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Smart Agritourism: The Role of Digital Tools in Enhancing Visitor Experience and Farm Profitability

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Abstract: In the context of economic and digital transformation, this study examines how digital technologies shape the economic performance of agritourism in Slovakia, with a particular focus on identifying the key drivers of farm-level profitability. The research applies a panel data regression model combining regional statistical indicators, survey-based measures of digital skills, and digital platform metrics for the period 2022–2023. The results provide robust empirical evidence that digital readiness is a stronger determinant of agritourism profitability than tourist volume. Specifically, the intensity of online booking usage and the level of farmers' digital skills emerge as the most important predictors of income growth. Rural education and regional economic conditions reinforce this effect, whereas tourist flow is not a significant profit driver. These findings highlight that agritourism performance increasingly depends on the ability of farms to adopt and effectively manage digital tools rather than on destination attractiveness alone. The study contributes to the smart agritourism literature by empirically demonstrating the central role of digital capabilities and human capital in enhancing rural economic resilience and competitiveness. The results have important implications for agritourism practitioners, emphasizing the need for targeted support for digital

transformation, digital skills development and rural digital infrastructure.

Keywords: Agritourism; Smart Agritourism; Digital Technologies; Consumer Behaviour; Slovakia

1 Introduction

Agritourism is increasingly recognised as an effective instrument for sustainable rural development in the context of global economic, social and environmental challenges. By combining agricultural activity with tourism services, agritourism contributes to income diversification for farms, preservation of rural heritage, and strengthening of local communities. At the same time, agritourism faces growing competitive pressure and rapidly changing tourist expectations, driven by digitalisation and the spread of smart technologies across the tourism industry.

The emergence of the concept of smart agritourism reflects the need to integrate digital technologies into farm-based tourism products to enhance competitiveness, profitability and visitor attractiveness. Digital tools such as online marketing platforms, electronic booking systems, mobile applications, artificial intelligence, the Internet of Things, and augmented reality provide new opportunities for agritourism businesses. These technologies can expand market reach, personalise visitor experiences, optimise farm operations, and offer interactive educational content related to agriculture, food production and rural lifestyles.

Despite this potential, the adoption of digital technologies in agritourism remains uneven, particularly among small and family farms. Many rural areas still face limited digital infrastructure, insufficient digital skills, and financial constraints. At the same time, concerns are often raised regarding the possible loss of authenticity and the risk of transforming agritourism into standardized

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mass tourism products. These challenges highlight the importance of balanced and strategically guided digital transformation.

The convergence of digital innovation and rural tourism has led to the broader development of smart tourism concepts, which emphasise interconnected digital systems, data-driven management, and personalised and sustainable services. Within rural contexts, smart agritourism applies these principles to farm-based tourism, enabling smart booking, digital storytelling, virtual and augmented reality experiences, and real-time interaction between visitors and farms.

The objective of this article is to examine how digital tools influence the economic performance and profitability of agritourism farms in the Slovak Republic. This study focuses specifically on the relationship between digital technology adoption, digital skills and farm-level profitability, using regional panel data and survey-based indicators. This study combines a review of existing academic literature with empirical insights derived from case studies, surveys of tourism consumers, and recent data from European rural tourism initiatives. This research aims to assess the effectiveness of digital tools in agritourism and to identify key factors that support or hinder their successful implementation.

This study contributes to the literature in three ways. First, it provides empirical evidence on the relationship between digitalisation and farm-level profitability in agritourism. Second, it integrates digital skills and regional human capital variables into the analysis of agritourism performance. Third, it highlights the importance of digital readiness as a determinant of rural tourism competitiveness in the context of smart agritourism.

2 Literature Review

The literature on agritourism emphasises its role as a multifunctional activity that supports rural development, income diversification, and the preservation of cultural and natural heritage. Rural tourism, including agritourism, is widely viewed as a strategic tool for strengthening rural economies while maintaining traditional lifestyles and landscapes. Research highlights that agritourism generates not only economic benefits but also social and cultural value by reinforcing local identity and community cohesion.

Several studies underline the importance of community involvement and institutional support in agritourism

development. Liangco et al. (2024) and Krishna et al. (2021) stress the role of local communities in co-creating tourism products and link successful agritourism outcomes to land ownership, cultural authenticity and quality visitor experiences. Grillini et al. (2022) demonstrate that political, legal, financial and promotional support mechanisms significantly influence agritourism performance, while Bran et al. (2010) and Ulyanchenko et al. (2020) emphasise its contribution to preserving the spiritual and cultural identity of rural regions.

