SWOT analysis on the adoption and diffusion of the decision support system in Mediterranean greenhouse farming areas.

SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis is a tool used for strategic planning in various fields like management, education, marketing, healthcare, and agriculture (Benzaghta et al., 2021). SWOT analysis can also be used at a larger, territorial level, where external factors for companies might become internal factors for the region. Here, the SWOT matrix (Table S1) was filled to highlight favourable conditions for greenhouse farming (S), persistent problems (W), external factors that can provide potential solutions (O), or that can worsen problems (T).

Table S1. Output of the SWOT exercise in the case studies.

Strengths	**Weaknesses**	**Opportunities**	**Threats**
Almeria, Spain			
Favourable climatic conditions: Ideal climate for diverse crop cultivation Strong organizational structures: Presence of cooperatives, irrigation communities, and trade unions Excellent marketing logistics: Efficient systems for product distribution Extensive ancillary industry: Availability of necessary agricultural inputs and services Technical advice: Access to great technical support and advice Dynamic farming community: Flexible and adaptive farmers and cooperatives Irrigation management: Advanced irrigation techniques and management	Weak bargaining power: Farmers have low bargaining power in the value chain Many middlemen: The presence of intermediaries reduces farmers' profits Workload: During the campaign, there are periods of intense activity followed by quieter ones with varying workloads Work-life balance: difficult to find a balance between farming and family, especially for women Environmental awareness: Lack of information leading to improper disposal of some waste Seasonal crop planning: Inefficient planning leading to overproduction and low prices	Low-cost technologies: Development and evaluation of affordable technologies for water savings and reduced nitrate leaching Market adaptation: Ability to quickly adapt to market demands for sustainability and product quality. Sustainable production: Increasing market demand for organic farming and integrated pest management Youth engagement: Sufficient young population to facilitate digital tool expansion Consumer trust: opportunity to demonstrate ecological and	Water scarcity: Risk of water shortages affecting production Market competition: Competition with non-EU markets Waste treatment: Lack of infrastructure for the treatment of a few types of waste. High investment costs: Significant investment required for greenhouse construction Rising production costs: Increasing costs for inputs and energy Rural hygiene: Need to improve compliance with hygiene standards in greenhouse areas

Strengths	**Weaknesses**	**Opportunities**	**Threats**
Continuous research: Ongoing research by public and private institutions	High production costs: Rising costs for fertilisers, fuel, and seeds Investment barriers: High costs for greenhouse construction limit access for young farmers Unskilled labour: most workforce do not hold specific skills, especially in digital tools	sustainable greenhouse production to consumers. Export potential: Strong potential for exporting produce to international markets Work-life balance: Greater awareness about the need to ensure proper work-life balance, with special attention to women Support for young farmers: there are incentives by the local government for starting a farming enterprise by young farmers	Public awareness: Need to raise international awareness about sustainable agricultural practices in Spain
Antalya, Turkey			
Optimised agricultural inputs: Efficient use of water, fertilisers, pesticides, and labour	Limited technology access: Reduced effectiveness in regions with limited access to advanced technology	Technological advancements: Potential for further improvement with advancing technology	Funding and support: Insufficient funding or support may hinder technology adoption

Strengths	**Weaknesses**	**Opportunities**	**Threats**
Environmental protection: Reduced environmental damage through prevention of over-irrigation and fertiliser leaching Technological utilisation: Use of sensors and technology for efficient greenhouse management Diverse crop production: Cultivation of high-demand crops like tomatoes, cucumbers, peppers, watermelons, bananas, and eggplants Positive public perception: General public belief in the minimal use of pesticides and safe disposal of greenhouse waste	Low level of knowledge: Challenges in finding qualified personnel High costs: Significant development and implementation costs for new technologies Low wages: economic conditions compared to the workload are not attractive, especially for the youth Aging agricultural population: The high average age of farmers creates resistance to adopting innovations Insufficient government support: Lack of adequate support from public institutions for model dissemination Low financing capacity: limited access to financial resources Inadequate demonstration activities: Limited activities to demonstrate the benefits of new technologies	Adaptation to diverse regions: Ability to broaden usage across different agricultural regions Educational activities: Raising farmer awareness and skills through educational programs Sustainable production: Opportunities for healthy and sustainable production practices Youth engagement: Increased use of technology may attract young people to agriculture Female labour: Potential to attract skilled female workers Cooperative development: opportunities to form more producer cooperatives	Misuse of technology: Potential negative outcomes from improper use of technology Technological infrastructure: Lack of infrastructure may reduce the effectiveness of new technologies Market conditions: Economic fluctuations and market conditions may impact sustainability Climate change: Adverse effects on crop yields and farming conditions Rising energy costs: Increased costs for energy and fuel needed for greenhouse operations Low profitability: Risk of farm abandonment due to low profitability

