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Methodological approach for assessing new incentives for soil health business models in EU

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Abstract: Soil health business models can lead to the maintenance of sustainable and competitive agriculture. The agricultural policy in the EU pursues different incentives to encourage adoption of environmentally oriented practices. Investments in soil health can lead to significant benefits not only for the environment but for society as well. The aim of this paper is to present the methodological approach for assessing new incentives for soil health business models in the frame of the NOVASOIL project. The goal is to investigate the opportunities and gaps of new incentives for redirection of financial streams and policy support measures for provision of innovative soil health technologies. The methodology includes two phases. The first one comprises of targeting new incentives for soil health and then identifying the corresponding gaps and opportunities. The second one continues the analysis with assessing the selected incentives with the BOCR-ANP model.

Keywords: business models; soil health; BOCR-ANP model

1. INTRODUCTION

Soil is the most irreplaceable and valuable natural resource involved in agricultural production. Soil health is getting more and more political attention and the EU member states are actively developing policies for improvement. Our research is focused on identifying and assessing incentives that can help make business models sustainable from the perspective of soil health. This is achieved by exploring the incentives that drive farmers and the other stakeholders to take action towards improving soil health. Through this process, we aim to address the question of how soil health business models can effectively contribute to the maintenance of sustainable and competitive agriculture. Our objec-

tive is to examine the role and impact of incentives for soil health in the creation of sustainable and competitive agricultural practices. This report is concentrated on the methodological part of our research. We investigate the opportunities and gaps of new incentives for redirection of financial streams and policy support measures for provision of innovative soil health technologies. The methodology includes two phases. The first one comprises of targeting new incentives for soil health and then identifying the corresponding gaps and opportunities in connection with certain business model. The second one continues the analysis with assessing the selected incentives with the BOCR-ANP model.

1.1. BOCR methodology

Decision-making often faces complexity in choosing the most appropriate management option no matter the area of research field. Economic outcome is not the only factor which is measured when choosing the best option. It is certainly the easily computable in quantitative aspect, however qualitative criteria should be also taken into consideration. The BOCR tool is based on a multiple criteria decision-making method (MCDM) – its core idea is to help researchers in solving multi-attribute problems. In its essence, the BOCR method is using ANP (analytic network process)/AHP (analytic hierarchy process) in comparing several alternatives within four separate hierarchies: Benefits hierarchy (B), and similar Opportunities hierarchy (O), Costs hierarchy (C) and Risk hierarchy (R), in order to solve complex decision-making problems.

When performing ANP method it is important to define what is the main objective (goal) and then which are the clusters that influence the decision on what alternative to choose. The research problem that we have is structured into a network of four elements – benefits, opportunities, costs and risks. This is basically the main structure of the model. After that, the pairwise comparison takes place. Here we have two levels – the clusters and the nodes. Finally, we use Saaty's 9-point scale to compare elements in each level. With the benefits and opportunities sub-network we ask the question “what presents the greater benefit/opportunity” and with the costs and risks – “what represents the highest cost or risk”.

The analytic hierarchy process (AHP) and the analytic network process (ANP) were introduced by Thomas Saaty (Saaty, 1997, 1980, 2000, 2001, 2005). AHP uses relativity in measuring both tangible and intangible criteria. It allows us to construct hierarchies with several levels including criteria that expands in lower and lower levels, until it reaches the sub-criteria (a top-down approach). According to Saaty (2006) the ANP is “a generalization of the AHP, with the basic structure is an influence network of clusters and nodes contained within the clusters”. This ap-

proach enables us to connect one criteria/sub-criteria from a cluster to another cluster and to take into consideration its influence. This is the reason for this approach to be named “network” because it reveals the interdependencies within the elements of the network.

One reason of substituting AHP with ANP is that certain research problems pose the need of involving the interdependence between clusters (both elements in the same cluster or another cluster), where the hierarchy is a “linear top down structure” (Saaty and Vargas, 2006). AHP method has been criticized by some researchers regarding the rank reversal which doesn't correspond to the multi-attribute utility theory (Leung and Cao, 2001). Therefore, the later proposal of the ANP as an extension of AHP takes into consideration the dependencies between the elements in the clusters.

ANP being an extension to the AHP is perceived as a tool for more complex problems where we seek to reveal the interconnections within the elements. Saaty (2005) suggests that when there is an independence between the elements in the hierarchy we should use AHP. In contrast, the ANP was proposed as a solution to address the issue of dependence among alternatives or criteria (Saaty, 2005).

