IMPLEMENTING AGRICULTURAL POLICIES FOR SUSTAINABLE DEVELOPMENT AND THE INTEGRATION OF IMMIGRANT WORKERS: AN APPLICATION OF MCA TO THE CASE OF TWO SOUTHERN ITALIAN PROVINCES

JEL classification: Q18, Q56, C65

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Abstract. *The main purpose of this paper is to consider suitable instruments of agricultural policy and to identify optimal combinations of such measures to pursue the complex target of sustainable development in a context of binding public budget constraints. To this end, we carry out an application of Multi-Criteria Analysis (MCA). The results show that a relatively small (but by no means negligible) weight is ascribed to environmental protection with respect to other intermediate targets (farm competitiveness and integration of immigrants). High importance is given to the measures of "Technical and professional education" and "Subsidies to technological innovation" by all types of stakeholder in any of the aggregation procedures considered. Concerning the target of "Immigrants' integration", panelists indicate "Technical and professional education" first, and then "General education" and "Housing policies" as the most important instruments. Our investigation seems to confirm how important is the issue of immigrants' integration and employment for the present and the future of Italian agriculture: immigrants may constitute a unique option for development, provided that policy makers are able to design suitable actions to promote not only economic incentives for their participation but also acceptable living conditions, in order really to foster social and cultural inclusion of immigrants and their families. Indeed, in a rural context, only when the economic and social dimensions are strictly connected, is it possible to plan improvements in farm productivity, economic growth and sustainable development.*

Keywords: *agricultural policy, sustainability, migrant workers, MCA*

1. Introduction

The main purpose of this paper is to consider suitable agricultural policy instruments and identify optimal combinations of such instruments to pursue the complex target of *sustainable development* in the context of binding public budget constraints. To this end, we adopt an integrated definition of sustainable development, including a variety of economic, social and environmental dimensions, together with an inter-generational rule imposing compatibility and time-consistency of private and public agents' choices.

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Dealing with agricultural policies, we stress the meaning of sustainability, especially in terms of two specific aspects: socio-economic inclusion of immigrant workers and the competitiveness of the agricultural sector. In the case of Italian agriculture, an adequate deployment of the immigrant work-force appears a strategic factor for the future growth of the sector. In this perspective, it seems appropriate to consider the immigrant workforce more as an important resource to be drawn on than as a welfare or public security problem to be dealt with[1]. For example, considering that one of the main deficiencies of Italian agriculture concerns the average size of farms, relatively small because of the predominance of family-run businesses, it can be argued that the workforce supplied by qualified, motivated, and young immigrants may represent a solution for an upgrade in size and a reorganization of the production process. Another weakness is connected with the mean age of producers and managers: the prevalence of elderly agricultural entrepreneurs calls for a significant turnover, but this is hindered by the shortage of a (large enough) cohort of young native farmers. Again, immigrants may offer an interesting solution by filling these gaps, provided that policy makers are willing and able to design policy actions to promote economic incentives and good conditions for fostering social and cultural inclusion for immigrants and their families.

Policies in favour of migrant workers should firstly aim at promoting more stability in agricultural employment by introducing and encouraging less fragmentary contracts, and by combating the underestimation of immigrants' abilities and level of instruction which involve serious loss of skill. As regards incentives to encourage immigrant entrepreneurship in agriculture, credit facilities and public subsidies to support long-run investments appear to be strategic options to be carefully considered. But policy makers must also be aware that alongside strictly economic measures, social measures aimed at the integration of immigrants are also important. Education policies, housing policies and health assistance are among the main kinds of intervention suitable for combating social exclusion and discrimination. Public involvement in support of the social and psychological conditions of immigrants is not only related to the responsibility of modern welfare but has strong economic implications. Indeed, in a fragile context like the rural one, the integration of immigrants and social cohesion are essential requirements for an effective planning of economic growth.

Typically, when seeking to implement policy measures targeting different goals, with a restricted set of available tools and under strong budget constraints, policy makers face complex multidimensional problems with difficult solutions. In this paper, with reference to a specific case of two provinces of Southern Italy, we carry out an application of Multi-Criteria Analysis (MCA), a methodology possibly to be used to deal with these problems. MCA is a set of techniques developed for decision making, based on identification and comparison of possible solutions to a complex problem. Usually, the decision maker is called to make choices in the presence of multiple instances coming from economic agents, society, lobbies and other stakeholders, and scarcity of resources. In the attempt to find the best solution, MCA aggregates groups of variables generating aggregate indicators able to reduce the dimension of the original problem. Making use of MCA, a case study for two provinces of Southern Italy (Benevento and Salerno, in the Campania region) will be illustrated. The case study, starting from the stakeholders' preferences on possible goals and tools of policy action, will try to achieve an appropriate solution in terms of relative budget allocation among the possible policy actions (i.e. how much to use an instrument for any given target).

[1] This is the stance of many authoritative observers. See for example INEA (2009).

