

ARTIFICIAL INTELLIGENCE AS A TOOL FOR OPTIMIZING PROMOTIONAL STRATEGIES FOR HORTICULTURAL PRODUCERS

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RESEARCH ARTICLE

Abstract

This paper analyzes the role of artificial intelligence in optimizing promotional strategies for local horticultural producers, based on a case study conducted on a family-owned cherry farm in western Romania. The study aims to identify the benefits, limitations, and opportunities associated with the use of AI in the marketing of horticultural products. The research methodology combines a review of the specialized literature on digital marketing and artificial intelligence with a practical case study analysis. The study evaluates current commercialization strategies and compares them with an optimized scenario that integrates digital marketing tools and AI-based solutions. The results indicate that the current reliance on intermediaries and the lack of digital marketing limit the producer's control over pricing and reduce revenue potential. The comparative analysis shows that, under the same production volume, the use of digital marketing and artificial intelligence could increase average prices and generate a revenue growth of approximately 30–50%. Furthermore, AI tools can support decision-making by analyzing market trends, identifying optimal sales periods, and improving communication with target audiences. However, the study also highlights several barriers to adoption, including limited financial resources, low levels of digital skills, and uncertainty regarding the return on investment. Despite these challenges, the findings suggest that artificial intelligence represents a strategic opportunity for improving the competitiveness of local horticultural producers.

Keywords: digital marketing, agri-food sector, consumer behavior, market competitiveness, data analysis

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INTRODUCTION

In recent decades, agriculture has undergone an accelerated process of digitalization, driven by the development of information technologies and the need to increase the economic efficiency of agricultural holdings. In this context, artificial intelligence (AI) has begun to be used not only in agricultural production processes, but also in marketing and promotion activities for agri-food products. New technologies enable the collection and analysis of large volumes of data on consumers, markets, and purchasing behavior, thereby facilitating the development of more efficient marketing strategies that are better adapted to market demand (Kotler, 2021).

The horticultural sector is one of the most important segments of agriculture, playing a significant role in ensuring food supply, supporting rural economic development, and creating employment opportunities. Fruit and vegetable production has a high economic value due to the constant demand for fresh and processed products, both in local and

international markets. In this context, the efficiency of marketing systems becomes an essential factor for the valorization of horticultural production and for the integration of producers into agri-food supply chains (Bhattacharjee & Banerjee, 2024). In general, it is considered that the participation of agricultural producers in modern distribution chains largely depends on their ability to adopt effective marketing strategies and to respond to market requirements (Slamet, 2017).

In recent years, the digitalization of agriculture has brought significant changes in the way horticultural producers promote their products and interact with consumers. The development of digital marketing and the use of online platforms have enabled farmers to communicate directly with consumers, promote their products, and identify new distribution channels (Mihailovic, 2024). Artificial intelligence is increasingly being integrated into digital marketing strategies, offering tools capable of analyzing consumer behavior, optimizing promotional campaigns, and personalizing communication with target

audiences. The application of AI-based technologies can contribute to increasing the efficiency of marketing strategies and strengthening the relationship between producers and consumers within the agri-food sector (Al-Taha'at, Harb, Al-Slaibi, O.A. & Hamadneh, 2025).

The horticultural sector presents a series of particular characteristics that make marketing activities essential for the effective valorization of production. Horticultural products are generally perishable, highly seasonal, and strongly influenced by fluctuations in market demand and prices. For this reason, producers must adopt efficient promotional strategies to ensure the rapid and profitable commercialization of their production (Sandeep G., Rohit K., Sachin K. V., 2023).

According to the specialized literature, "the marketing of horticultural products involves identifying appropriate distribution channels, developing relationships with intermediaries or final consumers, and adapting communication strategies to the specific characteristics of the market" (Sandeep G., Rohit K., Sachin K. V., 2023). At the same time, the development of digital technologies has opened new opportunities for the promotion of horticultural products, particularly through online platforms and digital marketing tools.

In recent years, artificial intelligence has increasingly been used in the field of marketing, providing tools capable of analyzing consumer behavior, optimizing promotional campaigns, and generating content tailored to different audience segments. The concept of AI-based marketing refers to the use of algorithms and data analysis technologies to improve communication and interaction processes between producers and consumers (Kotler, 2021). Such tools can contribute to increasing the visibility of agricultural products, identifying new market opportunities, and enhancing the efficiency of promotional activities.