Both AHP and ANP can be used as methods to prioritize one alternative over the others based on judgment of stakeholders, where the final goal is to choose the most appropriate one. Using BOCR analysis with both AHP and ANP models has been used as a valuable method in many research areas, including evaluation of product design (Chan et al., 2013), municipal solid waste management (Contreras et al., 2008, Brent, Rogers, Ramabitsa-Siimane, and Rohwer, 2007), modelling green initiatives (Sarmiento and Vargas-Berrones, 2018, Guo, Zhou, Li, and Xie, 2015), green energy production (Hussain et al., 2018), transportation (Bottero et al., 2011), and others.

With regards to studies in the agricultural field, BOCR-ANP has been used to assess financial tools for inclusion of farmers (Megantara and Priantina, 2020), choosing between the most

sustainable crop production (Strada, 2009), sustainable floriculture (Çürük and Alptekin, 2022), agroforestry (Lovric et al., 2018), and others.

In connection with soil problems research is relatively scarce at the moment. Several studies have adopted ANP method relating to soil erosion. Nekhay et al. (2009) apply ANP method to evaluate soil erosion risks. Another study from 2018 (Sajedi-Hosseini et al., 2018) used Fuzzy Analytical Network Process (FANP) which allows not only to reveal interdependencies but direct and indirect relationships. This study is the first to apply FANP in soil erosion studies.

An interesting study compares the use of AHP and ANP with regards to ecosystem services from farming area (Jorge-Garcia and Estruch-Guitart). One of the conclusions is that compared with AHP, which does not consider relationships between elements, ANP is more efficient method when analyzing intangible assists, as it is the case with different ecosystem services.

The usefulness of BOCR-ANP method is that it deals with multi-criteria problems, especially when monetary calculations are difficult or not applicable. When we work with qualitative data the use of criteria to evaluate more than one competing alternatives is required. Using this method, we are able to determine what is the relative importance of the criteria we have chosen by using pairwise comparisons. The decision to adopt a soil health incentive has on hand ecological, economic and social considerations, but on the other hand all of these should be considered through the complexities of the BOCR sub-network.

In our study, the use of BOCR-ANP provides us with a more structural approach which enable us to prioritize new incentives for improving soil health business models, considering the respective benefits, opportunities, costs, and risks.

2. METHODOLOGY

The methodology is divided into two phases.

2.1. Phase 1

Methodological steps:

- We construct category of agricultural incentives related to the Business Model Canvas building blocks.

- We identify new soil health incentives and assess their relation to the Business Model Canvas building blocks

- We will organize focus group with relevant stakeholders who will rank the 3 most important soil health incentives, which will be fed into Phase 2.

In Table 1 we summarize the typology of incentives and the relation with the five building blocks of the Business Model Canvas (BMC). This relation is direct and represents how implementing any of the incentives affects each element of the BMC.

Identifying new incentives for the provision of soil health activities is based on assessing current gaps of incentives (Table 2). Each of the proposed incentives in the NOVASOIL business case models are assessed whether they meet the five building blocks of the BMC following the identified direct relations from Table 1.

In the first column of Table 2 are the proposed incentives within the business models. The second column (Category of incentives) is the link between Table 1 and Table 2. Here, each of the proposed incentives in the first column should be referred to the category of incentives in Table 1. After identifying the relation between the incentives and the five building blocks of the BMC (which are already given in Table 1), the gaps will be revealed. Gaps are those building blocks which are not covered by the proposed incentives.

Finally, focus groups with relevant stakeholders will be organized. In this format it should be discussed and proposed the new incentives based on stakeholder's feedback. When discussing the new incentives, if their number is more than three, it is necessary to make a ranking of the incentives in order to select only three. Each one of the participants will have three votes for the proposed incentives, and those with the highest count will be the selected three incentives (they will be used in the next phase – the BOCR model).

Table 1. Typology of incentives and their relation to the BMC blocks

Category of incentives		Business Model Canvas building blocks				
		Customer value proposition	Channels and partnerships	Revenue and cost	Key resources	Key activities
Policy-driven	1.1. Prohibition of use					
	1.2. Property use rights					
	1.3. Taxes/charges					
	1.4. Mandatory farm set-asides					
	1.5. Subsidies					
	1.6. Conservation easements					
	1.7. Permits and quotas					
	1.8. Marketing labels (certificates/sustainability standards)					
	1.9. Offsets					
	1.10. Impact funds					
	1.11. Responsible sourcing of agriculture products and services					
	1.12. Corporate social responsibility					
Voluntary	2.1. Green bonds					
	2.2. Voluntary farm set-asides					
	2.3. Conservation concessions					
	2.4. Direct Payment for Ecosystem Services					
	2.5. Rewards for Ecosystem Services					
	2.6. Marketing labels (without certificates or standards)					

Source: Garrett, L. and Neves, B. (2016) *Incentives for Ecosystem Services: Spectrum*. Food and Agriculture Organization of the United Nations, Rome, Italy.

