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Using the Ecosystem Services Framework for Policy Impact Analysis: An Application to the Assessment of the Common Agricultural Policy 2014–2020 in the Province of Ferrara (Italy)

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Abstract: The objective of this study is to test a methodology for the classification of areas according to the provision of ecosystem services and for the evaluation of the effects of different agricultural policy scenarios. The evaluation focuses on the different categories of Ecosystem Services (ES) and applies a set of indicators available from secondary data sources. Two scenarios were compared, represented by the pre-2014 CAP and the CAP 2014–2020, based on the measures of the RDP 2014–2020 focused on enhancing ecosystems. The approach was implemented under two weighting solutions. First, we assumed that all indicators have equal weight. As a further step, the framework was integrated with a weighting procedure in order to account for the different importance of the various ES indicators. All municipalities offer a significant number of provisioning and cultural services, mainly connected to recreational opportunities. The indicators with higher importance in the area represent provisioning, supporting and regulating services, while cultural services have received less attention. Comparing the results of the simulation of different policy scenarios, there are no significant differences since the CAP 2014–2020 does not provide for measures likely to affect substantially the overall production of ecosystem services. While this result is plausible, the study confirms the limitations of available secondary data in providing a full account of ecosystem services provision and of their variations as a result of policy.

Keywords: multicriteria evaluation; ecosystem services; policy scenarios; weights; ranking

1. Introduction

An ecosystem is defined as an area, place or environment where organisms interact with the physical and chemical environment. “An ecosystem is a dynamic complex of plant, animal, and microorganism communities and the non-living environment interacting as a functional unit” [1]. The concept of Ecosystem Services (ES) has been used in research since the 1980s. The term involved the framing of beneficial ecosystem functions as services in order to increase public interest in biodiversity conservation [2]. In 2001, the Millennium Ecosystem Assessment (MEA) launched the ES in the global policy agenda. At present, the ES concept has become a central issue in conservation planning and environmental impact assessment [3]. Also, it is increasingly recognized that ES, and the natural assets that produce them, represent a significant contribution to sustainable development [4]. The ES concept is being integrated in current policies at global and European level [5,6]. The global strategic plan for biodiversity for the period 2011–2020 of the Convention of Biological Diversity complements previous conservation biodiversity targets with the addition of ES.

The ability of ecosystems to yield ES is largely connected to biodiversity; many researchers agree about the positive effect of biodiversity on ecosystem functions [7,8]. Biodiversity and agricultural production are connected and their capacity to be mutually supportive is increasingly recognized. On the one hand, maintaining biodiversity makes agricultural production and related practices more sustainable. On the other hand, it is recognized that changing agricultural land use is a major cause of the decline of biodiversity. As a result, the Common Agricultural Policy (CAP) has been reformed in order to meet the Europe 2020 Strategy goals. However, there is scope for further developing a policy framework that considers the most recent research on multidimensional ES and enhance the provision of ES in order to preserve social and cultural landscape values and maintain the multifunctionality of agricultural ecosystems. The rising demand for ES measurement, modelling and monitoring is currently the main driver for development of ES research [9]. Different perspectives are taken to describe the relationships underlying the supply of ES, which representation has been approached using derived land use or land cover data [10,11] experiments [12], expert opinion or modelling [13]. Despite the increase in publications on ecosystem goods and services, a comprehensive framework for integrated assessment and valuation of ES is still missing [14,15]. As a result, the ES concept is currently used in a range of studies with widely differing aims. According to Ash et al. [16] this variety presents a problem for policy makers as well as researchers because it makes it difficult to assess the credibility of assessment results and reduces the comparability of studies. According to Feld et al. [17], despite the great effort to develop indicator systems over the past decade, there is still a considerable gap in the widespread use of indicators for many of the multiple components of ES.

The objective of this paper is to test a methodology for the classification of areas according to the provision of ES and the evaluation of the effects of different agricultural policy scenarios on such classification. The study uses Multi Criteria Decision Analysis (MCDA) as a suitable tool to illustrate the differences in the provision of ES in different case study areas and to verify the possibility of using available secondary data at the municipality level to comparatively assess ES provision. The framework was applied to the classification of the 26 municipalities of the province of Ferrara, a traditional cultural landscape, characterized by agricultural areas and protected areas of natural importance. The novelty of the paper is on two grounds, which also overcome some of the open issues in previous publication of the application of PROMETHEE II for the comparison and ranking of the 26 municipalities based on the selected ES indicators. In particular, differently to [18], this application of the PROMETHEE also uses a weighing approach to reflect the relative preferences of potential decision makers or society. In addition, here the method is used to assess the effects of different policy scenarios on ES production. Altogether, the method in the present study was tested considering two policy scenarios and the classification approach in each of the two scenarios was implemented under two weighting solutions. First, the method was implemented without using weights, i.e., assuming that all indicators have equal weight. As a further step in the analysis, the framework was integrated with a weighting procedure in order to account for the different importance of the various ES indicators.

The structure of this paper is as follows: Section 2 describes the theoretical framework and the proposed methodology. In Section 3, the case study and the data are presented. In Section 4, the PROMETHEE method is applied for the two policy scenarios under different weighting solutions and the results are presented. Section 5, presents a discussion of the results and Section 6 illustrates the conclusions and suggests potential future directions.

2. Materials and Methods

2.1. Choice of the MCDA method PROMETHEE II

The approach used in the present study is based on the outranking method Preference Ranking Organization Methods for Enrichment Evaluations (PROMETHEE II). Outranking approaches have been the most widely used MCDA tools in evaluation and sustainability-related research as reported in various publications [19–21]. PROMETHEE II provides a complete ranking of a discrete set of alternatives, using the concept of net flow [22,23]. A considerable number of applications of the PROMETHEE is available in various fields [24–27]. Regarding ES evaluation, different studies have used ranking approaches as a tool to evaluate ES. Segura et al. [28] applied a PROMETHEE-based method to obtain new composite indicators for provisioning, maintenance and "direct to citizen services". Fontana et al. [29] have used PROMETHEE to compare land use alternatives considering ES as criteria. As well as for supporting decision making through ranking of alternatives, PROMETHEE has also been used to classify regions or areas. Vaillancourt and Waaub [30] used PROMETHEE to rank regions in order to allocate greenhouse gas emission rights. Queiruga et al. [31] applied PROMETHEE to rank municipalities according to their appropriateness for the installation of waste electrical equipment recycling plants. Chatzinikolaou et al. [32] applied PROMETHEE for the comparison and ranking of EU rural areas based on social sustainability indicators. Finally, Chatzinikolaou et al. [18] applied PROMETHEE for the comparison of the 26 municipalities of the province of Ferrara, based on the selected ES indicators.

2.2. PROMETHEE II Modeling Framework

For the implementation of the PROMETHEE II, the procedure proposed by Brans et al. [33] is recommended. The procedure starts by considering the multi-criteria problem (1):

$$Max\{f_1(a), \ldots f_k(a), \backslash a \in K\}, \quad (1)$$

where K is a finite set of actions a, and f_i, $i = 1, \ldots k$, are k criteria to be maximized.

The PROMETHEE methods include two phases, the construction of an outranking relation on K, and the exploitation of this relation in order to provide an answer to (1) [34]. The exploitation of the outranking relation is realised by considering a positive and a negative flow for each action. The preference structure of PROMETHEE is based on pairwise comparisons as follows:

$\mathrm{P(a,b)} = 0$ means indifference between a and b, or no preference of a over b;
$\mathrm{P(a,b)} \sim 0$ means a weak preference of a over b;
$\mathrm{P(a,b)} \sim 1$ means a strong preference of a over b;
$\mathrm{P(a,b)} = 1$ means a strict preference of a over b.

