportunities, productivity and compatibility with local sociocultural values where conventional agriculture is the better valued option, and minimization of soil erosion where the integrated olive is the best option.

## 4 Conclusions

A multicriteria comparison of conventional, organic and integrated olive farming has been carried out by implementing AHP on the basis of experts' knowledge. The multi-criteria approach is especially suitable for analyzing the multifunctional role of agricultural systems. AHP has enabled in an easily, intuitive and scientifically sound way the quantification of qualitative, subjective and intangible information in the manner of experts' judgments, and allowed dealing with a complex decision problem such as the multicriteria evaluation of agricultural systems, where lack of specific previous data is the rule. It makes possible a meaningful prioritization of the value of different farming systems. Thus, it is a vast new field of application of AHP, and, on the other hand, AHP is a powerful tool to agricultural economists, policy makers, etc., engaged in the analysis of sustainable farming systems.

[4] According to Lampkin and Padel (1994), income of organic farming in the short/medium term is lower than conventional one. However, authors admit this situation could change in the long term. Otherwise, in the short time, Sánchez Jiménez (1999) obtains a higher income for the organic olive farming with respect to conventional farming.

The suggested procedure for group decision-making enables to effectively capture (1) the relative agreement among different groups of decision agents and (2) the relative similarity of performance of the alternatives. It reveals the more conflictive issues which can be borne in mind to define new areas of interest where more in-depth research would be needed, thus improving the decision process.

In the application of AHP to the assessment of Andalusian olive-growing systems, the use of expert's judgments is justified due to the scientific and technical nature of the analyzed criteria. Moreover, lack or scarcity of 'written' information makes experts' methods a good option if a decision must be taken in a reasonable period and with relatively low consumption of resources.

Results are, in general, in agreement with previous studies when available, usually referring to one of few criteria, and confirm that the organic and integrated olive systems are more valuable than conventional one, thus providing a solid scientific base to endorse institutional and social support regarding the promotion and implementation of these farming systems in this region and cultivation. However, as it was hypothesized, a slight bias in the experts' opinions toward the type of farming to which they are professionally linked has been detected especially in the environmental topics, which are the more conflictive and where a more in-depth research should be carried out.

Quantification of the global performances of the three farming systems enables us to state that the value, in the average conditions of Andalusia, of the organic and integrated olive-growing systems are, respectively, 19% and 10% higher than the conventional system[5]. These figures could be an approximation to the true total economic value of these olive-farming systems for society as a whole, including for economic, technical, sociocultural and environmental services, and could serve as a guide to estimate fair levels of compensation that society owes olive-farmers who cultivate according to these more sustainable types of agriculture.

[5] These percentages are calculated on the basis of the aforesaid global performances, $\omega_G$, of the three farming systems according to the mean opinion of three types of experts (see section 3.1).

**5 References**

CEE, 1996. Declaración de Cork: un medio rural con vida. European Conference on Rural Development. 9 November.

Cobb, D., Feber, R., Hopkins, A., Stockdale, L., O'Riordan, T., Clements, B., Firbank, L., Goulding, K., Jarvis, S., Macdonald, D., 1999. Integrating the environmental and economic consequences of converting to organic agriculture: evidence from a case study. Land Use Policy 16, 207–221.

Forman, E., Saaty, T.L., Selly, M.A., Waldron, R., 1983. Expert Choice. Decision Support Software. McLean, VA.

Forman, E., Selly, M.A., 2001. Decisions by objectives. Expert Choice Inc. Available at: http://www.expertchoice.com.

Hansen, B., Alrøe, H.F., Kristensen, E.S, 2001. Approaches to assess the environmental impact of organic farming with particular regard to Denmark. Agriculture, Ecosystems and Environment 83, 11–26.

Hernández, A., Cardells, F., 1999. Aplicación del método de las jerarquías analíticas a la valoración del uso recreativo de los espacios naturales de Canarias. Available at: http://www.gobcan.es/ medioambiente/revista/1999/13/61/index.html.

Lampkin, N., Padel, S. (Eds.), 1994. The Economics of Organic Farming. CAB International, Wallingford.