Table 2. Relation of incentives with the five building blocks of the business model

Incentives	Category of incentives	Period before 2023	Period 2023-2027	Business Model Canvas building blocks				
				Customer value proposition	Channels and partnerships	Revenue and cost	Key resources	Key activities
Incentive 1	1.8	x						
Incentive 2	1.1	x						
Incentive 3	1.5	x						

Source: The authors.

2.2. Phase 2

The second phase includes comparing the selected incentives from the previous phase using the BOCR model (benefits, opportunities, costs, and risks). The goal is to assess the importance of new incentives development for: 1 – market linkages for healthy soil new value chain development of safety food and services; 2 – internal and bridging innovative ways of blending finance streams and policy measures; and 3 – creating a soil health business model to reduce production costs and costs as a result of using a differentiated approach in food production systems.

Table 3 presents the four main blocks of the BOCR model adapted for the need of the project to assess each alternative (incentive) for soil health business models. Each of the four construction blocks represent the framework requirements in the current BOCR model.

We use the following approach, where:

- The **goal** is to judge new incentives and find their importance for soil health business model development.
- **Control criteria** in our case will be economic, social, political, and technological.
- **Clusters** within each of the control criteria point to the importance of market linkages, innovative financial streams, cost saving, and other aspects of implementing new incentives for soil health.

The logic behind NOVASOIL BOCR model is illustrated on Fig. 1.

Following the logic in Fig. 1 NOVASOIL BOCR model, in Table 4 are presented the elements of the BOCR model, beginning with Alternatives (these are the selected incentives from Phase 1). Each of the four main blocks of the BOCR model have a second level of control criteria. Furthermore, each of the clusters contains elements which in more detail will help in comparing the alternatives. At the end the strategic criteria are defined individually by each business model.

Finally, the BOCR questionnaire based on the information above will be presented to the focus group discussions.

COLLECTION DATA

To collect the data, each partner in NOVASOIL project with a case study and business models should organise a focus group event and to invite relevant stakeholders which could contribute to the analysis.

The focus group should contain representatives of all stakeholders: farmers, researchers, policy makers, industry and supply chain actors, landowners, NGOs and civil society, consumers.

The focus group analysis has two phases:

Table 3. Four blocks BOCR model for new soil health incentives

BENEFITS	OPPORTUNITIES
<ul style="list-style-type: none"> - Improving food safety. - Long-term food security. - Developing new market niche. - Sustainable resources for future communities. - Contribution across local and national communities. 	<ul style="list-style-type: none"> - Creation of novel and innovative technology. - Economic opportunities to create jobs and business markets. - Minimize and eliminate the impact of future soil degradation. - Innovative sources of finance.
COSTS	RISKS
<ul style="list-style-type: none"> - Additional expenditures for overcoming barriers. - Long- and short-term investments. - Increased variable costs for soil health operations. 	<ul style="list-style-type: none"> - Incentives may not be effective for soil health. - Worsening soil health. - Insufficient knowledge and information about soil health.

Source: The authors.

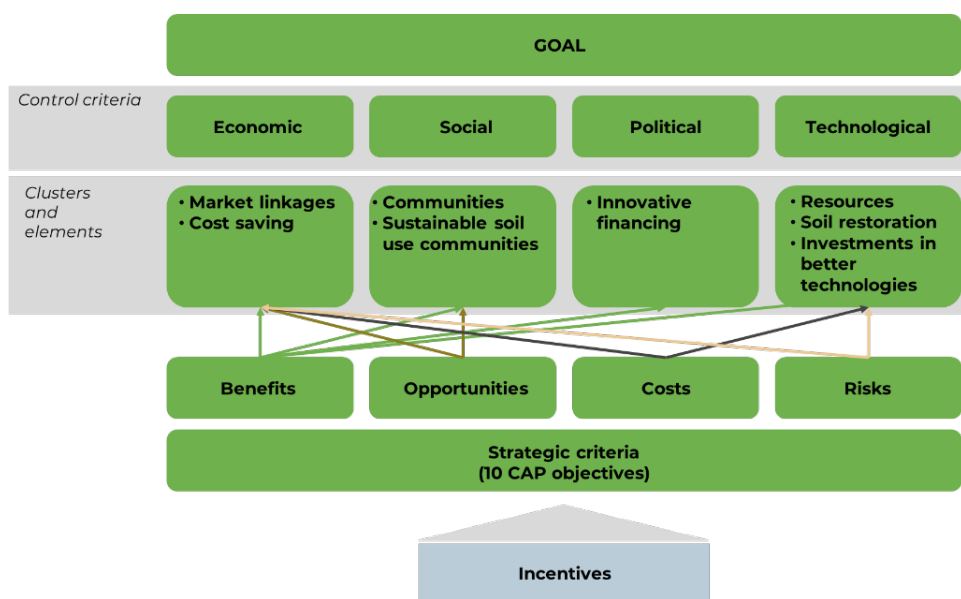


Fig. 1. NOVASOIL BOCR model

Source: The authors.