$H(d)$ is an increasing function of the difference d, between the performances of alternatives on each criterion and d is the deviation between the evaluations of two alternatives on each criterion (2) [35]:

$$\mathrm{H(d)} = \begin{cases} \mathrm{P(a,b),\ d \geq 0} \\ \mathrm{P(b,a),\ d \leq 0} \end{cases}, \quad (2)$$

The $H(d)$ function can be of various different forms, depending upon the judgment policy of the decision maker [36,37]. In the present study, the shape of the $H(d)$ function selected is the Gaussian form (3), [38], where d is the difference among the alternatives a and b $[d = f(a) = f(b)]$ and σ is the standard deviation of all differences d. This function requires the determination of σ, which should be defined between q (threshold) and p (strict preference threshold).

$$H(d) = 1 - exp\left\{-d^2/2\sigma^2\right\}, \quad (3)$$

The weights π represent the relative importance of the criteria used, if all criteria are equally important then the value assigned to each of them will be identical [39]. The multicriteria indicator of preference $\Pi(a,b)$, which is a weighted mean of the preference functions $P(a,b)$ with weights π_i for each criterion, express the superiority of the alternative a against alternative b after all of the criteria are tested (4):

$$\Pi(a,b) = \frac{\sum_{i=1}^{k} \pi_i P_i(a,b)}{\sum_{i=1}^{k} \pi_i}, \quad (4)$$

When each alternative is facing other alternatives, the following outranking flows are defined: the positive outranking flow, which expresses how an alternative is outranking all the others (5), the negative outranking flow, which expresses how an alternative is outranked by all the others (6), and finally, the net outranking flow, which is the balance between the positive and the negative outranking flows (7):

$$\varphi^{+}(a) = \sum\nolimits_{b \in k} \Pi(a,b), \quad (5)$$

$$\varphi^{-}(a) = \sum_{b \in k} \Pi(b,a), \quad (6)$$

$$\varphi(a) = \varphi^{+}(a) - \varphi^{-}(a), \quad (7)$$

$\Phi(a)$ is the net flow of each alternative and is used to obtain the final evaluation. More details on the implementation of the PROMETHEE are available on previous publication [18].

2.3. Weighting Approach

In the case of PROMETHEE, the methodology does not explicitly provide an own way to elicitate appropriate weights and it is then usually integrated with an approach to elicit weights. Macharis et al. [40] advise to determine weights according to several methods: AHP, direct rating, point allocation, trade-off and pairwise comparisons [41]. Different studies have attempted to evaluate which method offers the best results [42,43], but overall none of these methods are dominant or display superior performance. However, several authors have pointed out that the methods that derive weights as a ratio (i.e., swing weights or AHP) have higher internal consistency compared to the others [42,44,45].

The approach adopted in the present study is based on individual judgment elicitation [46]. In order to collect all the necessary information, a questionnaire was submitted to a group of experts, whose knowledge can support informed judgement and prediction on the issue of ecosystems, their services and landscape management [43]. The target was to choose regional experts in order to identify the potentials and/or weaknesses of the area, responding with a professional or organization remit. The objective was to consult with a range of experts including public and private organizations who are involved in the implementation and planning of policy issues affecting the region. Also of importance was the inclusion of the views of agencies, corporations and institutions, in order to collect different knowledge in the context of landscape management, biodiversity and ecosystem services (ES). The selected ES have a hierarchical structure, covering the four ES categories and the main ES groups on each category. In each question, we asked the interviewee to express the relative weights for indicators of the same level, quantifying their importance with respect to the upper level. Importance is quantified through the choice of the level of importance on a Ratio scale, on 9 levels plus the zero option [47]. The procedure is split into two parts: First, the set of individual weights w_{ij}^{l} is obtained by two normalization procedures from the questionnaire answers (8). This operation was undertaken firstly using the maximum value $maxwe$ as a normalising factor for the elicited weights w_{ij}^{l} and the sum of the weights for all elements belonging to the same group:

$$w_{ij}^{l} = \frac{\frac{we_{ij}^{l}}{maxwe}}{\sum_{i=1}^{I} \frac{we_{ij}^{l}}{maxwe}} = \frac{we_{ij}^{l}}{\sum_{i=1}^{I} we_{ij}^{l}} \quad (8)$$

with: l = hierarchical level $(1,2,3,4)$; j = expert; i = element; I = group; we_{ij}^{l} = relative importance of the element i within the group I as answered by expert j for the level l; $maxwe$ = maximum value among we_{ij}^{l} expressed by the DM within the same group (I).

The second part aims to obtain a single judgment (w_i) importance using a multiplicative function across levels and then an average across experts. The weight of each element i for the expert j (w_{ij}) with respect of the full set of elements placed in the same level l is obtained through a multiplicative function between the weights of the elements present for all the upper hierarchical levels (9).

$$w_{ij} = \prod_{i=1}^{L} w_{ij}^{l} \text{ with } l = 1;2;3, \quad (9)$$

Considering the hierarchical structure, the value of the importance of a generic element w_{ij} is dependent on the element placed at the upper hierarchical level. Using the multiplicative function helps consider within the analysis the zero value of the element placed on an upper level. This means that if one element placed at level 1 has importance equal to zero, then the entire lower level has a zero value. The synthesis of the judgment expressed by all experts (w_{ij}) for the same element, is obtained by using an arithmetical mean of the weights (10).

$$w_i = \frac{1}{j} \sum_{j=1}^{J} w_{ij}, \quad (10)$$

2.4. Agricultural Policy Scenarios

From the policy perspective, the context was represented by the pre-2014 CAP and, in particular, by the provisions of RDP 2007–2013. This represented the "Baseline scenario". In the next stage, the model simulated the "CAP 2014–2020 scenario", based on the measures of the RDP 2014–2020 of Emilia-Romagna and the specific operations of the Priority 4 addressed on restoring, preserving and enhancing ecosystems. The changes of each specific measure on the provision of ES were obtained from the common context indicators of Emilia-Romagna and the expected values according to the RDP 2014–2010. These changes were proportionally applied in the municipalities for each indicator in order to obtain the new values of the ES indicators.

3. Study Area and Empirical Information

3.1. ES Indicators

The study area is the province of Ferrara, located on the eastern side of the Emilia-Romagna Region. It comprises 26 municipalities covering an area of 2.632 km^2. Agriculture has traditionally played a significant role in the local economy, whereas the tourism sector has been developing gradually in recent decades [48]. The territory is characterized by a plain structure, with the transition to the east between continental and marine environment and the presence of the Delta of the Po river. The main activities are related to habitat restoration and conservation, species protection habitat, management of selected critical areas, and elaboration of development plans. However, the province is generally recognized as an ecosystem in "continuous evolution" [49]. Land reclamation activities and drainage systems have influenced the area by contributing in the development of agriculture, fishing and tourism. On the other hand, the concentration of population and economic activities lead to a decrease in the standards of environmental quality, land subsidence and environment pollution. Some recreational activities are seen negatively, e.g., the construction of buildings, and other activities associated with tourism, have negative impacts on the environment.

In order to evaluate the provision of ES, we used as case studies the 26 municipalities of the province of Ferrara and as criteria a set of ES indicators from the MEA, presented in the following section. The present study trying to cover the range of ES categories selected a total of twenty two ecosystem indicators that are presented in Table 1 and are divided according to the different categories and groups of ES.

In order to select the ES indicators, a review based on the MEA Framework and the literature available within each category of the ES was done. Though based on this review, in order to ensure applicability in different contexts, the selection of indicators was based on the data availability at municipality level. Trying to cover the range of ecosystem service categories, twenty two ecosystem indicators were selected, seven representing provisioning services, ten representing cultural services, three representing regulating and two representing supporting services. Measurable proxies were chosen for more than one ES indicator, as they were the only measurement available to represent the ES provision at municipality level. The availability of better data to describe some of the ES more precisely could improve the analysis; however, the proxies that were chosen were sufficient to describe ES provision in the area, especially related to the contribution of agriculture to ES provision. More details on the selection of ES indicators and the performance of each alternative (municipality) in relation to each criterion (ES indicator) are available in previous publication [18]. As observed in Table 1, moving from left to right of the hierarchy, we identified three hierarchical levels: ES categories (level 1), ES groups (level 2) and ES indicators (level 3). Thus, the ES category provisioning, placed at level 1 is composed of food and water provision and raw materials, that are located at level 2 (ES groups). Measurable proxies were chosen for more than one ES indicator as they were the only measurement available to represent the ES provision at municipality level. The availability of better data to describe some of the ES more precisely could improve the analysis; however, the proxies that were chosen were sufficient to describe ES provision in the area, especially related to the contribution of agriculture to ES provision. The selected ES indicators are those that are considered to give sufficient information on the benefits that people derive from an ecosystem among those available in the regional databases. This was partly done on purpose in order to assess the usability of secondary data to assess the provision of ES at the municipality level. The data obtained from statistics usable as proxies of ES provision in the area were provided by the National Institute of Statistics, other statistical databases (EUROSTAT, FAOSTAT) and regional sources (E-R; Ferrara).