Pacini, C., Wossink, A., Giesen, G., Huirne, R., 2004. Ecological-economic modelling to support multi-objective policy making: a farming systems approach implemented for Tuscany. Agriculture, Ecosystems and Environment 102, 349–364.

Pacini, C., Wossink, A., Giesen, G., Vazzana, C., Huirne, R., 2003. Evaluation of sustainability of organic, integrated and conventional farming systems: a farm and field-scale analysis. Agriculture, Ecosystems and Environment 95, 273–288.

Ramanathan, R., Ganesh, L.S., 1994. Group Preference Aggregation Methods employed in AHP: An Evaluation and an Intrinsic Process for Deriving Member's Weightages. European Journal of Operational Research 79, 249-265.

Saaty, T.L., 1977. A Scaling Method for Priorities in Hierarchical Structures. Journal of Mathematical Psychology 15, 234-281.

Saaty, T.L., 1980. The Analytic Hierarchy Process. McGraw Hill, New York. Pittsburgh (Reprinted in 1996 by RWS Publications).

Saaty, T.L., 1994. The Fundamentals of Decision Making and Priority Theory with the Analytic Hierarchy Process. Vol. VI, AHP Series, RWS Publications.

Sánchez Jiménez, S., 1999. El control de costes en el cultivo del olivar. PhD dissertation, Dept. of Business Administration, University of Jaen, Spain.

Stolze, M., Piorr, A., Häring, A., Dabbert, S., 2000. The environmental impact of organic farming in Europe. Organic Farming in Europe: Economics and Policy, Vol. 6. University of Hohenheim, Germany.

Woodward, L., Stolton, S., Dudley, N. (Eds.), 1989. Calidad de los alimentos: conceptos y metodología. Proceedings of Elm Farm and University of Kassel Meeting. SEAE - Sociedad Española de Agricultura Ecológica, 50 pp.