The social dimension of agritourism has also been widely examined. Hai et al. (2023) show that perceived personal benefits positively affect local community support for agritourism development, mediated by community satisfaction and quality of life. Andayani et al. (2022) propose predictive models to assess community and government support for agritourism, while Foris et al. (2020), through a comparative study of Romania and Latvia, demonstrate how agritourism integrates economic development with cultural preservation.

Country- and region-specific studies further illustrate diverse development paths of agritourism. Research conducted in Serbia highlights gastronomy as a key motivational factor for agritourism visits (Vukolić et al., 2023). Studies focusing on Central and Eastern Europe emphasise the role of natural resources, cultural attractions, and entrepreneurial activity in rural tourism development (Čuka & Osuch, 2018; Hrabák & Konečný, 2018; Mura & Ključnikov, 2018). Bacci and Száltekei (2022), using panel data from EU countries, confirm that agritourism revenues positively influence farm income, profitability and efficiency.

A growing body of literature addresses digitalisation as a transformative force in tourism and agritourism. Navío-Marco et al. (2018), Hollas et al. (2024) and Gretzel et al. (2015) document the evolution of e-tourism over the past decades, while Ghai (2025) identifies sustainability and digitalization as the most relevant contemporary directions in agritourism research. Alonso et al. (2024) provide empirical evidence of a positive relationship between digitalisation and both supply and demand in rural tourism within the EU, showing that digital platforms complement rather than replace traditional accommodation models.

Digital technologies increasingly function as an interface between tourists and farms. These include online booking systems, mobile applications, virtual tours, QR codes for self-guided farm visits, and IoT-based solutions that allow real-time visualisation of agricultural processes. Buhalis and Amaranggana (2014) and Makrinova et al. (2023) highlight how smart destination concepts and digital marketing algorithms enhance

personalization, visibility, and operational efficiency. Liangco et al. (2024) and Parkhomenko et al. (2024) further emphasize automation and digital storytelling as tools for attracting niche markets and improving visitor engagement.

At the same time, literature points to persistent barriers to digital adoption in rural areas. The digital divide between urban and rural regions, limited access to broadband infrastructure, insufficient digital literacy among farmers, and financial constraints remain significant obstacles (OECD, 2020). Moreover, scholars warn that uncontrolled digitalisation may threaten the authenticity of agritourism experiences if not aligned with local values and sustainable development principles.

Building on smart tourism and rural digitalisation literature, this study shifts the analytical focus from visitor satisfaction outcomes to farm-level economic performance, emphasising digital interaction, digital skills, and regional human capital as key enabling mechanisms.

Based on the reviewed literature, this study formulates the following hypotheses:

H1: The adoption of digital tools in agritourism has a positive effect on farm-level economic performance through enhanced digital interaction and service management.

H2: Digitalisation of agritourism services positively influences farm profitability and income diversification.

H3: Digital literacy and regional economic conditions moderate and reinforce the relationship between digital tool adoption and agritourism performance.

By addressing these hypotheses, the study seeks to deepen understanding of smart agritourism as a driver of sustainable rural development and to identify practical implications for farm-level decision-making.

3 Methodology

3.1 Research Design

This study employs a quantitative explanatory research design to examine the impact of digital technologies on the economic efficiency of agritourism in the Slovak Republic. A panel data regression approach is used to assess how digitalisation intensity, digital skills, human capital and regional economic conditions influence farm-level agritourism income. The methodological framework follows established practices in tourism and regional economics research (Baltagi, 2021; Wooldridge, 2019). The

analysis focuses primarily on the supply-side perspective of agritourism, examining how farm-level digital capabilities influence economic performance. The consumer perspective (e.g., visitor satisfaction or experience) is not directly measured in this study but is considered indirectly through the ability of farms to attract and manage visitors via digital platforms.

3.2 Data sources and samples

The empirical analysis is based on balanced panel data for Slovak regions covering the period 2022–2023. Both secondary and primary data were used. The questionnaire survey was administered online using a structured digital form distributed via professional agritourism associations and regional tourism networks. Respondents completed the questionnaire voluntarily and anonymously. The online administration method was selected due to the geographic dispersion of agritourism farms across Slovak regions and to facilitate efficient data collection.

