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Decision Support Model for Integrating the New Cross-Compliance Rules and Rational Water Management †

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Abstract: The aim of this study is to change land use by applying a decision support model that will contribute to the assimilation of the new cross-compliance rules, to optimal water management, and to the enhancement of the effectiveness and profitability of the farms. The research objective will be achieved by establishing 50-acre pilot fields for five farmer groups through the optimal allocation of limited economic and land resources. The result extracted will lead to the gradual incorporation of the new directives to reduce production costs and recognize the new cross-compliance rules.

Keywords: Common Agricultural Policy; cross-compliance; water management; decision support model

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1. Introduction

The research problem to be solved concerns the adaptation of the producers to the new and increasing cross-compliance requirements as the rules will be tightened for the period 2021–2027 and farmers must be ready for the additional obligations of the Common Agricultural Policy. This is why the present study aims to change the land uses by applying a decision support model to five farmer groups located in Thessaloniki, Serres, Kozani, and Kavala. The model will be configured so that its implementation will initially contribute to the assimilation of the new cross-compliance rules, to optimal water management, and to the enhancement of the effectiveness and profitability of the farms. The application of such a developed decision support model will allow each farm to determine its own optimal production plan based on specific limits, with the main objective of using water in a rational way and strengthening the farm's economic position by further contributing to reducing production and labor costs, increasing gross profit, and achieving environmental sustainability. By implementing the above actions, a twofold benefit will be achieved in addition to economic upgrading and increased competitiveness due to the delimitation of the inputs used; farms will be able to further adapt to the new guidelines of the Common Agricultural Policy (reference period: 2021–2027) gradually. The research objective will be achieved by establishing 50 acres of pilot fields for five farmer groups, and the result extracted will lead to the gradual incorporation of the new directives to reduce production costs and recognize the new cross-compliance rules.

The development of a decision support model is a project with a modular implementation process and multiple aspects. This model is based on an existing structure created by the Laboratory of Informatics in Agriculture, which belongs to the Aristotle University of Thessaloniki, and is adapted to the needs of the producers participating in the research.

At the same time, the laboratory's web-based platform will be used after its adaption to the needs of this research. The platform's function concerns the recording of technical and economic data, useful for drawing appropriate conclusions regarding the farms' economic positions. In addition to the aforementioned actions, producers will be taught and familiarized with the use of the platform. The initial use of the platform by the producers is aimed at further adapting it to the users' needs and highlighting possible errors. Regarding the scientific literature, the development of corresponding models and the use of corresponding platforms in various countries are evident [1–4], especially in Greece [5–9]. In fact, the desire to develop web-based platforms for use in the agricultural sector is particularly evident, as highlighted by the review of the most recent literature [10–13]. The remainder of this paper is structured as follows: (1) First, the Materials and Methods section presents the method used and the research stages (Section 2). (2) Subsequently, the research Expectative Results and the contribution to the agricultural sector are described in (Section 3). (3) Finally, the present study's conclusions and innovation parameters are given in detail (Section 4).

2. Materials and Methods

The development of a decision support model (DSM) for the adaptation to cross-compliance rules and farms' economic efficiency achievement is a project with a modular implementation process and multiple and complex aspects. For the model's development, it is initially necessary to collect a set of farmer groups' relevant data using a special questionnaire that is based on the scientific literature [14–17]. After the data collection, the multicriteria decision-making analysis and, especially, the multicriteria weight goal programming are used as they are also proposed by the relevant literature [14,18–25]. These methods are used to develop the decision support model according to the needs of the five farmer groups and to select the 50-acre pilot fields.

Then, the use of the web-based platform is carried out aiming to record the economic and technical data of the fifty-acre pilot fields. Through the use of the web-based platform, the producers' knowledge regarding the farmer group's sustainable position is actually enhanced [26]. In addition, the use of the online platform aims to create a technical and economic database in order to confirm whether the objectives of this research have been achieved in terms of farmer groups' profitability and production costs. In order to fulfill the above-mentioned aim, an economic and technical analysis of the results will be carried out for the economic evaluation of the study and the evaluation of the possibilities of using the new methodology. Minimizing inputs will also be explored. Finally, dissemination actions will be carried out in order to spread the forthcoming results.