Table 1. ES Indicators.

ES Category	ES Group	Code	ES Indicator
Provisioning	Food provision	K1	Number of agricultural holdings
		K2	Utilised agricultural area
		K3	Arable land
	Water provision	K4	Irrigated area
		K5	Irrigated area—surface water (natural and artificial basins, lakes, rivers or waterflows)
		K6	Irrigated area—groundwater
	Raw materials	K7	Wooded area
Regulating	Regulation of water	K8	Volume of irrigation water
		K9	Volume of irrigation water—surface water (natural and artificial basins, lakes, rivers or waterflows)
		K10	Volume of groundwater, irrigation and restoration consortiums
Supporting	Biological control	K11	Organic agricultural area
	Production quality	K12	Agricultural area of PDO and/or PGI farms
Cultural	Recreation and tourism	K13	Visitors arrivals
		K14	Italian visitors, arrivals
		K15	Foreign visitors, arrivals
	Accommodation establishments	K16	Collective accommodation establishments
		K17	Hotels and similar establishments
		K18	Holiday and other short-stay accommodation, camping grounds, recreational vehicle parks and trailer parks
	Recreation and tourism	K19	Number of active enterprises
		K20	Number of active enterprises in agriculture (crop production, support activities to agriculture)
		K21	Number of active enterprises in accommodation and food services activities
		K22	Number of farms with other gainful activities (agritourism, recreational and social activities)

Source: own elaboration.

3.2. Weights

The approach adopted in the present study is characterized by the use of an individual questionnaire, the design of a hierarchical series of questions to elicit the importance of the different components for each level and the use of a ratio method to compare the importance of the different objects within the same level. The choice of this method is somehow a compromise, using some elements of the ratio methods [42,44], which are considered the better performing of the weighting methods, while making explicit the hierarchical structure given to the problem, which is maintained during the elicitation of weights [50]. Given that the ES indicators are based on a hierarchical structure, starting from the four ES categories [51], the best way identified to elicit weights was through a number of hierarchical questions, each related to a node of the hierarchical structure of the ES. The calculations were made using Microsoft Office Excel.

The target sample of local experts was composed of 15 representatives from Universities, Research Centers, private and public administrations. In order to collect the necessary information, three workshops with the group of local experts were organized, aiming to gather the views of the regional experts and to identify the main ES provided from agriculture in the area. These workshops were built on different rounds of presentations of project results and interviews with experts, in order to share knowledge and ideas and to identify opportunities and problems regarding the provision of ES in the area [52]. Of the total, 15 experts participating in the workshops, 20% of them filled the questionnaire. Final questionnaires were from the University of Bologna, Department of Agricultural Sciences, the University of Ferrara and the Regional Agency ARPA E-R. Those filling the weighting questionnaires were asked to provide the opinions and views of the group of experts and not their personal opinion.

The average weights among ES indicators (level 3) are presented in Figure 1. As observed the indicators with higher importance are agricultural area of protected designation of origin (PDO farms) and the area of protected geographical indications (PGI farms) (0.125), volume of irrigation water (0.12), organic agricultural area (0.104). Other ES indicators with a significant importance are volume of irrigation groundwater (0.081) and surface water (0.072), utilized agricultural area (0.069), irrigated area (0.052), wooded area (0.048) and arable land (0.042). Lower importance have the collective accommodation establishments (0.032), hotels and similar establishments (0.031), irrigated area surface water (0.03) and groundwater (0.026), holiday and other short-stay accommodation (0.025) and number of agricultural holdings (0.023). The ES indicators with the lower importance are visitors arrivals (0.02), foreigners visitors (0.019), active enterprises in accommodation and food services (0.018), active enterprises in agriculture (0.017), Italian visitors (0.012) and farms with other gainful activities (0.011) and as observed, the ES indicators with lower importance are mainly representing cultural services.

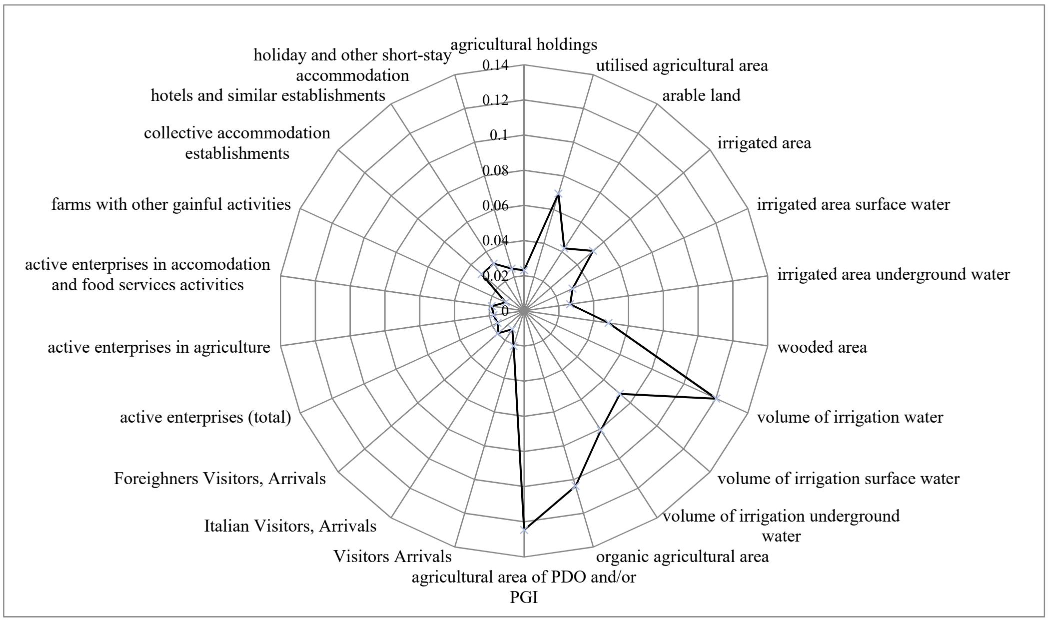

Figure 1. Weights of ES Indicators.

3.3. CAP Scenarios

From the policy perspective, the context was represented by the pre-2014 CAP and, in particular, by the provisions of RDP 2007–2013. This represented the Baseline scenario. In the next stage, the model simulated the CAP 2014–2020 scenario, based on the measures of the RDP 2014–2020 of Emilia-Romagna and the specific operations of the Priority 4 addressed on restoring, preserving and enhancing ecosystems. The evaluation of the ES was based on the pre-2014 CAP and by the provisions of RDP 2007–2013, representing the Baseline scenario. The alternatives are the 26 municipalities of the province and the criteria are the 22 ES indicators. Using the data contained in the evaluation matrix, the alternatives are compared pairwise with respect to each criterion. The next stage involves the exploration of the outranking relation.