After this brief introduction, section 2 illustrates the aim and main features of the MCA approach used in the following sections. Section 3 analyses more deeply the structure of the problem and the solution proposed by the Analytical Hierarchy Process (AHP), a well known technique which uses the MCA approach. Section 4 gives an account of the presence of immigrants employed in agriculture in the two selected provinces and provides a short report on their conditions and degree of integration. Section 5 analyses responses to the interviews conducted within a sample of stakeholders, considering their preferences on policy goals and actions to foster sustainable development. Finally, section 6 summarizes the main conclusions of the paper.

2. Multi-Criteria Analysis (MCA) for economic policy

When considering the presence of migrant workers in agriculture, there are at least two different possible spheres for public intervention. The first concerns policy measures designed to foster immigrants' integration and advancement in skills; the second is relevant for the promotion of competition and growth of the agricultural sector, taking into account the positive externalities exerted on the whole economy, the environment and the rural world. As is well known, budget constraints on policies have become more and more binding in recent years. This has imposed a strong need for parsimonious policy measures, to be carried out by privileging the targets most preferred by stakeholders and choosing the most efficient set of instruments to achieve those targets. Economic theory supplies well known (but somehow disputable) solutions to both problems. To select the best instruments to reach the targets, economists build up econometric models to estimate the model parameters and forecast the effects of instruments on targets. As is known, the reliability of this approach is hampered by the so-called Lucas critique which questions the parameters' property of policy invariance. Secondly, the econometric approach is in any case weak when policies are implemented in novel contexts with little previous experience, which makes it impossible to obtain a sound estimate of the effect of public intervention on economic and social variables. The problem of target selection is even harsher. Since no objective evaluations can be made on the relevance to public interest of each selected target, the assessment is conducted through several different methods based on disclosure of stakeholders' preferences. The revelation of actual preferences by stakeholders and the definition of a ranking rule remain, however, serious problems for the application of these techniques.

These problems are faced in this paper by resorting to an alternative approach, Multi-Criteria Analysis (henceforth MCA), a tool for decision-making used initially in the 70's and significantly improved in the following decades[2]. MCA is based on the comparison of different possible solutions to a complex multidimensional problem taking into account stakeholders' preferences, benefits and costs. A remarkable advantage of MCA is that it forces researchers and policy makers to set up the problem within an explicit formal framework. This helps to understand and consider more carefully even minor aspects of the problem and thus to carry out better medium- and long-run planning. Another advantage of using the MCA approach consists in the possibility of adopting a truly interdisciplinary view, as MCA methodology allows economic, social and

[2] For an introduction to MCA, see for example Vincke (1992), Finlay (1994) and Roy and Mousseau (1996). A comprehensive review is in Figueira *et al.* (2005).

environmental aspects of the problem to be addressed to be dealt with simultaneously. Despite these considerable advantages, MCA techniques have not yet found widespread diffusion and application. Nowadays, in many countries, and in Italy as well, political decision-making is still anchored to different criteria, often unfortunately not grounded in a solid and fair evaluation discipline.

In agricultural policy planning, and in general for any kind of policy, MCA might be a good tool to foster communication among planners, politicians, administrators, civil society representatives and other actors involved in the decisional process[3]. The ideal output of MCA should be the best compromise between different needs of different stakeholders, minimizing the distance between the individual optimum and the general optimal solution. Agricultural policy planning should be a good field for application of MCA techniques because: a) several stakeholders are usually involved in the decision process, b) stakeholders have typically different needs and preferences, c) final decisions are negotiated among stakeholders, d) the discussion is explicitly defined around specific themes and objectives. The big challenge in the implementation of MCA resides in the assignment of a specific weight to the single policy tool considering the different intermediate targets and the general goal to be accomplished. This task is performed by reducing the dimension of the problem and aggregating all relevant indicators: MCA produces a vector of weights for each instrument used to achieve intermediate targets and a vector of weights for each intermediate target to define the general goal (in our case sustainable development) as a suitable combination of intermediate targets.

3. A policy for sustainable development: setting up the problem

In this section and the following ones, we focus on a specific case to which an MCA technique known as the Analytical Hierarchy Process (henceforth AHP) is applied. The AHP technique, elaborated by Thomas L. Saaty (1980, 1992), is aimed at establishing a hierarchy among alternatives which would otherwise be non-comparable, by exploiting stakeholders' quantitative and/or qualitative judgments and summarizing the composite information in a single indicator, obtained by weighting elementary indices connected to stakeholders' indications (Saaty e Vargas, 2001 e Figueira *et al.*, 2005). We apply the AHP procedure to a specific case regarding two provinces of Southern Italy: Benevento and Salerno. The interest in these provinces stems from the high relative importance of the agricultural sector in the local economy and the noteworthy presence of immigrant workers in the labor force[4].