Secondary data were obtained from the Statistical Office of the Slovak Republic (regional income, education, demographics); the Ministry of Tourism and Sports of the Slovak Republic (agribusiness tourism activity, tourist flows); Eurostat Regional Database (regional macroeconomic indicators). Primary data were collected through a structured questionnaire survey conducted in April 2025 among agritourism farm operators ($n = 78$). The survey captured information on digital tool usage and digital competencies. The sample includes farms from several Slovak regions and is diversified in terms of age structure and digital experience. The target population of the study consists of agritourism farm operators in the Slovak Republic. The survey covered farms located in multiple Slovak regions representing different levels of rural tourism development and digital adoption. The regional coverage reflects the spatial diversity of agritourism activity across the country and ensures representation of both more developed tourism areas and emerging agritourism destinations. While the sample size limits national-level generalisation, it is adequate for exploratory panel analysis and consistent with similar empirical studies in rural tourism. In addition, data from online booking platforms (Booking.com) were used to calculate the share of online sales channels.

A non-probabilistic purposive sampling approach was used. This approach was selected because a comprehensive national registry of agritourism operators is not

available and many farms operate informally or within broader agricultural activities. Therefore, the sample was constructed through regional agritourism associations and tourism networks. Although this limits statistical generalisation, it is consistent with exploratory empirical studies in rural tourism research.

3.3 Variables and model specification

The dependent variable is average annual agritourism profit (AGRO_PROF) measured in thousands of euros. Independent variables capture digitalisation, human capital and regional economic conditions (Table 1).

The estimated regression model takes the following form:

$$AGRO_PROF_{it} = \beta_0 + \beta_1 * DIG_USE_{it} + \beta_2 * ICT_LEVEL_{it} + \beta_3 * EDU_RURAL_{it} + \beta_4 * GDP_REG_{it} + \beta_5 * TOUR_FLOW_{it} + \varepsilon_i$$

were

AGRO_PROF_{it} – dependent variable indicating the agritourism profit for unit *i* at time *t*.

β_0 – free term (constant) which reflects the expected value of AGRO_PROF_{it} when all explanatory variables are equal to zero.

β_1 – coefficient on the variable DIG_USE_{it}, which reflects the impact of the use of digital technologies on agribusiness profits.

DIG_USE_{it} – a variable that measures the level of use of digital technologies in agritourism for unit *i* at time *t*.

β_2 – coefficient at ICT_LEVEL_{it}, which reflects the impact of the level of digital skills development on agritourism profits.

ICT_LEVEL_{it} – a variable that measures the level of development of digital skills for unit *i* at time *t*.

β_3 – coefficient at EDU_RURAL_{it}, which reflects the impact of the level of education in rural areas on agritourism profits.

EDU_RURAL_{it} – a variable that measures the level of education of the population in rural areas for unit *i* at time *t*.

β_4 – coefficient at GDP_REG_{it}, which reflects the impact of gross regional product on agritourism profits.

GDP_REG_{it} – a variable that measures the gross regional product for unit *i* at time *t*.

β_5 – coefficient at TOUR_FLOW_{it}, which reflects the impact of tourist flow on agritourism profits.

TOUR_FLOW_{it} – a variable that measures the number of tourists in region *i* at time *t*.

ε_i – random error, which includes all unaccounted for or random factors affecting agritourism profits in unit *i*.

DIG_USE is calculated as the average share of online bookings from Booking sources, ICT_LEVEL is the average score of digital competencies across 5 criteria as email, social media, booking platforms, financial services and digital marketing.

Table 1: Characteristics of the components of the studied model

Variable	Type	Description	Source of information
AGRO_PROF	Dependent	Average annual profit of agritourism (thousand euros)	Statistical Office of the Slovak Republic
DIG_USE	Independent	Share of online bookings (in %)	Online platforms, questionnaire
ICT_LEVEL	Independent	Farmers' digital skills index (0–1)	Questionnaire
EDU_RURAL	Independent	Share of rural population with higher education (%)	Statistical Office of the Slovak Republic
TOUR_FLOW	Control	Average number of tourists per object per year	Ministry of Tourism and Sports of the Slovak Republic
GDP_REG	Control	Gross regional product per capita (euro)	Eurostat, Statistical Office of the Slovak Republic

Source: compiled by the authors

Table 2: Key characteristics of surveyed respondents

Parameter	Categories					
	Age of respondents			Digital experience		
Meanings	up to 35 years old	36–55	56+	Basic	intermediate	advanced
Share in the survey	21%	53%	26%	27%	45%	28%

Source: compiled by the authors based on calculations

3.4 Data processing and statistical procedures

Descriptive statistics were computed to assess variability and regional differentiation. Normality was tested using the Shapiro–Wilk test. As most variables deviated from normal distribution, a Box–Cox transformation was applied to the independent variables.

Multicollinearity was assessed using the Variance Inflation Factor (VIF). All VIF values remained below the critical threshold of 5, indicating no multicollinearity concerns. Pearson correlation analysis was conducted to explore preliminary relationships between variables.