As a next stage, for the evaluation of ES was implemented the CAP 2014–2020 scenario, based on future agricultural policies that may affect the supply or demand of ES. The revised measures of the RDP 2014–2020 of the Region and the specific operations of the Priority 4. All the key measures of Priority 4 support preserving, restore and enhance the ecosystems and will no doubt continue to do so in the future CAP. However, only some of these measures have a direct influence on the values of the selected ES indicators in the present study. In order to understand which of the selected ES indicators are directly affected by the key measures and operations, a detailed review of the different operations and output indicators of each measure has been performed, comparing the overall description of the current situation of the programming area [53], based on common and specific context indicators [54]. The agri-environment measure (M10) is especially important, applying agricultural practices that contribute to climate change mitigation, compatible with the protection and improvement of the landscape and the natural resources. The operation 10.01.10 provides a financing of 25 million euro for actions devoted to setting aside arable land for a 20-year period for use for environmental purposes and management of Natura 2000 sites. According to the PSR of Emilia-Romagna Region, the output indicator of this operation is the area of the arable land that will be setting aside, which is 5.317 ha. Moreover, the context indicator is the total arable land of the region, which is 830.083 ha. With the implication of this operation, there shall be a reduction of 0.64% of the arable land and as a consequence a reduction of 0.50% of the total utilized agricultural area of the region. The same procedure was applied for the rest of the Measures that have a direct impact on the values of the selected ES indicators. These are organic farming (M11) and the operation 11.1 payments to convert to organic farming practices and methods, the operation 4.3.02 for irrigation infrastructures of Measure 4 and the operation 8.5 of Measure 8 about forest area development and improvement of the viability of forests. Table 2 presents the specific operations that affect the selected ES indicators, and the change of the value of each one. The common context indicators and the expected value of each one presented above, refer to the region of Emilia-Romagna. In order to calculate the expected values in municipality level, the same proportion was applied for each indicator to all the municipalities, in order to obtain the new values of the ES indicators.

Table 2. Key Measures and changes.

Measure/Type of Operation	Common Context Indicators	Value	Output Indicators	Value	Expected Value
M4 Investments in physical assets					
	Irrigated area (24.1% of UAA)	256.980	Area concerned by investments for saving water	3.714	
	Vol. of irrigation water (m^3)	775.566.900	Reduction in water use at the level of the investment	50%	769.973.616
	Vol. of irrigation water (m^3/ha)	3.012	Vol. of water reduction from efficient irrigation systems	5.593.284	1.506
	Vol. of irrigation surface water (m^3)	122.209.036	Surface water passing to irrigation systems more efficient (16.10% of vol.)	900.518	121.308.518

Table 2. *Cont.*

Measure/Type of Operation	Common Context Indicators	Value	Output Indicators	Value	Expected Value
M4 Investments in physical assets					
	Vol. of irrigation groundwater	186.441.270	Groundwater passing to irrigation systems more efficient (24.56% of vol.)	1.373.710	185.067.559
M8 Investments in forest area development and improvement of the viability of forests					
8.5 support for improving the environmental value of forest ecosystems	Forest Area (ha)	611.000	Area concerned for woodland and agroforestry systems	1.311	612.311
M10 Agro-environmental climate payments					
10.1.10 Set aside arable land for environmental purposes	UAA (ha)	1.064.210	Area (ha)	5.317	1.058.893
	Arable land (78% of UAA)	830.083	Area arable land setting aside	5.317	824.766
M11 Organic farming					
11.1 payment to convert to organic farming practices	Area (ha) under organic farming	81.511	Area—convertion to organic farming	7.181	88.692

Source: [55] and own elaboration.

4. Results

4.1. Baseline Scenario

In the Baseline scenario the performances of each municipality on each ES indicator is based on the conditions of the area under pre-2014 CAP. The performance of each alternative in relation to each criterion is presented in Table A1 (Appendix A). Table 3, Figures 2 and 3 present the evaluation of the study areas, as obtained from the net flows in the no weighting and weighting situations. In the no weighted case, the 26 municipalities are divided into different groups, according to the value of their net flows. The first group is characterized by positive net flows higher than +1, the second group by positive net flows but lower than +1, the third group, by net flows around 0 (from −0.2 to +0.2). The fourth group is characterized by small negative flows (down to -1) and the fifth by negative net flows less than −1. The first group of municipalities consists of: Comacchio, Goro, Argenta and Jolanda di Savoia, all located in the eastern area of the province. Comacchio and Argenta have the highest values in the indicators that represent cultural services, such as foreign visitors, hotels and similar establishments, the number of active enterprises providing accommodation and food service activities and the number of farms with other gainful recreational activities. Goro has the highest rate in the number of active enterprises in agriculture (crop and animal production, support activities to agriculture) and the highest number of farms with other gainful agricultural activities. These features are indeed connected to key features of the area. Since a large part of the territory is within the Po Delta Park, it contains important Natura 2000 sites. Visits to the area are important, especially during the summer months. During holiday time, the demand for beaches, the presence of areas of high naturalistic value, and the historical places have promoted a development of hospitality structures, rental houses, hotels, camping areas, beaches with restaurants, etc. The areas in this group are presented in Figure 2 as the 'green group'. The second group of municipalities, with a positive net flow but lower than +1, are Migliaro, Codigoro, Vigarano Mainarda, Bondeno Massa Fiscaglia and Portomaggiore. Migliaro and Godigoro, located in the east area of the province, have high rates in the indicators that represent cultural services, such as Italian visitors, holiday and short-stay accommodation, recreational vehicle and trailer parks. Migliaro also has the highest rate in organic agricultural area. The third group, with net flows around 0 (from −0.2 to +0.2), consists of Mesola, Poggio Renatico, Cento, Ro and Sant'Agostino. Small negative flows (down to −1) distinguish the fourth group including, Migliarino, Ostellato, Lagosanto and Mirabello. These municipalities are in the middle of this evaluation, since the rates are neither extremely high nor particularly low. These results are connected to the key features of the area, since main recreational services in the area are related to habitat restoration and conservation and species protection habitat and are not provided in all the municipalities. The municipalities with net flows that vary from +1 to −1 are presented in Figure 2 as the 'blue group'. The fifth group of municipalities, located in the central area of the province, (Masi Torello, Ferrara, Voghiera, Formignana, Copparo, Tresigallo and Berra) has negative net flows less than −1 and are presented in Figure 2 as the 'red group'. Berra has no organic agricultural area, hotels or similar accommodation services. Tresigallo has no wooded area. Formignana has no hotels or similar establishments. Other indicators with low rates in these municipalities are agricultural farms with other gainful activities, processing of agricultural products or energy production and the agricultural area of PDO and/or PGI farms.

Table 3. Ranking of the Municipalities: Baseline and CAP 2014–2020 Scenario.

No Weighting Approach		Weighting Approach	
Municipality	**Net Flow (Φ)**	**Municipality**	**Net Flow (Φ)**
Comacchio	2.888194373	Argenta	4.744695
Goro	2.543589598	Comacchio	4.381133
Argenta	1.997682356	Jolanda di Savoia	3.926883
Jolanda di Savoia	1.190854183	Codigoro	3.714846
Migliaro	0.720865791	Ferrara	2.196219
Codigoro	0.709070084	Ostellato	1.230804
Vigarano Mainarda	0.694387495	Migliaro	1.059046
Bondeno	0.614876652	Bondeno	0.469557
Massa Fiscaglia	0.402104543	Massa Fiscaglia	0.129943
Portomaggiore	0.257389617	Goro	0.067499
Mesola	0.194863948	Portomaggiore	0.026196
Poggio Renatico	0.146803521	Mesola	0.006676
Cento	0.008314139	Migliarino	−0.30101
Ro	−0.14634547	Poggio Renatico	−0.66587
Sant'Agostino	−0.21655112	Voghiera	−0.96395
Migliarino	−0.27198083	Copparo	−1.06896
Ostellato	−0.28124392	Lagosanto	−1.11787
Lagosanto	−0.30769265	Cento	−1.21871
Mirabello	−0.68414923	Vigarano Mainarda	−1.34012
Masi Torello	−1.00385534	Sant'Agostino	−1.64226
Ferrara	−1.14179801	Berra	−1.65351
Voghiera	−1.26554807	Ro	−1.71409
Formignana	−1.32908587	Masi Torello	−1.9448
Copparo	−1.34379219	Formignana	−2.31724
Tresigallo	−2.09068952	Tresigallo	−2.94112
Berra	−2.28626409	Mirabello	−3.06399

Source: own elaboration.