# FIGURES

## Figure 1. AHP Model for the Multifunctional Comparison of the Olive-Growing Systems

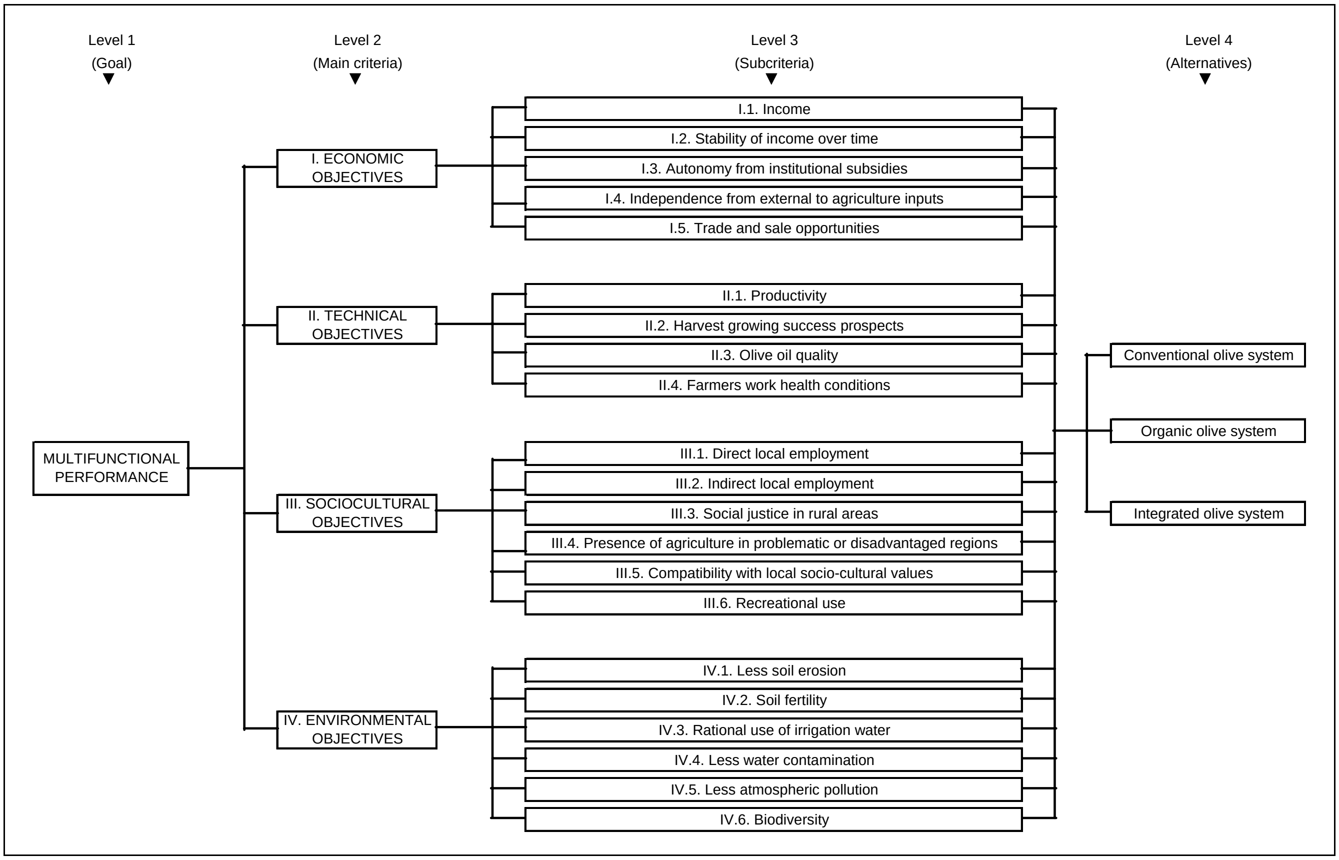