The theoretical experiment of the paper lies in the attempt to design policy intervention aiming at the general purpose of promoting sustainable development of agriculture in the two selected areas based on three intermediate goals: a) farm competitiveness, b) environmental sustainability and c) social and economic integration of immigrant workers and their families. The application is carried out following the standard steps of the AHP procedure:

1. The first step consists in building the hierarchy process. The hierarchy is defined on three levels: General goal, Intermediate targets and Policy instruments, as shown in Figure 1.
2. The second step consists in the definition of the intermediate targets, which contribute to

[3] On MCA and agricultural policy, see van Mansvelt (1997), Roseland (2000) and von Wirèn-Lehr (2001). For a specific focus on land planning decisions in Italy, see Fusco Girard e Nijkamp (2005).

[4] See section 4 for a short description of agriculture in Benevento and Salerno provinces.

the general goal with (possibly) different weights. These latter are derived from stakeholders' judgments on their relative importance.

3. The third step consists in the assignment of weights to the policy instruments reflecting their perceived effectiveness on intermediate targets.
4. The last step consists in specifying the aggregation function needed to reach the best output, i.e., final decision (in our case the best combination of measures to reach intermediate targets and the choice of targets most representative of public interest).

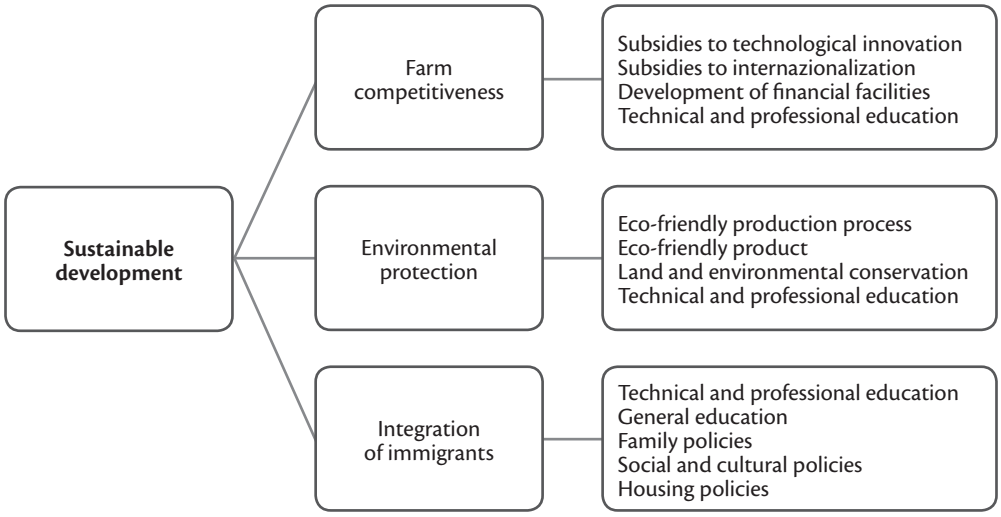
Figure 1 depicts the structure of the hierarchy i.e. the general goal, intermediate targets and a set of policy instruments for each target[5]. The notion of sustainable development is naturally articulated in three (non-exclusive) proposed targets, i.e. farm competitiveness, environmental protection and integration of immigrants. Farm competitiveness is a crucial factor for the development and growth of the agricultural sector. Environmental protection is critical for the well-being of the population, commercial penetration on agribusiness markets (considering the increasing demand for eco-friendly products), the process of integration of immigrants and land conservation. Finally, integration of immigrants is a major challenge for agriculture: integrated migrant workers are strictly needed for a valuable contribution to guarantee growth rates comparable to those of recent decades.

Likewise, for each of the intermediate targets, a set of policy instruments has been selected (again, these are to be taken as only some of all the potential actions that could be adopted). In greater detail, for farm competitiveness we consider the following instruments: i) subsidies to technological innovation; ii) subsidies to internationalization; iii) development of financial facilities; iv) support to technical and professional education. Regarding the target of environmental sustainability, the selected policy actions are: i) subsidies to the adoption of eco-friendly production processes, ii) subsidies to the production of eco-friendly goods and services; iii) measures for land and environmental conservation; iv) support to technical and professional education. Finally, concerning the social and economic integration of immigrant workers and their families, the selected measures are: i) support to technical and professional education; ii) support to general education of workers and their families; iii) family policies in favour of immigrants (such as access to the national health system, counselling, child care, etc.); iv) social and cultural policies (sport, culture, social activities); v) housing and anti-segregation policies.

Figure 1 is a representation of steps 1 and 2 above. Step 3 consists in the assignment of weights to intermediate targets and policy instruments. The procedure for the assignment of weights starts from the preferences as expressed by a selected panel group. Information collected from the interviews has enabled first of all the building of a vector of weights for each of the interviewed actors, secondly, thanks to an aggregation procedure, an overall vector of weights and finally a ranking for policy instruments. However, there are at least three preliminary issues to be addressed: 1) How to choose panelists? 2) How to determine individual weights? and 3) How to determine aggregate weights?

[5] In the MCA terminology, intermediate targets and policy instruments are indicated respectively as "choice criteria" and "alternatives".