3. Expectative Results and Discussion

The present work essentially aims to transform the Laboratory of Informatics in Agriculture's existing research into an organized framework of rational water use management, with the ultimate goal of reducing production and labor costs, increasing gross profit, and achieving the environmental sustainability of Greek farms [8]. This research aim will essentially be achieved with the optimal allocation of the limited economic and land resources of the agricultural producers.

It should be particularly pointed out that the connection of farmers to the decision support model and the electronic management of their farms has multiple benefits since they are part of the innovative and rational management of water use. The organization and extraction—through the model—of an optimal production plan will create more effective farms, based on the challenges linked to the principles of the new Common Agricultural Policy. This study is also an innovative action as it motivates producers to adopt more effective farming methods. Last but not least, it should be also pointed out that the producers' engagement with the decision support model is continuous as they input data individually into a relative web-based platform and will soon be given the opportunity to simulate valid and numerous production plans.

4. Conclusions

It is worth noting that this study is carried out for the first time on such a large scale with a view of extending it to other areas. It should also be considered innovative as it includes information on the main crops of the regions with the aim of managing entire agricultural areas rather than just a single farm while it is known that alternative crops are limited in the area. The process, after the implementation of the decision support model (DSM), will be considered effective if it motivates the producers—through the integration and assimilation of the new cross-compliance rules—to pursue more efficient crops without eliminating the existing ones and always with the aim of increasing their profitability.

Pilot fields can be considered small production plans. Thus, producers will understand the expected profit by implementing this research process on a larger scale. Finally, the farmers' connection with information technology and, in particular, with the decision support model (DSM) has a two-fold perspective as they will be able to enter personalized data themselves and simulate numerous production plans taking into account the new cross-compliance rules and rational water management.

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References

1. Tiwari, D.N.; Loof, R.; Paudyal, G.N. Environmental–Economic Decision-Making in Lowland Irrigated Agriculture Using Multi-Criteria Analysis Techniques. *Agric. Syst.* **1999**, *60*, 99–112. [CrossRef]
2. Li, Y.P.; Huang, G.H. Interval-Parameter Two-Stage Stochastic Nonlinear Programming for Water Resources Management under Uncertainty. *Water Resour. Manag.* **2007**, *22*, 681–698. [CrossRef]
3. Rupnik, R.; Kukar, M.; Vračar, P.; Košir, D.; Pevec, D.; Bosnić, Z. AgroDSS: A Decision Support System for Agriculture and Farming. *Comput. Electron. Agric.* **2019**, *161*, 260–271. [CrossRef]
4. Meng, C.; Li, W.; Cheng, R.; Zhou, S. An Improved Inexact Two-Stage Stochastic with Downside Risk-Control Programming Model for Water Resource Allocation under the Dual Constraints of Water Pollution and Water Scarcity in Northern China. *Water* **2021**, *13*, 1318. [CrossRef]
5. Moulogianni, C.; Bournaris, T. Assessing the impacts of rural development plan measures on the sustainability of agricultural holdings using a pmp model. *Land* **2021**, *10*, 446. [CrossRef]
6. Latinopoulos, D. Multicriteria Decision-Making for Efficient Water and Land Resources Allocation in Irrigated Agriculture. *Environ. Dev. Sustain.* **2009**, *11*, 329–343. [CrossRef]
7. Manos, B.; Papathanasiou, J.; Bournaris, T.; Voudouris, K. A Multicriteria Model for Planning Agricultural Regions within a Context of Groundwater Rational Management. *J. Environ. Manag.* **2010**, *91*, 1593–1600. [CrossRef] [PubMed]
8. Bournaris, T.; Papathanasiou, J.; Manos, B.; Kazakis, N.; Voudouris, K. Support of irrigation water use and eco-friendly decision process in agricultural production planning. *Oper. Res.* **2015**, *15*, 289–306. [CrossRef]
9. Papathanasiou, J.; Bournaris, T.; Tsaples, G.; Digkoglou, P.; Manos, B.D. Applications of DSSs in Irrigation and Production Planning in Agriculture. *Int. J. Decis. Support Syst. Technol.* **2021**, *13*, 18–35. [CrossRef]
10. Schut, M.; Kamanda, J.; Gramzow, A.; Dubois, T.; Stoian, D.; Andersson, J.; Lundy, M. Innovation Platforms in Agricultural Research for Development: Ex-ante Appraisal of the Purposes and Conditions under Which Innovation Platforms can Contribute to Agricultural Development Outcomes. *Exp. Agric.* **2019**, *55*, 575–596. [CrossRef]
11. Amiri-Zarandi, M.; Hazrati Fard, M.; Yousefinaghani, S.; Kaviani, M.; Dara, R. A Platform Approach to Smart Farm Information Processing. *Agriculture* **2022**, *12*, 838. [CrossRef]