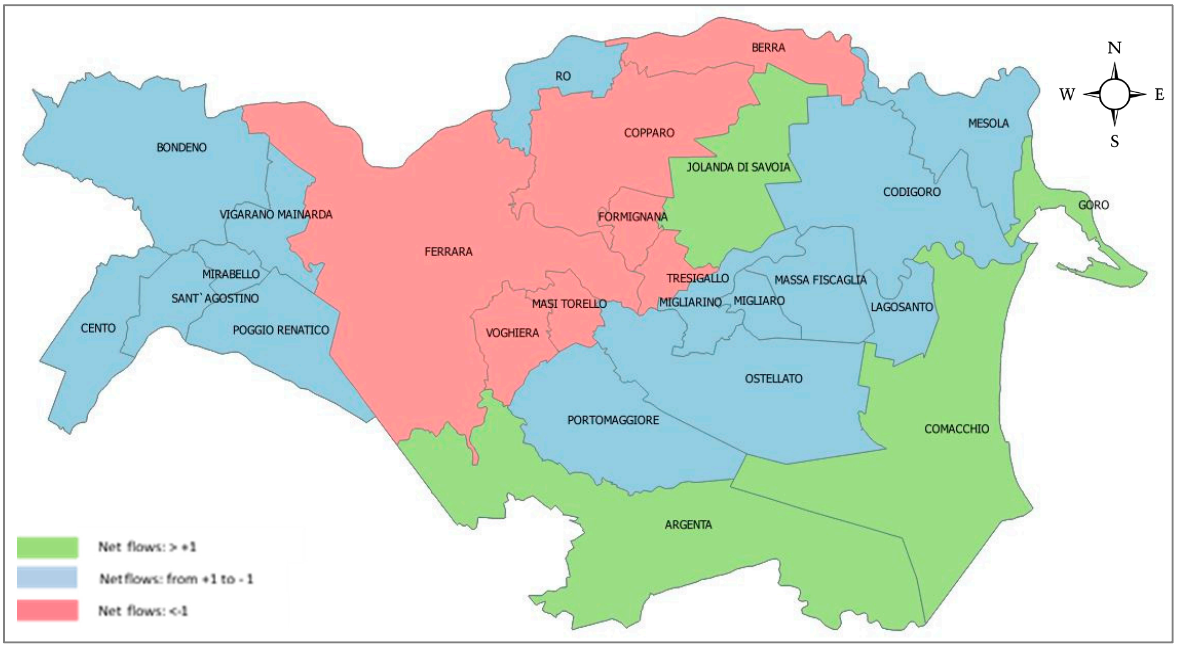

Figure 2. Classification of the municipalities—no weighting approach.

Comparing the net flows of the municipalities, as obtained with and without the integration of the weights (Table 3 and Figure 3) there are differences in all the municipalities. In the ranking of the municipalities as obtained without the weighting approach, the highest net flow observed is 2.88 and the lowest is −2.28, with a variation of 5.16 among the municipalities. That means that the preference of one municipality to the next is not very high and so the net outranking flows do not vary among the municipalities. On the contrary, in the ranking of the municipalities with the integration of the weights the net flows vary from 4.74 to −3.06, with a variation of 7.8 among the municipalities. The higher variation is a result of the integration of the weights, due to the relevant importance of the weighted ES indicators). According to the results with the integration of the weights, the 26 municipalities are divided into 5 different groups. The first group of municipalities, characterised by the higher positive net flows (more than +1), consists of Argenta, Comacchio, Jolanda di Savoia and Codigoro, Ferrara, Ostellato and Migliaro. They have high performances in all the ES indicators that represent provisioning services and also in more than one indicator that has high importance, such as utilized agricultural area (W6), arable land (W9), irrigated (W7) and wooded area (W8). The second group with a positive but lower than +1 net flow consists of Bondeno and Massa Fiscaglia that have the higher performances in irrigated area from natural and artificial basins (W12). The third group, with small positive and negative net flows around 0 (from +0.2 to −0.2), consists of Goro, Portomaggiore, Mesola and Migliarino. The municipalities that have net flows more than +1 are presented in Figure 3 as the green group. The municipalities with net flows that vary from +1 to −1 are presented in the Figure 3 as the blue group. Small negative flows (down to −1) distinguish the fourth group including, Poggio Renatico, and Voghiera. The fifth and last group of municipalities, Copparo, Lagosanto, Cento, Vigarano Mainarda, Sant'Agostino, Berra, Ro, and Masi Torello, Formignana, Tresigallo and Mirabello has negative net flows down to −2. These municipalities have very low performances in more than one indicator that represent provisioning or cultural services. The municipalities with net flow lower than −1 is presented in Figure 3 as the red group.

As regards the classification of the municipalities with and without the integration of the weighting approach, there are differences, in more than one case. Argenta, Comacchio and Jolanda di Savoia have high net flows in both cases, so they take the higher places in the two classifications. Goro on the other hand, is in the second place in the case of no weighting and in the tenth with the integration of the weighting approach. This is because it has the highest rate in farms with other gainful activities, which is the indicator with the lowest importance. Moreover, Goro has low performance in PDO & PGI farms and organic farming, the first and third more important ES indicators. Another change that is observed is Ferrara (twenty first without weights and fifth with weights). The reason of the low position in the classification without weights is the lowest rate in active enterprises in agriculture which is an indicator with very low importance (W20). The reason of the higher position in the weighted approach is also the high rate in organic farming, the third more important ES indicator. In the case of Copparo, from the twenty fourth place (with no weights) takes the sixteenth (with weights) due to the low performance in indicators that have low importance such as holiday and short-stay accommodation (W14) and active enterprises in agriculture (W20). The municipalities of Ro and Sant'Agostino take the fourteenth and fifteenth place in the classification without weights and lower places when the weights are integrated (twenty second and twenty, respectively) due to the high performance in indicators that have low importance such as enterprises in accommodation and food services (W19), Italian visitors (W21) and farms with other gainful activities (W22).

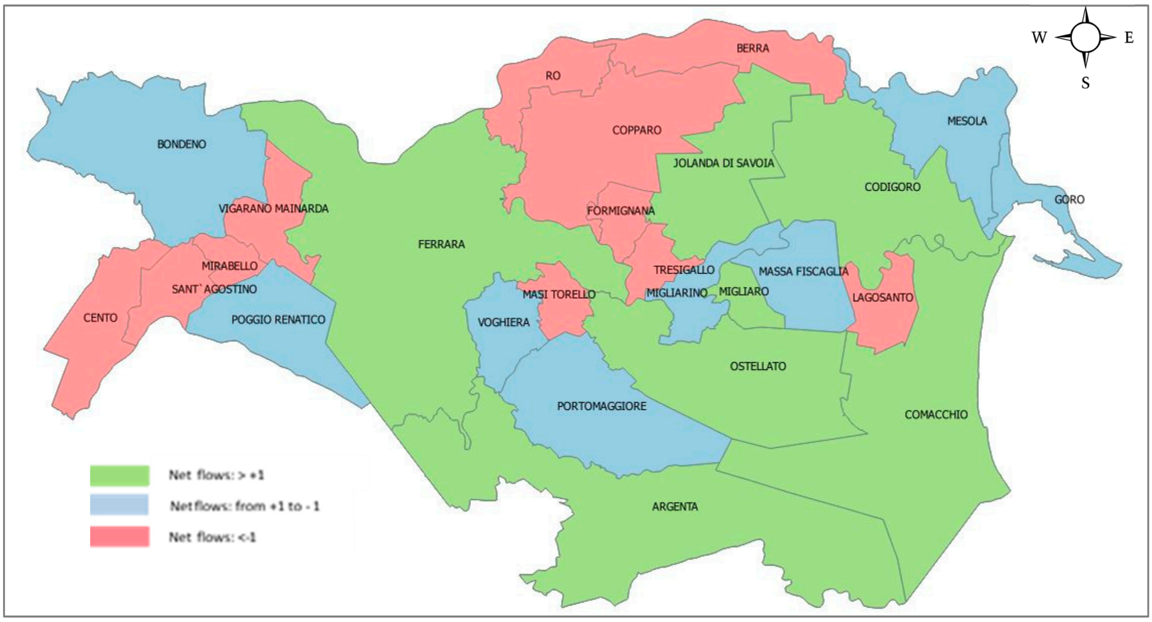

Figure 3. Classification of the municipalities—weighting approach.