Fig. 1 - MCA General goal, intermediate targets and policy instruments



Concerning the first question, we have chosen as members of the panel stakeholders and decision makers (farmers, immigrant farm workers, representatives of labor unions and trade associations, local politicians and researchers)[6]. Secondly, in order to determine individual weights we resort to the AHP technique. Following this procedure, each panelist assigns a value of importance to one policy instrument compared with another through a pairwise comparison expressed either as a verbal judgment (instruments A and B are considered indifferent; A is barely/appreciably/greatly preferred to B or vice versa) or a quantitative assessment. The answers are then elaborated to build up a frame like the one shown in Table 1, where preferences are alternatively expressed in terms of verbal judgments and values of importance (1 standing for indifference and 9 for absolute dominance).

Tab. 1 - Scale of pairwise comparisons

Definition	Intensity of importance	Explanation
Equal importance	1	Two elements contribute equally to the general objective
Moderate importance	3	Experience and judgment slightly favour one element over another
Strong importance	5	Experience and judgment strongly favour one element over another
Very strong importance	7	One element is favoured very strongly over another
Extreme importance	9	The evidence favouring one element over another is of the highest possible order of affirmation

Intensities of 2, 4, 6, and 8 can be used to express intermediate values. Intensities 1.1, 1.2, 1.3, etc. can be used for elements that are very close in importance.

[6] Precisely, the panel is formed by 7 farm owners, 1 agribusiness entrepreneur, 2 managers, 3 labor union representatives, 1 local politician, 2 researchers specialized in agricultural economics, 4 immigrant workers. The questionnaire and the list of the names of the 20 panelists are available on request.

To define individual weights, starting from panelists' judgments, it is possible to build the Pairwise Comparison Matrix (PCM), which, in our case, has a number of rows and columns equal to the number of policy instruments (or intermediate targets). For example, if the policy instrument 2 is strongly preferred to the instrument 3, in the cell (row 2, column 3) of the PCM the number 5 will appear; if the intermediate target 4 very strongly dominates target 1, in the cell (row 1, column 4) of the PCM the number 1/7 will appear and so forth.

Once the PCM has been obtained in this way, weights are determined by the values of the eigenvector associated with the maximum eigenvalue of the matrix. In the presence of many instruments (or intermediate targets), it is necessary to test the consistency of pairwise comparisons through the Saaty Consistency Index

$$CI = \frac{(\alpha_{max} - n)}{(n - 1)}$$

where α_{max} is the higher eigenvalue of PCM and n is the matrix dimension. By construction, the Consistency Index is such that:

$$0 \leq CI \leq 1$$

where higher values of ***CI*** indicate lower consistency. According to Saaty, $CI = 0.1$ is the threshold over which consistency is not sufficient.

Finally, once individual weights have been obtained, to achieve aggregate weights, an aggregation procedure has to be applied. In our case, the aggregation is carried out by computing a weighted average adjusted by individual weights. To this purpose, considering a single panelist, let us denote w_{ij} the weight given to instrument i to achieve the intermediate target j and W_j the weight given to the intermediate target j to reach the general goal (sustainable development). This implies that the products $w_{ij}W_j$ represent the weights that each panelist assigns to each policy instrument to achieve the general goal. Each policy instrument weight is therefore calculated as the average

$$\omega_i = \frac{1}{\mathrm{m}} \sum\nolimits_{\mathrm{k}} \rho^k w_{ij}^k W_j^k$$

where $\boldsymbol{m}$ is the number of panelists, $\boldsymbol{k}$ is the panelist indicator and ρ^k is a weight possibly to be assigned to any panelist on the basis of the individual ***CI*** or other factors, as in section 6. Notably, while forcefully $\sum w_{ij} = \sum W_j = \sum w_{ij}W_j = 1$, it may happen that $\sum \omega_i \equiv \omega \neq 1$. In this case the adjustment is made by assigning the value $\omega_i' = \frac{\omega_i}{\omega}$ to aggregate weights.

4. The case studies: the provinces of Benevento and Salerno

It is well known that in the last decade flows of migration have been non-homogeneous over the country as a whole. Even if in the last years before the financial crisis in 2007-2009 a small increase in migration inflows to Southern Italy was recorded, migrants continue to go mainly to the northern regions. Nevertheless, the southern region of Campania has become an important destination for many migrants in recent years. As shown in Table 2, between 2005 and 2010, Campania has registered an impressive increase (+77.4%) in the number of incoming migrants, i.e. from 92,619 to 164,268 persons, which amount to more than one quarter (26.5%) of the

entire number of immigrants located in Southern Italy. Arguably, this enormous increase has been boosted by the recent economic crisis, because of which many migrants who had lost their jobs in the North, have decided to move to alternative (and underpaid) occupations in Campania. This decision is motivated by the presence of a strong shadow economy in the region that, more so than in Northern Italy, may assure an irregular job in the agricultural or other non-manufacturing sectors.