However, in the case of local horticultural producers, the adoption of digital technologies and AI-based tools is often limited by several factors, including a low level of digital skills, limited financial resources, and lack of access to information and training in the field of digital marketing (Department of Agriculture, 2015). These aspects may represent significant barriers in the process of modernizing the promotional strategies used by local producers.

Starting from these considerations, the aim of the present paper is to analyze the role of

artificial intelligence in optimizing promotional strategies for local horticultural producers.

The research objectives are:

to identify the main benefits of using artificial intelligence in the marketing of horticultural products;

to highlight the limitations and barriers in the adoption of these technologies;

to analyze the opportunities that artificial intelligence can offer to local producers in the process of product promotion.

Based on these objectives, the research is grounded on the following hypotheses:

H1: The use of artificial intelligence-based tools in promotional strategies contributes to increasing the efficiency of marketing campaigns for local horticultural producers.

H2: A low level of digital skills and limited financial resources represent the main barriers to the adoption of artificial intelligence by local horticultural producers.

MATERIAL AND METHOD

The research conducted in this paper has an analytical role and is based on the case study method. The analysis focuses on a farm, a family-owned horticultural holding located in western Romania.

The methodology combines a review of the specialized literature on the marketing of horticultural products and the use of artificial intelligence (AI) in digital marketing, with a practical analysis of the promotional strategies applied within the studied farm.

The purpose of this approach is to highlight how AI-based tools can contribute to improving the promotional strategies used by local horticultural producers, as well as to identify the main opportunities and limitations associated with the use of these technologies.

The case study is conducted on a family-owned horticultural farm, referred to in this paper as Ferma Tau, specialized in cherry production within a super-intensive system. The farm is located in western Romania and has a total area of approximately 12 hectares, of which around 10 hectares are occupied by the cherry orchard, one hectare consists of technological roads and infrastructure, and approximately one hectare is cultivated with plum trees.

The cherry plantation was established approximately five years ago and is organized as a super-intensive system, characterized by a high tree density and the use of modern cultivation technologies. In order to support

production and reduce climate-related risks, the plantation is equipped with a drip irrigation system supplied by a water accumulation basin, as well as anti-hail netting, which protects the crop against extreme weather events. At present, the farm is in its early production stage, being only in its second year of yield. In the third year after planting, the production was very low, amounting to approximately 100 kg of fruit, which cannot be considered a commercially relevant output.

Starting from the current year, the farm is entering a development stage in which a more significant level of production is expected, with the plantation projected to reach its maximum production capacity in the coming years.

The commercialization of cherry production is primarily carried out through collaboration with intermediaries who collect the fruit directly from the farm and subsequently distribute it to supermarket and hypermarket chains. The farm's current strategy involves establishing partnerships with companies specialized in fruit packaging and distribution to large retail chains.

In the medium and long term, the farm's objective is to develop direct commercial relationships with supermarkets and hypermarkets, as well as to explore the possibility of accessing external markets through exports.

At present, the farm's promotional activities are limited and rely mainly on direct relationships and interpersonal communication. Commercial contacts have been established primarily through professional networks and direct discussions with representatives of retail chains. So far, the farm has not used digital marketing tools, such as promotion through social media or the development of a dedicated online platform.

This situation is mainly explained by the fact that the farm is still in the initial production phase, and the investments made so far have been primarily directed towards the development of agricultural infrastructure and the maintenance of the plantation.

Several methods of analysis were used in conducting this research. Firstly, a comparative analysis was carried out between the traditional promotion methods used within the farm and the opportunities offered by digital tools and artificial intelligence in optimizing marketing strategies.

Secondly, a qualitative analysis was conducted on the factors influencing the

commercialization of horticultural production, taking into account the specific characteristics of the fresh fruit market, such as production seasonality, product perishability, and price fluctuations depending on the harvesting period and the level of market competition.

The research results must be interpreted considering certain limitations of the study, which may influence the degree of generalization and applicability of the formulated conclusions. Firstly, the analysis is based on a single case study, namely a family-owned horticultural farm in its early years of production, which limits the possibility of generalizing the results to the entire horticultural sector.