4.2. CAP 2014–2020 Scenario

The CAP 2014–2020 scenario is based on the RDP 2014–2020 and the methodology was implemented integrating the new values of the ES indicators. The performances of the alternatives are presented in Table A2 (Appendix A). Table 3 presents the evaluation of the areas, as obtained from the net flows in the no weighting and weighting situations. According to the values of the net flows, the municipalities have the same classification with the Baseline scenario with no weights. As described, the values for only some of the ES indicators are affected by the CAP 2014–2020 scenario. The most important change is observed in organic farming, increased by 8.81% due to the implication of the measure 11.1 (convert to organic farming). However, the effect of this increase is flattened when applied to the municipalities: Lagosanto, Mirabello, Goro and Berra do not have area under organic farming, so the implication of the operation 11.1 does not affect them. Moreover, in nine municipalities less than 1% of the area is under organic farming, in five municipalities is less than 5% and in two less than 10%. As a result, even with the implication of the operation 11.1, the performances in most of the cases continue to be very low and do not change their position in the final classification. Other changes are observed in the utilized agricultural area, which is decreased by 0.5% and the arable land which is decreased by 0.64%, due to the implication of the measure about setting aside arable land (10.1.10). The wooded area is increase by 0.21% due to the implication of the measure for improving the resilience of forest ecosystems (8.5). Finally, the volume of irrigation water is decrease by 0.70% due to the implication of the measure about irrigation infrastructures (4.3.02). When these changes are proportionally applied in the municipalities, they flatten the effects of the CAP 2014–2020 scenario, and do not change their final classification.

The municipalities have the same classification as the Baseline scenario with the integration of the weights (Table 3). Since the values for only some of the ES indicators are affected by the CAP 2014–2020 scenario, and the weighting approach is the same, the municipalities have the same classification in the Baseline and the CAP 2014–2020 scenario. Comparing the classification of the municipalities with the simulation of different policy scenarios, there are no differences in the positions the municipalities. The RDP 2014–2020 of the Region is built under the six Priorities with an almost equal emphasis on each one of the priorities. In the present study, the CAP 2014–2020 scenario is built considering only one of these (Priority 4), trying to measure how the Rural Development Policy might affect ES and their provision at municipality level. As expected, the values only for some ES indicators change, since all measures are designed to promote and enhance ecosystems but not only some of them provide straightforward measurable effects on the indicators selected. The estimations made in order to build the CAP 2014–2020 scenario, do not lead to significant effects that change the classification of the municipalities.

5. Discussion

The present study faced different limitations and challenges, regarding data availability, and the structure of the methodological approach. An important challenge was the lack of information with respect to the provision of ES. Particularly, the main issue concerned the number of gaps in the ES metrics and indicators available at municipality level, with respect to the number and quality of indicators needed to reflect the ES approach in a comprehensive way. The indicators available for most ES are not fully satisfactory in their ability to evaluate the quality and quantity of benefits provided. Another challenge the present study had to face was to analyze the interactions between ES and to understand the mechanisms that produce them. Due to data paucity and to the explicit choice to use secondary data avoiding ecosystem modelling exercises, it was not possible to consider any interactions of the ES [56]. As a result, in this study, the values of the different services were assessed independently and regarded as additive. In order to analyze trade-offs and interactions between ES there is need for an approach that allows us to investigate interactions among different services beyond simple linear correlations [57]. Information about the provision of ES at the local level is lacking; relevant information such as Mid-term evaluation reports were not yet available at the time of the study, in order to present compiled information on the RD performance, indicator values of output and result indicators. Although the number of indicators in each category varies significantly due to the different data availability and reliability, the evaluation focuses on all the categories of ES and applies a set of non-overlapping indicators from the available secondary data sources. Approaches using monetary values are available in the literature. In general, these frameworks include three main parts: (i) measuring the provision of ES; (ii) determining the monetary value of ES; (iii) designing policy tools for managing ES [58]. The present study, did not attempt (on purpose) to value ES directly, especially not to value them in monetary terms. The selected ES indicators are intended to be a sufficiently accurate estimator of the benefits that people derive from an ecosystem but they are not aimed to monetize the benefits that are derived. Although monetary methods can provide estimates of benefits and costs comparable among assessments, their use can often be challenging especially when complex interactions (including ecological, social and economic) characterize the provision of ES [59]. Even though there are many fundamental and methodological problems associated with the assignment of values to ecosystem goods and services [60,61], the monetization of ES has been regarded as a promising strategy to make nature visible to decision makers, and can hence been seen as a development of this work.

Another limitation regarding the construction of the CAP 2014–2020 scenario was to identify the effects of the reformed CAP measures on the provision of ES in municipality level. The framework was applied based on two different agricultural policy scenarios, the Baseline based on the RDP 2007–2013 and the CAP 2014–2020 based on the RDP 2014–2020. The CAP 2014–2020 scenario is based on the revised measures of the RDP and the specific operations of the Priority 4. The estimations made in order to measure the changes on the provision of ES by each specific measure, do not lead to significant effects of the CAP 2014–2020 in the provision of ES. According to the results, the implementation of the CAP 2014–2020 will not change significantly the provision of ES in the area.

6. Conclusions

The objective of this study is to test a methodology for the classification of areas according to the provision of ES and for the evaluation of the effects of different agricultural policy scenarios on such classification. As a general remark, it is observed that the provision of ES varies greatly from one municipality to the next. All the municipalities offer a significant amount of provisioning and cultural services, mainly connected to recreational opportunities.

The conclusions regarding the weighting integration is that elicitation of weights to the ES indicators effects the evaluation of the provision of ES since it takes into account the different relevance of various indicators in the area. The ES indicators that represent provisioning services were all of high importance. Since agricultural activities play a significant role in the local economy, provisioning services are at the core of local concerns. Less attention is given in cultural services, probably because some recreational activities are seen negatively since they influence the environment and the naturalistic value of the area. Municipalities with high performances in cultural services obtain high positions in the classification where the ES are equally weighted, while when the weights are applied, they take lower positions because cultural services receive less attention by the experts.

In the present study, the CAP 2014–2020 scenario is built considering Rural Development Policy and only one of its priority (Priority 4), the one more clearly connected to ES. As expected, only the value of some ES indicators change, since all measures are designed to promote and enhance ecosystems but only some of them includes provisions that have straightforward measurable effects on the indicators selected. The estimations made in order to build the CAP 2014–2020 scenario, do not lead to significant effects that change the classification of the municipalities, which support the hypothesis of a moderate effect of policy as compared to the overall provision of ES in the area. An integrative framework that takes a wide range of ES and small landscape scales into account is still not available. Such a framework should be comprehensible and able to be applied at small range of scales to different ecosystems or landscapes [62]. The present study tried to meet some of these challenges by the development of a framework for the evaluation of the provision of multiple ES at municipality level. The methodology adopted, considered different policy scenarios and different weights of the ES indicators in order to provide comparative classifications of municipalities; in this way it can be used as a support to the comparative evaluation of the ES of the ranked regions. This approach can also be extended to explicitly supporting policy design with respect to zoning/targeting. From the experience carried out in this study, we can conclude that the application of the PROMETHEE, in particular with the integration of the weights for the ES indicators, has shown the potential to support the characterization of agricultural land in terms of the provision of multiple ES. The study has applied a simple model that assumes linearity in the effects of policy on the provision of ecosystem services (i.e., ecosystem services produced are proportional to policy implementation) and in the evaluation of ES, i.e., the benefits derived from an ecosystem service follow a linear utility over space and time [63]. In further research, this can be improved in several ways, considering dynamics, functional relationship between policy outcome and ES provision, seasonality and other interactions, as well as changes in marginal value depending on location or quantity or services produced. In terms of further research, the present application highlighted the need of the PROMETHEE methodology to be supported by stronger approaches in modelling policy effects, in order to become a valuable tool for an evaluation of different regional/national policies. Moreover, the impacts on distributional effects over different regions could be included in the present approach. Regarding the weighting process, it could be integrated with improved approaches compared to the one used here, according to the problem structure, the evaluation criteria and the access to stakeholders and decision makers.