Tab. 2 - Foreign residents in Southern Italy and Campania

Years	2005		2010	
	Units	%	Units	%
Benevento	2.917	3.1	6.202	3.8
Salerno	19.282	20.8	38.082	23.2
Avellino	7.177	7.7	11.257	6.9
Caserta	19.693	21.3	32.784	20.0
Napoli	43.550	47.0	75.943	46.2
Campania	92619	100.0	164.268	100.0
Southern Italy	321.900		618.990	

Source: ISTAT (2011)

The distribution of immigrants in Campania is shown in Table 2. For agriculture, Campania is one of the most important regions in Italy, as it contributes significantly to the total added value of agriculture. It is characterized by intensive farming, and small- and medium-sized farms with family management. The specialization is especially in fruit, vegetables and tobacco production but also livestock, especially buffaloes, and dairy production, labor intensive activities that, very often, resort to migrant workforce as the local labor supply is quantitatively not sufficient and often not motivated to accept a kind of job with unappealing features, i.e. seasonality, short-term and bad working conditions. For these reasons, in the provinces of Campania with a strong agricultural vocation (Caserta, Salerno and Benevento), the immigrant work force exceeds the 54%, as shown in Table 3.

The specialization of national groups in different activities is worthy noting: Indians and Pakistanis are usually employed on livestock farms, especially for buffaloes, concentrated on the coast (Litorale Domizio), Villa Literno in the province of Caserta and Battipaglia in the province of Salerno. Sub-Saharan migrants are frequently employed as day labor in the fruit and vegetable sector (strawberries and tomatoes for example) especially in the Piana del Sele and Agro Nocerino-Sarnese areas in Salerno province, while Moroccans and Albanians are often employed in the tobacco harvest between August and September in Aversa, Marcianise and Capua areas (province of Caserta). In Benevento, a significant presence of immigrants in agriculture is in the Valle Telesina and near the border of the province of Caserta, where a relatively large number of Romanian migrants is employed in oil and wine agribusiness (IOM, 2010). The working conditions, especially in small farms, are usually critical and sometimes totally unacceptable: migrants are required to work seven days per week, without definite working hours, protection and security, for monthly salaries ranging from €300 to €600 (Amnesty International, 2012).

Tab. 3 - Immigrants employed in agriculture with permanent contracts (2010)			
	Employed in agriculture	**Immigrants**	**%**
Benevento	905	124	13.7
Salerno	4.145	691	16.7
Avellino	1.648	76	4.6
Caserta	4.005	968	24.2
Napoli	3.998	268	6.7
Campania	14.701	2.127	14.5
South Italy	73.371	9.282	12.7
Source: ISTAT (2012)			

5. A policy for sustainable development: collection and elaboration of data

This section explains the procedure adopted for data elaboration. The first step has been accomplished by collecting our data through interviews with selected panelists. The proposed questionnaire asks the panelists about a) the estimated relative effectiveness of each policy instrument for reaching the target and b) the perceived relative importance of each intermediate target with respect to the general goal of sustainable development. To express their preferences on measures and targets, panelists are required to distribute a hypothetical budget among different policy instruments and targets[7]. Since preferences are expressed in terms of pairwise options, 22 questions are asked to each panelist. Moreover, to test the consistency of individual and aggregate weights, as a final control question, the interviewee is asked to assign a ranking between 1 and 5 to each policy instrument[8], in a multiple comparison which is subsequently turned into a pairwise comparison, as is later shown. The same procedure is applied to define weights of intermediate targets with respect to the general goal.

The second step consists in the conversion from preferences as expressed by answers to the questionnaire (e.g. A deserves 70% and B 30% of the budget or A has an assessment of 5 and B only 3) to Saaty values of importance (from 1 to 9) as shown in Table 1.

In the first case, we adopt this procedure: defining q as the budget share split between two rival policy instruments, so that $\frac{1}{2} \leq q \leq 1$, each answer has been expressed in values of importance considering alternatively the following transformations:

$$x_1 = \frac{q}{1-q}; \quad x_2 = 10 \log_{10} \frac{q}{1-q}; \quad x_3 = \mathrm{e} * \ln \frac{q}{1-q}; \quad x_4 = 10[q - (1-q)].$$

In this way we obtained Table 4 in which typical q values are reported from each x transformation. As Table 4 shows, the linear transformation x_4 seems to be preferable to the other alternatives because it is the only one a) for which no significant adjustment is required to convert original values into Saaty values (except for $q=0,50$ that is rounded up to 1); b) for which each Saaty value is matched by a typical and unique q (except for unit Saaty value) and c) which tends

[7] Questions are formulated as: "Having a total budget of 100, how would you allocate it among these instruments (targets)?".
[8] Figures between 1 and 5 correspond to items "extremely effective", "very effective", "sufficiently effective", "slightly effective" e "not effective".

to uniformly distribute preferences in Saaty values (for example, the value 8 is assigned to q values included in the interval $0{,}875 \leq q < 0{,}925$, while the value 7 in the interval $0{,}825 \leq q < 0{,}875$; intervals have equal size except for the extreme ones).