**Figure 2. Performances of the Olive Systems at the Four Main Objectives and Goal**

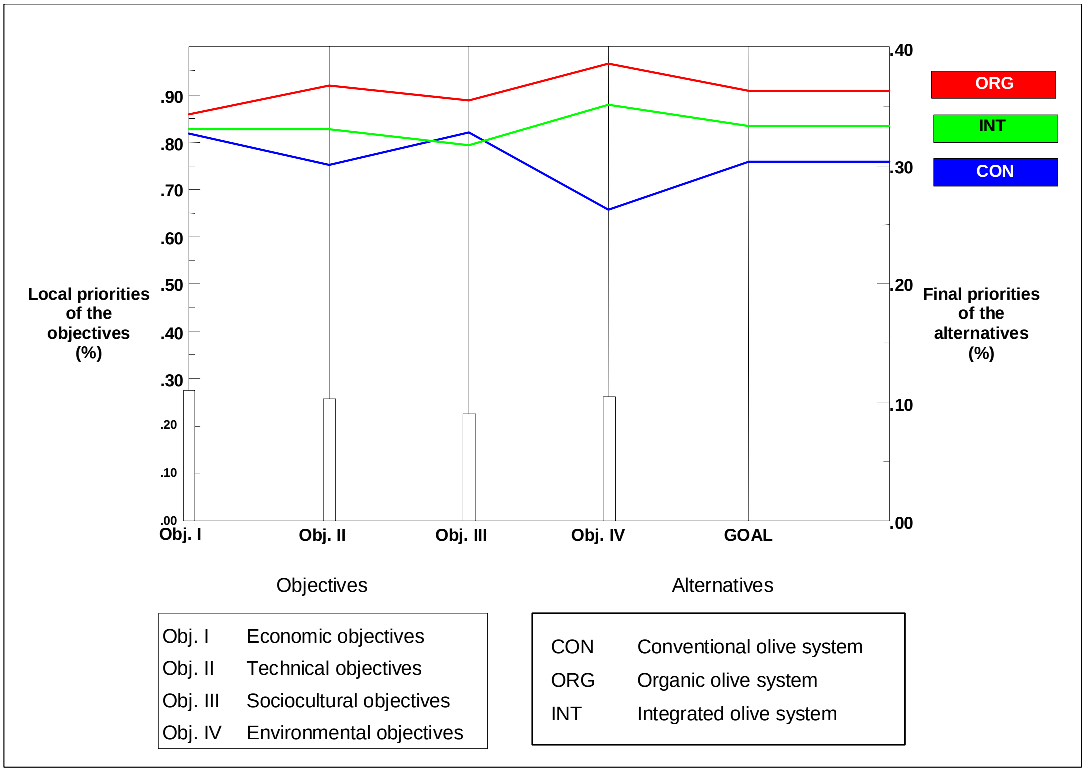
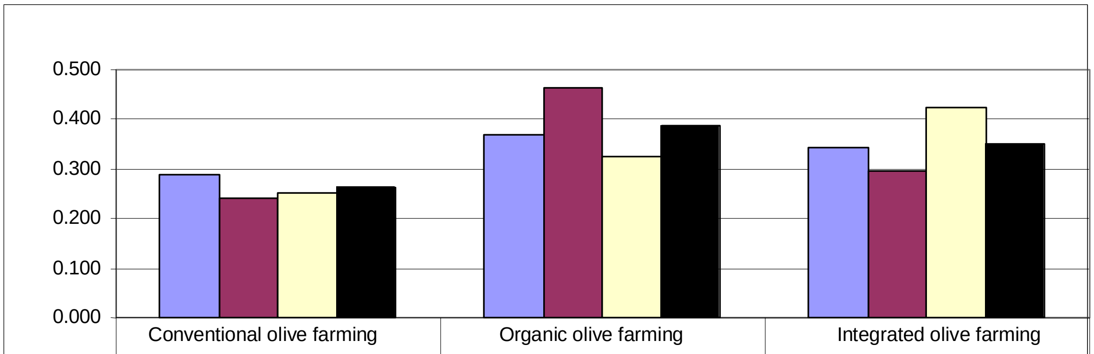