Secondly, the current level of implementation of digital marketing tools and AI-based technologies within the analyzed farm is low, which means that the analysis relies largely on assessing the potential of these technologies, based on specialized literature and current trends in agri-food marketing. Therefore, some of the conclusions are grounded in the potential of these technologies, as reflected in the literature and market trends, rather than on the results of a concrete implementation.

In addition, it should be noted that part of the data used in the analysis is of an estimative nature, considering that the farm has not yet reached its maximum production capacity, and economic results may vary depending on external factors such as market evolution, demand dynamics, the level of competition, and climatic conditions. Furthermore, the analysis of artificial intelligence usage has a predominantly theoretical character, based on simulations and specialized literature, as these tools have not yet been effectively implemented within the analyzed farm. These aspects may influence both the level of revenues and the overall profitability of the activity.

Nevertheless, the study provides a relevant perspective on how local horticultural producers could use digital technologies and AI-based tools to improve promotional strategies and increase the efficiency of the production commercialization process.

RESULTS AND DISCUSSIONS

The analysis carried out within the case study highlights a number of relevant aspects regarding how local horticultural producers commercialize their production and develop their promotional strategies. In the case of the analyzed farm, cherry production is still in its early bearing years, which influences both the volume of production available for commercialization and the strategies used for its valorization.

At present, the commercialization of production is mainly carried out through specialized companies that collect the fruit from the farm and subsequently distribute it to supermarket and hypermarket chains. This method allows access to the market without additional investments in distribution or marketing activities; however, it reduces the producer's direct control over the commercialization process and the final price of the products.

An important aspect identified in the analysis is the significant variation in prices on the fresh fruit market, particularly in the case of cherries. The selling price is influenced by several factors, including the timing of market entry, climatic conditions, and the level of competition from other producing countries, such as Greece or Hungary. Thus, when production reaches the market earlier, prices may be higher, but as supply increases and competition intensifies, prices tend to decline.

In this context, the ability of producers to analyze market trends and adopt efficient promotional strategies becomes an important factor in increasing the competitiveness of horticultural holdings.

In the case of the analyzed farm, promotional activities are currently limited and rely mainly on direct commercial relationships and interpersonal communication. Commercial contacts are established through direct discussions with representatives of retail chains or with companies specialized in fruit distribution. The lack of use of digital marketing tools reflects a situation frequently encountered among local horticultural producers, especially in the early stages of farm development, when financial resources are primarily directed toward production investments.

In order to highlight the main opportunities and limitations associated with the use of digital technologies in the promotion of horticultural products, a SWOT analysis was conducted regarding the use of artificial

intelligence in the marketing strategies of horticultural producers.

Table 1

SWOT Analysis on the Use of Artificial Intelligence in the Promotion of Horticultural Products

Strengths	Weaknesses
Modern super-intensive cultivation system	Production is still in the early stages of development
Potential for obtaining high-quality products	Lack of use of digital marketing
Possibility of access to retail chains	Limited financial resources for investment in promotion
Opportunities	Threats
Use of artificial intelligence in digital marketing	Competition from other producing countries
Increased product visibility through online platforms	Significant price fluctuations
Possibility of accessing external markets	Seasonality and perishability of products

The results of the analysis highlight that, although the analyzed farm benefits from a modern production infrastructure, the lack of digital marketing tools may limit the development potential of its commercial activity. In this context, the integration of artificial intelligence-based solutions could contribute to optimizing the promotional strategies used by horticultural producers.

Artificial intelligence can be used in the marketing of horticultural products in several ways. Firstly, data analysis can enable the monitoring of market trends and price dynamics, facilitating the anticipation of favorable periods for product commercialization. The analysis of data related to production, demand, and market prices can provide valuable insights for planning commercialization strategies.

Secondly, artificial intelligence can support digital marketing activities by generating content for online product promotion, managing social media campaigns, and analyzing consumer behavior. Such tools can contribute to increasing the visibility of horticultural products and to developing a direct

relationship between producers and consumers. Moreover, the use of artificial intelligence can facilitate the identification of new distribution channels and potential business partners, contributing to the diversification of sales markets and increasing the competitiveness of horticultural producers.