Tab. 4 - From budget shares q to Saaty values of importance x

q	x_1	x_2	x_3	x_4
0,95	19,00	12,79	8,00	9,00
0,90	9,00	9,54	5,97	8,00
0,85	5,67	7,53	4,71	7,00
0,80	4,00	6,02	3,77	6,00
0,75	3,00	4,77	2,99	5,00
0,70	2,33	3,68	2,30	4,00
0,65	1,86	2,69	1,68	3,00
0,60	1,50	1,76	1,10	2,00
0,55	1,22	0,87	0,55	1,00
0,50	1,00	0,00	0,00	0,00

Tab. 5.a - Numerical preferences and Saaty values

	5	4	3	2	1
5	1,00	2,25	3,67	5,50	9,00
4		1,00	2,33	4,00	7,00
3			1,00	2,50	5,00
2				1,00	3,00
1					1,00

Tab. 5.b - Numerical preferences and rounded Saaty values

	5	4	3	2	1
5	1,00	2,00	4,00	6,00	9,00
4		1,00	2,00	4,00	7,00
3			1,00	3,00	5,00
2				1,00	3,00
1					1,00

In the second case, the evaluation from 1 to 5 is converted into Saaty values of importance by using the following transformation:

$$\frac{y}{z} + y - z \quad \text{con } y \geq z$$

where y =1,2,3,4,5 and z =1,2,3,4,5 are the original values of preferences for each couple of instruments and targets. Table 5.a shows the Saaty importance values, for each combination of judgments on the relative effectiveness of the instruments. Since in some cases the Saaty values are not integer values, in table 5.b they are rounded to the closest integer. The same procedure is applied with respect to the intermediate targets and the general goal.

It is now possible to build up an individual PCM for each interviewee to work out vectors for weights of a) instruments to pursue intermediate targets and b) intermediate targets to pursue the general goal. Table 6.a gives an example of individual PCM (the one obtained by answers of panelist n.1). Considering in particular the intermediate target "Environmental protection", the panelist n.1 states to distribute the budget a) in two equal shares (50% each) between the instruments "Subsidies in favour of eco-friendly production" and "Subsidies in favour of eco-friendly products"; b) in shares of 60% and 40% between "Subsidies in favour of eco-friendly produc-

tion" and "Land and environment conservation"; in shares of 20% and 80% between "Subsidies in favour of eco-friendly production" and "Technical and professional education"; in shares of 60% and 40% between "Subsidies in favour of eco-friendly products" and "Land and environment conservation"; in shares of 20% and 80% between "Subsidies in favour of eco-friendly products" and "Technical and professional education" and finally in shares of 10% and 90% between "Land and environment conservation" and "Technical and professional education". Following the transformation x_4 (see Table 4), the first option corresponds to the value 1 appearing at first row and second column in Table 6.a; the second option to the value 2 (first row, third column), the third to 1/6 (first row, fourth column) and so on.

Tab. 6.a - Individual PCM from budget shares

1	1	2	1/6
	1	2	1/6
		1	1/8
			1

Tab. 6.b - Individual PCM from numerical evaluations

1	1	5	1/4
	1	5	1/4
		1	1/9
			1

Table 6.b is built up by a similar procedure, considering the evaluations expressed on a 1 to 5 scale. Considering again the answers of panelist n.1, the scores assigned to the instruments are respectively 3 for "Subsidies in favour of eco-friendly production", 3 for "Subsidies in favour of eco-friendly products", 1 for "Land and environment conservation", 5 for "Technical and professional education". From these evaluations, using Table 5.b, the individual PCM illustrated in Table 6.b is obtained.

The values of the eigenvectors associated with the highest eigenvalues for the PCMs reproduced in Tables 6 are reported in columns "Weights 1" and "Weights 2" of Table 7: therefore the first derives from pairwise comparisons expressed in terms of shares of budget to be assigned, while the second stems from a comparison among several alternatives evaluated on a 1 to 5 scale. As a result of the choices made by panelist n.1, he/she attaches weights respectively of 50% to the intermediate target "Farm competitiveness", 25% to "Environmental protection" and 25% to "Integration of immigrants". Likewise, to pursue the target "Farm competitiveness", she/he assigns the highest weight to the instrument "Technical and professional education", between 45.45% (first column) and 46.12% (second column); equal weights, ranging from 24.72% to 25.25%, to the instruments "Subsidies to technological innovation" and "Subsidies to internationalization" and a lower weight to "Development of financial facilities" (between 4.44% and 4.05%). Similarly, the weights given to different instruments to pursue the other intermediate targets "Environmental protection" and "Integration of immigrants" are shown in the lower parts of Table 7.

