# Optimizing Mussel Production Systems: The Role of Technological Tools Against Unpredictable External Conditions - Abstract

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**Summary**

Mussel production is an activity of specific importance of mainland coastal areas of Greece, as it is the source of supplementary (or main) incomes for fishermen. Previous research showed that the system involves a relatively small number of heterogeneous farms and producers, with different levels of entrepreneurial organization and production practices, which have an impact on their economic performance. However, a common external threat for mussel farms relates to unpredicted changes in environmental conditions. Since mussels are able to feed by absorbing nutrients from sea water, they also accumulate other substances in high concentrations, while they are also vulnerable to physiochemical changes (e.g. temperature and oxygen) in water. The presence of toxins in aquatic ecosystems, therefore, generates important threats for the viability of mussel production as well as for public health. Indeed, mussels are distributed for human consumption of after costly processing in sanitation facilities, while also they can be discarded – or even the production area can be put out of operation - if toxins are found in high concentrations. These destructive implications can be avoided if adverse environmental conditions are detected at a very early stage and mussels can thus be moved to another part of the sea rea, where conditions are better. SmartMussel project proposes a model of automated, remote-controlled management system for mussel farms, which uses probes of temperature, dissolved oxygen and conductivity associated with prediction software to demonstrate the potential need for mussel movement between marine areas. As part of SmartMussel project, this paper examines the potential socioeconomic effects of introducing and operation this automated system. In particular, the analysis is based on the development of a linear programming model, where three types of mussel farms (large size farms (LSF), medium size farms (MSF) and small size farms (SSF) according to the occupied surface area) are included as separate blocks of variables and constraints. Data for the analysis are derived from an on-site questionnaire survey of mussel farmers in the study area of Vistonikos Gulf (Eastern Macedonia, Greece), which were refined and calibrated based on additional survey data from Thermaikos Gulf (Central Macedonia, Greece). The results of the model indicate the optimal structure of the sector, which highlight how each farm type can be viable compared to other types. The optimized objective function (i.e., the total gross margin of mussel farms) is then used within a cost-benefit analysis framework, which is related to the number of possible outbreaks of adverse conditions that can lead to the destruction of production. Through this analysis, the mid-and long-term effects of using the automated systems are approached, thus demonstrating the necessity of introducing it and its usability in terms of risk management. Among other findings of the analysis, the contribution of the sector to employment and specific proposals for increasing the viability of each farm type are revealed.

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Linear programming, cost-benefit analysis, risk management