A concrete example of the use of artificial intelligence in the marketing of horticultural products is represented by platforms such as ChatGPT, used for generating promotional content, or tools integrated into social media platforms, such as Meta Ads Manager, which allow the analysis of consumer behavior and the optimization of advertising campaigns. For example, a horticultural producer can use ChatGPT to create attractive product descriptions or to draft promotional messages tailored to different audience segments. These materials can then be used in campaigns on platforms such as Facebook or Instagram, where, with the help of artificial intelligence algorithms, advertisements can be targeted to specific audiences based on interests, location, or purchasing behavior. In this way, the promotional process becomes more efficient and better aligned with market requirements.

In continuation of this process, the use of artificial intelligence can be integrated into a concrete promotional campaign. For example, the producer could run a campaign on the Facebook platform, publishing images and videos from the orchard that highlight product quality, freshness, and production methods. Promotional messages can be generated and optimized using AI-based tools, so that they are tailored to the target audience. By using paid promotion features, the campaign can be directed toward consumers in urban areas or toward potential business partners, depending on their interests and purchasing behavior. In this way, the producer can increase product visibility and facilitate direct sales, reducing dependence on intermediaries.

In order to highlight the impact of market factors on the commercialization of horticultural production, several estimated data points from the analyzed farm can also be considered. In the case of cherries, prices vary significantly depending on the timing of market entry and climatic conditions. Thus, under favorable seasonal conditions, when production reaches the market early (mid-May), the price can reach approximately 20 RON/kg. Subsequently, as supply increases and competition intensifies, the price may decrease

significantly, even reaching 5 RON/kg during the peak season. In the case of late varieties, there is the possibility of a price increase again up to 15–20 RON/kg; however, this depends on changes in climatic conditions.

Regarding production, the analyzed farm is still in its early bearing years, which makes it difficult to estimate actual production with precision. In the first year, production was insignificant (approximately 100 kg), and in the following year, production was lost due to frost. However, for the current year, an estimated production of approximately 40–50 tons is expected. At full maturity of the plantation, total production could reach values between 300 and 400 tons, highlighting the high potential of the farm.

The maintenance costs of the farm are high, exceeding €120,000 annually, including expenses related to labor, agricultural inputs, and plantation maintenance. In relation to the estimated revenues, which may reach approximately 750,000 RON in an optimized scenario, it can be observed that profit remains relatively low. Under these conditions, the profitability of the activity is strongly influenced by the achieved selling price and is directly dependent on market fluctuations. Therefore, at present, profitability remains uncertain, considering that the farm is still in the initial stage of production.

The method of production commercialization directly influences the revenues obtained. Currently, the farm's strategy is oriented toward a mixed system, based both on collaboration with intermediaries and on the development of direct relationships with retail chains. In the case of sales through intermediaries, the obtained price is lower; however, this option provides greater security in the commercialization of production. On the other hand, direct sales to retailers or to external markets could lead to higher prices, estimated to be approximately 30% higher.

The main issue identified in the commercialization process is external competition, particularly from countries such as Greece and Hungary, which are able to offer highly competitive prices. This situation creates constant pressure on prices and reduces the ability of local producers to achieve a stable profit margin.

In order to highlight the impact of digital marketing and AI-based tools on production commercialization, a comparative analysis was conducted between two scenarios: the current

commercialization model and an optimized scenario.

Table 2

Comparative analysis of commercialization strategies

Indicator	Current Scenario	Optimized Scenario (Digital Marketing + AI)
Average price/kg	8–10 RON/kg	12–15 RON/kg
Quantity sold	40–50 tons	40–50 tons
Sales channel	Intermediaries	Direct + retail
Control over pricing	Low	High
Visibility	Low	High
Estimated total revenue	320,000 – 500,000 RON	480,000 – 750,000 RON

Source: own estimates based on data from the analyzed farm.

The comparative analysis highlights that, under conditions where the production volume remains constant, the differences in revenue are generated exclusively by the commercialization strategy and the use of marketing tools. Thus, the integration of digital marketing and artificial intelligence can lead to higher prices and a significant increase in revenues.

For a clearer illustration of these differences, an estimated simulation of the impact of using artificial intelligence in promotional strategies can also be conducted. Under current conditions, where production is predominantly commercialized through intermediaries, at an average price of approximately 8–10 RON/kg and an estimated production of 40–50 tons, total revenue may range between 320,000 and 500,000 RON.