A considerable number of studies have contributed to the valuation and classification of ES and the linkages between how CAP contributes and changes the provision of ES. However, such assessment remains tested in small spatial scales. The present study could be considered an innovative work on ES valuation, testing in particular evaluation on ES at municipality level, which is the lowest spatial scale at which official statistical data are available and possibly small enough to account for functional scales, such as those related to landscape or hydromorphology. Altogether, it can be concluded that the framework adopted in the present study could be used as an instrument to structure environmental or regional policy problems and support decisions. Its further exploration could contribute to improving valuation methods for ES provision, in an attempt to narrowing the gaps between the ecosystem service concept, practical regional planning and agricultural policies evaluation.

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Author Contributions: This study was designed and written principally by Parthena Chatzinikolaou. Meri Raggi contributed mainly to the introduction section; and Davide Viaggi commented and contributed mainly to the methodology, the discussion and the conclusion sections. All authors were involved in the finalization of the submitted manuscript. All authors read and approved the final manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Evaluation matrix Baseline scenario.

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22
X1	10.03%	91.20%	91.77%	12.99%	8.24%	0.88%	1.37%	9.62%	8.29%	82.26%	28.31%	13.72%	0.80%	84.66%	15.34%	5.66%	20.0%	80.0%	5.15%	1.19%	6.61%	10.30%
X2	3.11%	90.02%	93.16%	2.78%	24.95%	2.24%	0.76%	3.85%	14.58%	40.90%	0.0%	3.28%	0.01%	86.81%	13.19%	0.00%	0.0%	0.0%	0.99%	3.46%	5.0%	5.81%
X3	7.58%	92.72%	94.83%	4.71%	55.48%	2.13%	0.18%	3.78%	54.51%	10.09%	0.78%	4.39%	0.13%	81.85%	18.15%	2.04%	22.22%	77.78%	2.86%	2.14%	6.68%	3.24%
X4	5.92%	91.54%	91.86%	0.83%	51.07%	6.53%	0.09%	0.62%	55.09%	7.62%	0.37%	1.14%	1.73%	77.81%	22.19%	3.62%	43.75%	56.25%	8.24%	0.79%	6.08%	3.27%
X5	4.22%	91.36%	98.89%	11.00%	5.13%	0.34%	0.70%	18.92%	2.42%	91.59%	12.76%	3.91%	0.59%	81.41%	18.59%	3.17%	35.71%	64.29%	3.20%	6.69%	7.17%	6.73%
X6	3.78%	91.09%	96.62%	10.54%	19.68%	0.69%	1.14%	8.05%	19.81%	70.57%	11.36%	6.49%	67.24%	80.20%	19.80%	24.21%	25.23%	74.77%	9.74%	11.36%	15.44%	7.51%
X7	8.74%	91.06%	89.98%	3.95%	16.84%	1.69%	0.29%	4.44%	12.17%	37.16%	1.23%	3.88%	0.72%	84.93%	15.07%	2.26%	30.0%	70.0%	3.73%	0.72%	7.08%	3.99%
X8	20.70%	91.12%	81.79%	12.23%	23.47%	7.96%	0.31%	9.84%	27.27%	29.27%	9.09%	1.58%	25.93%	72.0%	28.0%	38.91%	19.77%	80.23%	41.55%	0.28%	6.42%	3.99%
X9	1.33%	92.18%	85.46%	0.63%	20.48%	1.96%	0.12%	0.54%	23.09%	42.15%	0.30%	1.09%	0.01%	88.64%	11.36%	0.23%	0.0%	100%	0.53%	2.16%	5.76%	5.83%
X10	0.31%	92.06%	99.53%	0.29%	12.63%	0.0%	0.47%	0.22%	51.28%	45.99%	0.0%	0.0%	0.07%	95.05%	4.95%	1.81%	25.0%	75.0%	4.58%	84.29%	1.75%	20.83%
X11	2.57%	90.57%	97.09%	5.26%	1.68%	0.37%	0.28%	12.15%	0.49%	97.28%	0.31%	46.19%	0.01%	100%	0.0%	0.68%	0.0%	100%	0.50%	4.62%	10.0%	5.53%
X12	0.88%	92.51%	93.23%	2.42%	4.03%	0.0%	0.83%	1.79%	3.41%	66.26%	0.0%	0.76%	0.05%	84.64%	15.36%	0.68%	33.33%	66.67%	1.31%	7.29%	5.54%	5.88%
X13	1.27%	92.73%	86.14%	0.57%	2.07%	0.0%	1.09%	0.44%	2.35%	8.16%	1.33%	8.43%	0.02%	91.94%	8.06%	1.13%	0.0%	100%	0.58%	0.9%	6.58%	6.12%
X14	1.32%	94.61%	98.63%	1.67%	5.61%	1.34%	0.06%	1.58%	13.05%	80.21%	18.15%	0.0%	0.01%	88.64%	11.36%	0.23%	0.0%	100%	0.74%	3.61%	7.73%	2.94%
X15	3.64%	88.17%	97.75%	5.55%	0.97%	0.0%	0.25%	3.67%	0.72%	91.69%	0.63%	11.23%	0.43%	86.35%	13.65%	2.26%	40.0%	60.0%	2.31%	26.99%	5.63%	12.41%
X16	1.19%	90.54%	84.13%	1.84%	4.95%	0.0%	0.18%	1.70%	2.40%	90.92%	39.77%	3.13%	0.15%	90.63%	9.37%	1.58%	0.0%	100%	1.02%	0.38%	7.52%	9.78%
X17	0.67%	92.68%	98.78%	0.43%	4.11%	0.0%	0.49%	0.41%	2.98%	97.02%	70.27%	0.0%	0.01%	88.64%	11.36%	0.45%	0.0%	100%	0.44%	0.86%	4.31%	3.85%
X18	0.56%	86.05%	92.49%	0.12%	16.42%	32.64%	0.0%	0.09%	17.95%	50.70%	0.0%	0.0%	0.01%	88.64%	11.36%	0.23%	0.0%	100%	0.71%	1.08%	5.95%	9.30%
X19	4.50%	93.54%	94.51%	9.44%	8.55%	1.08%	0.07%	8.14%	7.53%	87.45%	3.67%	0.24%	0.84%	84.47%	15.53%	2.26%	20.0%	80.0%	1.39%	2.75%	7.44%	4.58%
X20	3.15%	92.84%	88.79%	2.34%	37.85%	8.51%	0.26%	1.71%	35.90%	50.98%	0.11%	1.59%	0.04%	82.29%	17.71%	1.58%	14.29%	85.71%	1.87%	1.02%	5.53%	3.28%
X21	4.18%	92.09%	91.33%	4.77%	8.77%	2.42%	0.59%	3.70%	9.86%	76.05%	3.15%	2.45%	0.49%	89.21%	10.79%	2.26%	10.0%	90.0%	2.90%	0.79%	7.25%	9.26%
X22	2.10%	92.93%	93.97%	1.17%	0.83%	5.27%	0.73%	1.07%	0.86%	27.13%	1.08%	0.43%	0.01%	95.88%	4.12%	0.90%	0.0%	100%	0.625	2.48%	8.70%	7.36%
X23	2.17%	90.23%	88.78%	0.68%	47.32%	5.55%	0.0%	0.54%	44.87%	46.12%	0.75%	0.60%	0.12%	79.92%	20.08%	0.90%	75.0%	25.0%	1.48%	0.66%	7.25%	2.98%
X24	1.03%	90.48%	86.34%	0.59%	14.58%	2.31%	0.0%	0.57%	10.50%	12.91%	7.49%	5.93%	0.16%	75.70%	24.30%	0.68%	66.67%	33.33%	1.03%	0.75%	6.72%	5.0%
X25	2.28%	90.62%	79.76%	1.05%	55.31%	31.46%	0.30%	0.80%	53.58%	12.30%	0.44%	1.32%	0.37%	71.15%	28.85%	1.58%	42.86%	57.14%	1.49%	1.03%	7.18%	3.95%
X26	2.76%	92.05%	74.78%	2.14%	26.81%	1.59%	0.31%	1.77%	21.26%	3.97%	0.04%	22.94%	0.04%	79.84%	20.16%	0.68%	0.0%	100%	1.045%	1.83%	5.49%	6.07%

Table A2. Evaluation matrix CAP 2014–2020 scenario.