**Figure 3. Final Priorities of the Alternatives with respect to the Environmental Sub-Objectives for Every Group of Experts**




| | Conventional olive farming | Organic olive farming | Integrated olive farming |
|---|---|---|---|
| ConExp | 0.290 | 0.367 | 0.342 |
| OrgExp | 0.241 | 0.463 | 0.295 |
| IntExp | 0.253 | 0.324 | 0.423 |
| Mean | 0.262 | 0.386 | 0.352 |

*ConExp = Conventional experts; OrgExp = Organic experts; IntExp = Integrated experts; Mean = Mean of the three groups.*

# TABLES

## Table 1. Priorities in All the Nodes of the AHP Olive Model and Agreement and Similarity Indicators

| Nodes of the AHP model | Local priorities of nodes* | Final priorities of alternatives* | | | Agreement among experts | | | | Similarity of performance | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 1<br>Level 2<br>Level 3 | Level 1<br>Level 2<br>Level 3 | Conventional olive system | Organic olive system | Integrated olive system | Local priorities of nodes | | Final priorities of alternatives | | Local priorities of nodes | | Final priorities of alternatives | |
| | | | | | RGA Index | Agreement degree | RGA Index | Agreement degree | RSP Index | Similarity degree | RSP Index | Similarity degree |
| (Column number) | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Goal | 1.000 | 0.304 | 0.363 | 0.333 | 18.67 | ••• | 18.11 | ••• | 17.24 | ••• | 16.85 | ••• |
| I. Economic objectives | 0.269 | 0.327 | 0.343 | 0.330 | 12.88 | •• | 27.55 | ••• | 14.71 | •• | 51.72 | ••• |
| I. 1. Income | 0.216 | 0.314 | 0.347 | 0.339 | n/a | n/a | 20.79 | ••• | n/a | n/a | 26.55 | ••• |
| I. 2. Stability of income over time | 0.200 | 0.305 | 0.369 | 0.326 | n/a | n/a | 15.65 | •• | n/a | n/a | 14.02 | •• |
| I. 3. Autonomy from institutional subsidies | 0.218 | 0.376 | 0.280 | 0.344 | n/a | n/a | 46.98 | ••• | n/a | n/a | 9.46 | •• |
| I. 4. Independence from external to agriculture inputs | 0.168 | 0.276 | 0.405 | 0.319 | n/a | n/a | 26.71 | ••• | n/a | n/a | 6.98 | • |
| I. 5. Trade and sale opportunities | 0.198 | 0.351 | 0.331 | 0.318 | n/a | n/a | 8.90 | • | n/a | n/a | 28.30 | ••• |
| II. Technical objectives | 0.253 | 0.301 | 0.368 | 0.331 | 8.79 | • | 15.90 | •• | 17.54 | ••• | 14.42 | •• |
| II. 1. Productivity | 0.226 | 0.363 | 0.292 | 0.345 | n/a | n/a | 37.69 | ••• | n/a | n/a | 12.10 | •• |
| II. 2. Harvest growing success prospects | 0.262 | 0.321 | 0.350 | 0.329 | n/a | n/a | 19.69 | ••• | n/a | n/a | 29.13 | ••• |
| II. 3. Olive oil quality | 0.245 | 0.287 | 0.389 | 0.324 | n/a | n/a | 8.84 | • | n/a | n/a | 9.06 | •• |
| II. 4. Farmers work health conditions | 0.267 | 0.241 | 0.432 | 0.327 | n/a | n/a | 11.04 | •• | n/a | n/a | 5.07 | • |
| III. Sociocultural objectives | 0.221 | 0.328 | 0.355 | 0.317 | 34.89 | ••• | 27.78 | ••• | 12.82 | •• | 23.08 | ••• |
| III. 1. Direct local employment | 0.184 | 0.327 | 0.357 | 0.316 | n/a | n/a | 15.31 | •• | n/a | n/a | 20.69 | ••• |
| III. 2. Indirect local employment | 0.166 | 0.316 | 0.366 | 0.318 | n/a | n/a | 14.20 | •• | n/a | n/a | 15.31 | ••• |
| III. 3. Social justice in rural areas | 0.173 | 0.329 | 0.340 | 0.331 | n/a | n/a | 32.06 | ••• | n/a | n/a | 75.00 | ••• |
| III. 4. Presence of agricult. in disadvantaged regions | 0.182 | 0.282 | 0.396 | 0.322 | n/a | n/a | 14.10 | •• | n/a | n/a | 7.98 | • |
| III. 5. Compatibility with local socio-cultural values | 0.151 | 0.422 | 0.285 | 0.293 | n/a | n/a | 6.35 | • | n/a | n/a | 5.64 | • |
| III. 6. Recreational use | 0.144 | 0.301 | 0.376 | 0.323 | n/a | n/a | 13.95 | •• | n/a | n/a | 11.72 | •• |
| IV. Environmental objectives | 0.257 | 0.262 | 0.386 | 0.352 | 8.70 | • | 8.80 | • | 5.78 | • | 7.01 | • |
| IV. 1. Less soil erosion | 0.234 | 0.267 | 0.334 | 0.399 | n/a | n/a | 6.86 | • | n/a | n/a | 7.54 | • |
| IV. 2. Soil fertility | 0.173 | 0.287 | 0.367 | 0.346 | n/a | n/a | 4.59 | • | n/a | n/a | 10.91 | •• |
| IV. 3. Rational use of irrigation water | 0.127 | 0.287 | 0.367 | 0.346 | n/a | n/a | 8.70 | • | n/a | n/a | 10.79 | •• |
| IV. 4. Less water contamination | 0.179 | 0.237 | 0.429 | 0.334 | n/a | n/a | 8.26 | • | n/a | n/a | 5.19 | • |
| IV. 5. Less atmospheric pollution | 0.125 | 0.252 | 0.421 | 0.327 | n/a | n/a | 10.53 | •• | n/a | n/a | 5.70 | • |
| IV. 6. Biodiversity | 0.162 | 0.262 | 0.386 | 0.352 | n/a | n/a | 12.28 | •• | n/a | n/a | 5.61 | • |

**According to the mean opinion of the three types of experts*
*••• = High; •• = Medium; • = Low ; n/a = Not applicable*
*Limits for the segmentation of RGA and RSP Indexes:* $P_{1/3}^{RGA} = 8.90$; $P_{2/3}^{RGA} = 15.90$; $P_{1/3}^{RSP} = 7.98$; $P_{2/3}^{RSP} = 14.71$.