Finally, Table 7 also shows standard deviation (SD), the Saaty Consistency Index *CI* for the column Weights1 and the correlation index between the two sets of weights. SD gives a measure of the agent's attitude on discrimination among the different policy instruments to reach each target. In column Weights1, SD has an average value around 0.1415. Out of 60 cases, it assumes a value lower than 0.1 in 19 cases and values lower than 0.2 in 43 cases. In column Weights 2, SD takes an average value around 0.1364. Out of 60 cases, it assumes a value lower than 0.1 in 14 cases and values lower than 0.2 in 54 cases. For instruments connected with the intermediate target "Farm competitiveness", SD assumes an average value around 0.1654; out of 40 cases, it

assumes a value lower than 0.1 in 4 cases and values lower than 0.2 in 31 cases. For instruments connected to the intermediate target "Environmental sustainability", SD assumes an average value around 0.1310; out of 40 cases, it assumes a value lower than 0.1 in 15 cases and values lower than 0.2 in 30 cases. Finally, for instruments connected to the intermediate target "Integration of immigrants", SD takes an average value around 0.1204; out of 40 cases, it assumes a value lower than 0.1 in 14 cases and values lower than 0.2 in 36 cases.

The Consistency Index *CI* measures, as mentioned above, the internal consistency of each set of panelist's answers. For example, considering three instruments A, B and C and evaluating 2 the preference for A with respect to B, and 3 the preference for B with respect to C, the preference for A with respect to C should be consistently evaluated 6. In this case, *CI* would assume the lowest value 0, indicating maximal consistency. If instead, the preference for A with respect to C is evaluated 1/6, *CI* would assume the value 0.1. In this investigation, *CI* takes an average value around 0.0731. Out of 60 cases, it assumes values equal to 0 in 11 cases, values lower than 0.05 in 33 cases and lower than 0.1 in 48 cases.

Tab. 7 - Targets, instruments and individual weights (panelist n. 1)

	Intermediate targets and instruments	Weights 1	Weights 2
0.5000	Farm competitiveness		
	Subsidies to technological innovation	0.2472	0.2525
	Subsidies to internationalization	0.2472	0.2525
	Development of financial facilities	0.0444	0.0405
	Technical and professional education	0.4612	0.4545
	Standard Deviation (SD)	0.1702	0.1690
	Consistency Index (CI)	0.0035	
0.2500	Environmental protection		
	Subsidies in favour of eco-friendly production	0.1250	0.1793
	Subsidies in favour of eco-friendly products	0.1250	0.1793
	Land and environment conservation	0.0695	0.0448
	Technical and professional education	0.6806	0.5965
	Standard Deviation (SD)	0.2882	0.2396
	Consistency Index (CI)	0.0069	
0.2500	Integration of immigrants		
	Technical and professional education	0.1194	0.2000
	General education	0.4056	0.4000
	Family policies	0.2259	0.2000
	Social and cultural policies	0.1130	0.1000
	Housing policies	0.1361	0.1000
	Standard Deviation (SD)	0.1236	0.1225
	Consistency Index (CI)	0.0399	
	Linear correlation index (LC) = 0.9752		

Finally, to measure how similar and consistent are preferences coming from pairwise and multilateral comparisons, the correlation coefficient between Weights 1 and Weights 2 is computed. Its value equals 0.9752 for Panelist n. 1 (see Table 7) and is on average equal to 0.7496; out of 20 cases, it assumes values larger than 0.9 in 8 cases, values larger than 0.7 in 13 cases and larger than 0.5 in 19 cases. Thus, on the whole, panelists show a good ability to discriminate among policy instruments and answer in a consistent way. Furthermore, the weights obtained turn out to be robust with respect to the type of comparison adopted[9].

6. A policy for sustainable development: results and main conclusions

The last step of the procedure to determine the role and importance of each instrument for achieving intermediate targets and of each target for pursuing the general goal consists in finding an aggregation function able to synthesize all previous information to get a vector of aggregate preferences. For this purpose, we resort to a simple weighted mean of individual weights. Weighting is made with four different methods, i.e., by considering absolute values, *CI*s, *DS*s and correlation indexes.

The results are summarized in Table 8. In the upper frame, in each of the first four columns, the vector of aggregate weights is reported. This is the final aggregate ranking of targets with respect to the general goal of sustainable development. The last column shows the values of SD computed across rows to measure the variability of weights obtained through different procedures. As mentioned before, columns in Table 8 are derived by different methods of aggregation (i.e. by using different methods to weight individual preferences). In particular, the first two columns in Table 8 (upper frame) come from the column "Weights 1" of Table 7; the third and fourth columns from "Weights 2" in the same Table. The column "Weights 1 (CI)" is constructed by dividing each individual weight by the value *(1 + CI)*, so as to ascribe a greater importance to the answers with a higher degree of consistency[10]. A similar procedure is applied also to columns labeled "Weights 1 (SD)" and "Weights 2 (SD)" where weighting individual preferences is based on individual abilities to discriminate among instruments (those who discriminate more get a higher weight) and takes place by dividing by *(1-SD)*. Lastly, the column "Weights 2 (CL)" is obtained by multiplying weights in table 7 (column labeled "Weights 2") by the linear correlation coefficient so as to recognize a greater weight to panelists more internally consistent (i.e. with answers to pairwise comparisons more consistent with answers to multilateral comparisons).