12. Borrero, J.D.; Mariscal, J. A Case Study of a Digital Data Platform for the Agricultural Sector: A Valuable Decision Support System for Small Farmers. *Agriculture* **2022**, *12*, 767. [CrossRef]
13. Runck, B.C.; Joglekar, A.; Silverstein, K.; Chan-Kang, C.; Pardey, P.; Wilgenbusch, J.C. Digital agriculture platforms: Driving data-enabled agricultural innovation in a world fraught with privacy and security concerns. *Agron. J.* **2022**, *114*, 2635–2643. [CrossRef]
14. Bournaris, T. A Multi-Criteria Model for Investigating the Income, Employment, and Environmental Impacts of Irrigated Agriculture. Master's Thesis, Department of Agriculture, School of Geotechnical Sciences, Aristotle University of Thessaloniki, Thessaloniki, Greece, 2003.
15. Martika-Vakirtzi, M.; Dimitriadou, E. *Accounting in Types of Agricultural Holdings*; Grafima: Thessaloniki, Greece, 2007.
16. Kitsopanidis, G.; Kamenidis, C. *Agricultural Economics*, 3rd ed.; ZHTH: Thessaloniki, Greece, 2003.
17. Kouriati, A.; Dimitriadou, E.; Bournaris, T. Farm accounting for farm decision making: A case study in Greece. *Int. J. Sustain. Agric. Manag. Inform.* **2021**, *7*, 77. [CrossRef]
18. Katsaounis, M. Techno-Economic Analysis and Organization of Agricultural Production in the Area Askio of Kozani. Master's Thesis, School of Agriculture, Aristotle University of Thessaloniki, Thessaloniki, Greece, 2012.
19. Briggs, T.; Kunsch, P.L.; Mareschal, B. Nuclear waste management: An application of the multicriteria PROMETHEE methods. *Eur. J. Oper. Res.* **1990**, *44*, 1–10. [CrossRef]
20. Vaillancourt, K.; Waaub, J.-P. Environmental site evaluation of waste management facilities embedded into EUGÈNE model: A multicriteria approach. *Eur. J. Oper. Res.* **2002**, *139*, 436–448. [CrossRef]
21. Kapepula, K.-M.; Colson, G.; Sabri, K.; Thonart, P. A multiple criteria analysis for household solid waste management in the urban community of Dakar. *Waste Manag.* **2007**, *27*, 1690–1705. [CrossRef]
22. Queiruga, D.; Walther, G.; González-Benito, J.; Spengler, T. Evaluation of sites for the location of WEEE recycling plants in Spain. *Waste Manag.* **2008**, *28*, 181–190. [CrossRef]
23. Vego, G.; Kučar-Dragičević, S.; Koprivanac, N. Application of multi-criteria decision-making on strategic municipal solid waste management in Dalmatia, Croatia. *Waste Manag.* **2008**, *28*, 2192–2201. [CrossRef] [PubMed]
24. Wang, J.J.; Jing, Y.Y.; Zhang, C.F.; Zhao, J.H. Review on multi-criteria decision analysis aid in sustainable energy decision-making. *Renew. Sustain. Energy Rev.* **2009**, *13*, 2263–2278. [CrossRef]
25. Moulogianni, C. Comparison of Selected Mathematical Programming Models Used for Sustainable Land and Farm Management. *Land* **2022**, *11*, 1293. [CrossRef]
26. Bournaris, T. Designing and Development of a Web Portal for E-Government and Farm Management. Ph.D. Thesis, Department of Agricultural Economics, School of Agriculture, Aristotle University of Thessaloniki, Thessaloniki, Greece, 2009.