Strengths	Weaknesses	Opportunities	Threats
	High input costs: Significant expenses for irrigation systems, pesticides, and fertilisers Many working hours: Long and heavy working schedules on farm can generate problems in family management, especially in case on small children	Export market: Strong potential for exporting fresh vegetables to neighbouring countries	Aging infrastructure: Lack of public intervention to renovate old facilities
Monastir, Tunisia			
Employment creation: Source of local employment High-value crops: Cultivation of crops with higher margins and added value Efficient irrigation: Effective use of irrigation water Efficient soil use: High income per unit area Tax incentives: Availability of tax incentives for investments	Small field sizes: Limited land area per farm Saturated domestic market: Limited price development due to market saturation Poor crop diversification: Limited variety of vegetables grown High equipment costs: Expensive new multi-tunnel equipment Low financing capacity: Limited access to financial resources Difficult management of personal life: greenhouse tasks require many working	Growing demand for healthy food: Increasing consumer preference for healthy products Export potential: Opportunities for exporting produce Employment and income improvement: Potential for additional crops and diversified production Packaging development: Opportunities in segmented and pre-	Water shortages: Risk of water scarcity affecting production Rising energy costs: Increased costs for energy and fuel Low profitability: Risk of farm abandonment due to low profitability Aging infrastructure: Lack of public intervention to renovate old facilities

Strengths	Weaknesses	Opportunities	Threats
	hours and especially women often cannot balance work and family Seasonal production: Inconsistent employment opportunities High production costs: Significant expenses in production Low level of specialisation: Limited formal knowledge and technical expertise among producers Water scarcity: Poor availability and quality of irrigation water Quality control issues: Lack of control over quality and productivity Inadequate packaging: Poor packaging for marketing Lack of collective organisation: Weak producer cooperatives and associations	packed products for mass distribution Medium-sized farm development: Potential for export-oriented production with supplementary heating Environmental incentives: New financial incentives for environmental sustainability	Market competitiveness: Difficulty competing with larger, more advanced farms Public perception: Negative views on greenhouse products and environmental impact Climate change: Potential adverse effects on crop yields and farming conditions
Tuscany, Italy			

Strengths	**Weaknesses**	**Opportunities**	**Threats**
Favourable climatic conditions: Tuscany's climate supports diverse crop cultivation Well-established farming sector: A long history and tradition in agriculture Short value chain: Direct sales to local wholesalers and cooperatives High crop diversity: Tomatoes, courgettes, lettuce, melons, and strawberries Sustainable practices: Increasing use of rainwater recycling and biomass-fuelled heating	Burdensome bureaucracy: Complex processes to access public incentives Low bargaining power: Small, family-owned farms struggle against large-scale retailers Level of cooperation: Limited collaboration among farmers Generational turnover: Aging farmer population with low youth involvement Propensity to innovate: Reluctance to adopt new technologies Water scarcity: Significant issue during summer months, with growing length of drought periods Unskilled labour: Prevalence of unskilled workforce Work-life balance: Difficult to find a work-life balance due to the need to work many	Increased demand for healthy and local food: Growing consumer preference for fresh, locally-produced food Public incentives: Availability of funding opportunities for sustainable innovation and young farmers Technological advancements: Potential for adopting digital tools and other farming innovations to improve sustainability Sustainable food strategies: Local retailers' companies focusing on sustainability attributes of food Youth involvement: Encouraging younger generations to enter the	Farm exit: Risk of abandonment of farm activities, particularly among smaller farms Aging farmers: Increasing average age of farmers may result in lock-in situations Market competitiveness: Challenges in competing with larger, more technologically advanced farms, both domestically and internationally Public perception: Negative views on greenhouse-grown food and their environmental impact Climate change: Potential adverse effects on crop yields and farming conditions, especially given the growth of extreme events

Strengths	Weaknesses	Opportunities	Threats
	hours on-site, which may prevent new entrants, e.g. young parents Environmental impact: Great quantities of plastic waste and toxicity issues due to pesticide use	sector, especially through secondary school programs Sustainability investments: Opportunities for investments in eco-friendly practices, by following existing exemplary models	Economic viability: High production costs and relatively low profit margins