Finally, in the lower frame of Table 8, the values of aggregate weights of the intermediate targets in fulfilling the general goal of sustainable development are displayed. The first column shows the simple average of individual weights; figures in the second column are averages of individual weights after being divided by *(1+CI);* figures in the third column are averages of individual weights after being divided by *(1-SD)*[11].

[9] The equivalent for other panelists of the data in Table 7 are available on request.

[10] Figures are then normalized by averaging over individuals, and re-proportioning so that the sum of weights amount to 1.

[11] It is worthwhile recalling that the weights of Table 8 are expressed so as to obtain aggregate weights of intermediate targets summing up to 1. From those figures, it is easy to compute the weight of each instrument with respect to any intermediate target by multiplying values in the upper frame by the ones in the lower. For example: the weight of the instrument "Subsidies to technological innovation" to achieve the target "Farm competitiveness" is obtained as the product of the suitable values in the upper and lower frames, according to the chosen weighting procedure.

Summarizing, Table 8 shows the importance assigned to policy instruments (to reach targets) and intermediate targets (to fulfill the general goal) by stakeholder panelists. Even if the panel is relatively small, our experiment may be considered significant, especially considering: a) the adoption of a rigorous method in the elaboration of individual and aggregate preferences; b) the internal consistency emerging from the analysis of Table 8, where weights obtained with different aggregation procedures come out to be definitely steady; c) the relevant policy implications.

Tab. 8 - Targets, instruments and aggregated weights

	Weights 1 CI	Weights 1 SD	Weights 2 LC	Weights 2 SD	SD
Farm competitiveness					
Subsidies to technological innovation	0,109762	0,113178	0,104672	0,104744	0,004146
Subsidies to internationalization	0,068305	0,068905	0,071328	0,072032	0,001815
Development of financial facilities	0,094211	0,097169	0,079924	0,079801	0,009218
Technical and professional education	0,125127	0,1291	0,132445	0,134768	0,004193
Environmental protection					
Subsidies in favour of eco-friendly production	0,050698	0,046767	0,064252	0,062596	0,008659
Subsidies in favour of eco-friendly products	0,043791	0,040408	0,043116	0,041244	0,001579
Land and environment conservation	0,058631	0,054419	0,046073	0,043896	0,006938
Technical and professional education	0,088137	0,088359	0,077218	0,078109	0,006122
Integration of immigrants					
Technical and professional education	0,093518	0,0935	0,095364	0,094554	0,000900
General education	0,076057	0,075171	0,082016	0,081345	0,003532
Family policies	0,074349	0,073417	0,073387	0,072874	0,000614
Social and cultural policies	0,044335	0,043047	0,044914	0,044063	0,000781
Housing policies	0,073083	0,076557	0,085293	0,089976	0,007772
	Simple	**CI**	**SD**		
Farm competitiveness	0,392120	0,397636	0,408564		
Environmental protection	0,231320	0,240824	0,229562		
Integration of immigrants	0,376535	0,361544	0,361872		

The latter point deserves some final comments. First, the intermediate targets we propose for panelists' evaluation receive a positive assessment by all the panelists. In particular, they ascribe a smaller (but by no means negligible) weight to environmental protection with respect to other intermediate targets. Concerning the different kinds of stakeholders included in the panel, one can verify that environmental protection is considered more important by researchers than by other groups, with migrants much less interested in it than in other targets. There is clear evidence of the strong weight granted to the instrument "Technical and professional education" by all kinds of stakeholders in any of the aggregation procedures considered. This instrument is judged to be the most important one for each of the three intermediate tar-

gets, and preferred to welfare policies by immigrants themselves[12]. Similar arguments may be applied to the measures favouring technological innovation. These are highly considered (especially by the entrepreneurs) together with development of financial facilities for farmers. Concerning the target of "Integration of immigrants", panelists indicate as the most important instrument "Technical and professional education", and then "General education" and "Housing policies".

In conclusion, the results of this investigation seem to confirm how important is the issue of immigrants' integration and employment for the present and the future of Italian agriculture. As pointed out in the introduction, immigrants may bring a unique opportunity to the entire agricultural system provided that policy makers are able to design suitable actions to promote not only economic incentives for immigrant participation but also acceptable living conditions truly to foster social and cultural inclusion of immigrants and their families. Beside economic measures, investments on the social side are just as important for immigrant inclusion and modernization of the agricultural system. Education, housing policies, social and cultural promotion, health assistance are only some of the several measures that could be implemented to combat social exclusion and discrimination. In a general perspective, these measures also have a "productive" meaning and are not merely linked to welfare. Indeed, in a rural context, only when the economic and social dimensions are strictly inter-connected is it possible to plan improvements in farm productivity, economic growth and sustainable development.

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[12] It is worth noting that while (as expected) different groups of stakeholders express different preferences on the importance of intermediate targets, they have very homogeneous opinions about the effectiveness of instruments in pursuing intermediate targets.

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