Table 4. NOVASOIL BOCR model

BOCR	CONTROL CRITERIA	CLUSTERS	ELEMENTS IN CLUSTER
Goal	Assessing new incentives and finding their importance for soil health business model development.		
Strategic criteria	Correspond to the 10 CAP objectives: 1. to ensure a fair income for farmers; 2. to increase competitiveness; 3. to improve the position of farmers in the food chain; 4. climate change action; 5. environmental care; 6. to preserve landscapes and biodiversity; 7. to support generational renewal; 8. vibrant rural areas; 9. to protect food and health quality; 10. fostering knowledge and innovation.		
Alternatives	Incentive 1 Incentive 2 Incentive 3		
BOCR			
	Economic	Market linkages	* Producing safe food, * Good Agricultural Practice, * Good management Practice, * Long chain.
		Cost saving	* Gross margin increasing, * Higher retail price, * Better product quality, * Decreasing variable costs.
BENEFITS	Technological	Resources	* Knowledge of latest technologies, * Immediately available.
	Social	Contribution across local and national communities	* Informational campaigns, * Knowledge hubs.
	Political	Innovative financing	* Better access to finance, * Soil health financial measures, * Improvement productivity, * Efficiency improvement.

BOCR	CONTROL CRITERIA	CLUSTERS	ELEMENTS IN CLUSTER
OPPORTUNITIES	Economic	Market linkages	* Long term results in food security, * Food demand.
		Cost saving	* Long term return, * Initial costs, * Sustainable crop production.
	Technological	Soil restoration	* Fertilization, * Soil remediation, * Sustainable soil management.
	Social	Sustainable soil use	* Climate change, * Biodiversity preservation, * Soil quality, * Regulation of water cycle.
COSTS	Economic	Market linkages	* Developing nature-positive production, * Costs for informational campaign * Increased marketing costs.
		Cost saving	* Gross margin increasing, * Higher retail price, * Better product quality, * Decreasing variable costs.
	Technological	Investments in better technologies for healthy soil	* Precision agriculture, * Cover crops, * Crop rotation, * Increasing short-term investments.
RISKS	Economic	Market linkages	* Barriers to change practices for health practices, * Perceived risk, * Access to finance, * Initial costs.
		Cost saving	* Increasing expenditures for soil health operations, * Increasing variable costs, * Increasing initial costs.
	Political	Innovative financing	* Decreasing liquidity, * Increasing the long-term assets, * Income decrease.

Source: The authors.

Phase one includes analysis of each incentive that is currently applied in the case study. All identified incentives should be evaluated in Table 2. In addition, new incentives should be discussed and proposed based on stakeholder's feedback.

When discussing the new incentives, if their number is more than three, it is necessary to make a ranking of the incentives to select only three.

The ranking process should be the following: each one of the participants will have three votes

for the proposed incentives; and those with the highest count will be the selected three incentives. The top 3 selected incentives will be used in the next phase of the analysis – the BOCR evaluation.

Phase two contains the BOSR questionnaire which should be filled out for each of the selected incentives on phase 1 (identified top 3 incentives). Note that each soil health business model has a different questionnaire.

There are two approaches to deliver the assessments:

1. To create a focus group and every participant gives his assessment. The final assessments are the average of individual assessments.

2. To create a focus group and the final assessment is made by achieving consensus in the group (the group discusses every assessment until they agree).

DISCUSSION

Our paper aims at discussing a methodological approach for assessing new incentives for soil health. Opportunities and gaps of new incentives for redirection of financial streams and policy support measures for provision of innovative soil health technologies can be assessed. The two phases of the methodology cover on one hand new and improved incentives for soil health, and on the other a comprehensive analysis with the BOCR-ANP model. The usefulness of BOCR-ANP method is that it deals with multi-criteria problems, especially when monetary calculations are difficult or not applicable. Using this method in relation with soil health problem is relatively scarce in the scientific literature. We choose to use BOCR-ANP because it provides us with a more structural approach which enable us to prioritize new incentives for improving soil health business models, considering the respective benefits, opportunities, costs, and risks.

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