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22
X1	10.03%	90.74%	91.64%	12.99%	8.24%	0.88%	1.38%	9.55%	8.23%	81.65%	30.96%	13.72%	0.80%	84.66%	15.34%	5.66%	20.0%	80.0%	5.15%	1.19%	6.61%	10.30%
X2	3.11%	89.57%	93.03%	2.78%	24.95%	2.24%	0.77%	3.82%	14.47%	40.59%	0.00%	3.28%	0.01%	86.81%	13.19%	0.00%	0.0%	0.0%	0.99%	3.46%	5.0%	5.81%
X3	7.58%	92.26%	94.70%	4.71%	55.48%	2.13%	0.18%	3.75%	54.10%	10.02%	0.85%	4.39%	0.13%	81.85%	18.15%	2.04%	22.22%	77.78%	2.86%	2.14%	6.68%	3.24%
X4	5.92%	91.08%	91.73%	0.83%	51.07%	6.53%	0.09%	0.61%	54.68%	7.57%	0.40%	1.14%	1.73%	77.81%	22.19%	3.62%	43.75%	56.25%	8.24%	0.79%	6.08%	3.27%
X5	4.22%	90.90%	98.75%	11.00%	5.13%	0.34%	0.70%	18.78%	2.40%	90.91%	13.95%	3.91%	0.59%	81.41%	18.59%	3.17%	35.71%	64.29%	3.20%	6.69%	7.17%	6.73%
X6	3.78%	90.64%	96.49%	10.54%	19.68%	0.69%	1.15%	7.99%	19.66%	70.05%	12.42%	6.49%	67.24%	80.20%	19.80%	24.21%	25.23%	74.77%	9.74%	11.36%	15.44%	7.51%
X7	8.74%	90.61%	89.85%	3.95%	16.84%	1.69%	0.29%	4.41%	12.08%	36.89%	1.34%	3.88%	0.72%	84.93%	15.07%	2.26%	30.0%	70.0%	3.73%	0.72%	7.08%	3.99%
X8	20.70%	90.67%	81.68%	12.23%	23.47%	7.96%	0.31%	9.77%	27.07%	29.05%	9.95%	1.58%	25.93%	72.0%	28.0%	38.91%	19.77%	80.23%	41.55%	0.28%	6.42%	3.99%
X9	1.33%	91.72%	85.34%	0.63%	20.48%	1.96%	0.12%	0.54%	22.92%	41.83%	0.33%	1.09%	0.01%	88.64%	11.36%	0.23%	0.0%	100%	0.53%	2.16%	5.76%	5.83%
X10	0.31%	91.60%	99.39%	0.29%	12.63%	0.0%	0.47%	0.22%	50.90%	45.64%	0.00%	0.0%	0.07%	95.05%	4.95%	1.81%	25.0%	75.0%	4.58%	84.29%	1.75%	20.83%
X11	2.57%	90.12%	96.96%	5.26%	1.68%	0.37%	0.28%	12.06%	0.49%	96.56%	0.34%	46.19%	0.01%	100%	0.0%	0.68%	0.0%	100%	0.50%	4.62%	10.0%	5.53%
X12	0.88%	92.05%	93.10%	2.42%	4.03%	0.0%	0.84%	1.78%	3.39%	65.77%	0.00%	0.76%	0.05%	84.64%	15.36%	0.68%	33.33%	66.67%	1.31%	7.29%	5.54%	5.88%
X13	1.27%	92.27%	86.01%	0.57%	2.07%	0.0%	1.10%	0.44%	2.33%	8.10%	1.46%	8.43%	0.02%	91.94%	8.06%	1.13%	0.0%	100%	0.58%	0.9%	6.58%	6.12%
X14	1.32%	94.14%	98.49%	1.67%	5.61%	1.34%	0.06%	1.57%	12.96%	79.61%	19.84%	0.0%	0.01%	88.64%	11.36%	0.23%	0.0%	100%	0.74%	3.61%	7.73%	2.94%
X15	3.64%	87.73%	97.61%	5.55%	0.97%	0.0%	0.25%	3.64%	0.71%	91.01%	0.69%	11.23%	0.43%	86.35%	13.65%	2.26%	40.0%	60.0%	2.31%	26.99%	5.63%	12.41%
X16	1.19%	90.09%	84.01%	1.84%	4.95%	0.0%	0.18%	1.68%	2.38%	90.25%	43.49%	3.13%	0.15%	90.63%	9.37%	1.58%	0.0%	100%	1.02%	0.38%	7.52%	9.78%
X17	0.67%	92.22%	98.64%	0.43%	4.11%	0.0%	0.49%	0.41%	2.96%	96.30%	76.86%	0.0%	0.01%	88.64%	11.36%	0.45%	0.0%	100%	0.44%	0.86%	4.31%	3.85%
X18	0.56%	85.62%	92.36%	0.12%	16.42%	32.64%	0.00%	0.09%	17.81%	50.33%	0.00%	0.0%	0.01%	88.64%	11.36%	0.23%	0.0%	100%	0.71%	1.08%	5.95%	9.30%
X19	4.50%	93.07%	94.38%	9.44%	8.55%	1.08%	0.07%	8.09%	7.47%	86.80%	4.01%	0.24%	0.84%	84.47%	15.53%	2.26%	20.0%	80.0%	1.39%	2.75%	7.44%	4.58%
X20	3.15%	92.37%	88.66%	2.34%	37.85%	8.51%	0.26%	1.70%	35.64%	50.60%	0.12%	1.59%	0.04%	82.29%	17.71%	1.58%	14.29%	85.71%	1.87%	1.02%	5.53%	3.28%
X21	4.18%	91.63%	91.20%	4.77%	8.77%	2.42%	0.59%	3.68%	9.79%	75.48%	3.44%	2.45%	0.49%	89.21%	10.79%	2.26%	10.0%	90.0%	2.90%	0.79%	7.25%	9.26%
X22	2.10%	92.47%	93.83%	1.17%	0.83%	5.27%	0.74%	1.06%	0.85%	26.93%	1.18%	0.43%	0.01%	95.88%	4.12%	0.90%	0.0%	100%	0.625	2.48%	8.70%	7.36%
X23	2.17%	89.78%	88.65%	0.68%	47.32%	5.55%	0.00%	0.53%	44.53%	45.78%	0.82%	0.60%	0.12%	79.92%	20.08%	0.90%	75.0%	25.0%	1.48%	0.66%	7.25%	2.98%
X24	1.03%	90.03%	86.22%	0.59%	14.58%	2.31%	0.00%	0.57%	10.42%	12.82%	8.22%	5.93%	0.16%	75.70%	24.30%	0.68%	66.67%	33.33%	1.03%	0.75%	6.72%	5.0%
X25	2.28%	90.16%	79.64%	1.05%	55.31%	31.46%	0.30%	0.80%	53.18%	12.21%	0.48%	1.32%	0.37%	71.15%	28.85%	1.58%	42.86%	57.14%	1.49%	1.03%	7.18%	3.95%
X26	2.76%	91.59%	74.67%	2.14%	26.81%	1.59%	0.31%	1.75%	21.10%	3.94%	0.05%	22.94%	0.04%	79.84%	20.16%	0.68%	0.0%	100%	1.045%	1.83%	5.49%	6.07%

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