In an optimized scenario, where digital marketing and AI-based tools are used to identify customers, promote products, and optimize the timing of sales, the average price could increase to approximately 12–15 RON/kg. Under these conditions, for the same production

volume, total revenue could reach values between 480,000 and 750,000 RON.

This difference highlights an estimated potential revenue increase of approximately 30–50% through the use of digital marketing strategies and artificial intelligence-based tools, without changing the production volume, but solely by optimizing promotion and commercialization strategies. In this context, artificial intelligence can contribute to identifying optimal sales periods, selecting appropriate distribution channels, and adapting communication according to market requirements. Furthermore, the use of artificial intelligence can help reduce decision-making uncertainty by providing producers with relevant information regarding market evolution and consumer behavior.

However, the use of digital marketing and artificial intelligence-based tools does not automatically guarantee an increase in sales. The implementation of these strategies also involves certain risks, such as additional costs generated by online promotion, which may affect the farm's budget, especially in the early stages of development. Furthermore, there is a high dependence on digital platforms, and changes in their algorithms or policies may significantly influence product visibility.

Another important risk is the lack of experience in using digital tools, which may lead to inefficient campaigns and suboptimal allocation of the promotional budget. In addition, the results obtained through digital marketing can be difficult to predict, and the return on investment is not guaranteed.

Moreover, in the case of horticultural products, their perishable nature and dependence on external factors, such as climatic conditions or competition, can significantly influence demand, making the outcomes of promotional campaigns variable. Under these conditions, the use of digital tools and artificial intelligence must be approached strategically, through continuous adaptation to market conditions and careful resource management.

The results obtained support the hypotheses formulated within the research, based on the data and observations derived from the case study. Thus, hypothesis H1, according to which the use of artificial intelligence contributes to increasing the efficiency of promotional strategies, is confirmed by several elements highlighted in the analysis. Firstly, the use of digital marketing would allow increased product visibility compared to the current

situation, where promotion is limited and primarily based on direct relationships. Secondly, the possibility of direct commercialization would lead to higher prices compared to sales through intermediaries. The simulation indicates a potential increase in total revenues of approximately 30–50%, reflecting a higher economic efficiency of promotional strategies based on digital tools and artificial intelligence.

At the same time, hypothesis H2 is also confirmed, as the analysis highlights the

CONCLUSIONS

The present paper aimed to analyze the role of artificial intelligence in optimizing promotional strategies for local horticultural producers, based on a case study applied to a fruit farm specialized in cherry production. The results obtained highlight that the commercialization of horticultural production is significantly influenced by factors such as seasonality, price fluctuations, and the level of market competition, which require the adoption of more efficient marketing strategies.

The analysis shows that, under current conditions, the lack of use of digital marketing tools and the dependence on intermediaries lead to reduced control over pricing and limited commercialization of production. In contrast, the integration of digital marketing and artificial intelligence-based tools can contribute to increasing product visibility, identifying more advantageous distribution channels, and obtaining higher prices. The simulation conducted within the study indicates a potential revenue increase of approximately 30–50%, under conditions of maintaining the same production volume, which highlights the importance of optimizing promotional strategies.

The research results confirm the formulated hypotheses. Thus, hypothesis H1 is validated by the fact that the use of artificial intelligence and digital marketing leads to increased efficiency of marketing activities, reflected in greater visibility, more favorable pricing, and higher revenues. At the same time, hypothesis H2 is also confirmed, as the analysis revealed the existence of real barriers to the adoption of these technologies, such as limited financial resources and a low level of digital skills.

existence of real barriers to the adoption of these technologies. In the case of the analyzed farm, the lack of digital marketing usage is primarily determined by the prioritization of investments toward production, as well as by limited financial resources available in the early stages of development. Additionally, the low level of digital skills and the lack of experience in using online promotional tools represent factors that hinder the implementation of artificial intelligence-based solutions.

From a practical perspective, the results of the study highlight that local horticultural producers could significantly benefit from the use of digital tools and artificial intelligence in the process of promoting and commercializing their production. The implementation of these solutions should be carried out gradually, depending on available resources, through the development of digital competencies and by orienting toward direct or mixed sales channels. In this context, the use of artificial intelligence represents not only a technological opportunity but also a strategic direction for enhancing the competitiveness of horticultural producers in today's market.

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