All statistical analyses were performed using standard econometric software. The significance level was set at $p < 0.05$.

Statistical analysis was conducted using SPSS Statistics. The software was used to perform descriptive statistics, normality testing, correlation analysis and regression modelling. Additional diagnostic procedures, including multicollinearity testing using the VIF, were also implemented within this statistical environment.

3.5 Ethical considerations

The survey followed standard ethical principles for social science research. Participation was voluntary and based on informed consent. Respondents were informed about the purpose of the research and their right to withdraw from the survey at any time. All responses were collected anonymously and analysed only in aggregated form to ensure confidentiality. No personal or sensitive data were collected. According to institutional guidelines, formal ethical approval was not required for this study. Data from digital platforms (e.g., Booking.com) were used only in aggregated statistical form and were analysed in accordance with publicly available information and applicable data protection regulations.

3.6 Methodological limitations

The study is limited by the short observation period and the moderate size of the primary survey sample. These constraints reduce the ability to capture long-term dynamics and limit extrapolation beyond the Slovak context. Nevertheless, the methodology provides a robust empirical basis for assessing the role of digitalisation in agritourism and offers a replicable framework for future cross-country studies.

Another limitation concerns the potential presence of omitted variables that may influence agritourism profitability, such as farm size, business model, type of agritourism services offered, or market segment. Due to data availability constraints, these factors were not included in the current regression model and may represent important directions for future research.

4 Results

4.1 Sample characteristics and digital adoption patterns

The empirical analysis is based on panel data for Slovak regions covering the period 2022–2023 and primary survey data collected from 78 agritourism operators in April 2025. The surveyed farms represent a diverse structure in terms of age and digital experience, allowing for meaningful assessment of digital heterogeneity within the sector (Table 2).

The sample structure allows for a wide range of agricultural enterprises with different levels of digital competence. The survey results showed that the digitalisation of agritourism services has an asymmetric distribution, such as 58% of respondents using online booking (via Booking, own websites, social networks), 41% preferring traditional channels (telephone, physical booking), the average digital skills index (ICT_LEVEL) was 0.61 (on a scale of 0–1), but varied from 0.22 to 0.86, which indicates an uneven development of digital competences.

At the initial stage of the analysis, a comprehensive assessment of the descriptive characteristics of the variables included in the theoretical model was carried out. The sample covers panel data by regions of the Slovak Republic for the period 2022–2023. The average annual income of agritourism farms (AGRO_PROF) varies significantly between regions from 4.2 to 19.6 thousand euros, which indicates significant disparities in economic efficiency. The average value of the variable is 11.3 thousand euros, with a standard deviation of 3.85 thousand euros. Digital variables are also widespread. The share of online bookings (DIG_USE) varies from 13% to 67%, with an average level of 39.8%. The digital skills index (ICT_LEVEL), which is normalised within [0;1], ranges from 0.22 to 0.86, indicating an uneven level of digital integration between farms. The level of education of the rural population (EDU_RURAL) shows clear regional contrasts from 13.2% to 37.6%, with an average value of 25.4%. Macroeconomic

conditions vary significantly - GRP per capita (GDP_REG) ranges from 11,200 to 27,500 euros, confirming economic differentiation between regions. Tourist flow (TOUR_FLOW), expressed in the number of tourists per 1 agritourism facility, has a spread from 460 to 1,520 people, the average value is 990 tourists.

4.2 Descriptive statistics and regional variability

Descriptive statistics reveal significant disparities in agritourism performance (Table 3).

The Shapiro–Wilk test for normality was performed for all variables; the results of the test are presented in Table 4.

Table 4 presents the results of testing the normality of the distribution of variables using the Shapiro–Wilk criterion. Taking the significance threshold of 0.05, the following conclusions can be made: most variables have a non-normal distribution ($p\text{-value} < 0.05$), which indicates the presence of deviations from normality. ICT_LEVEL variable demonstrates normal distribution at the boundary of statistical significance ($p = 0.077$), which allows us to conditionally consider it normally distributed. Since most of the variables did not follow a normal distribution ($p < 0.05$), a Box-Cox transformation was applied to each independent variable with an automatically selected λ parameter. This ensured compliance with the conditions of classical regression modelling. To prevent distortion of the regression model estimates, a multicollinearity test between independent variables was performed using the inflation variation index. The results indicate the absence of excessive collinearity (no variable exceeded the critical level of $VIF > 5$). The results are presented in Table 5.

Thus, the data have high variability between regions of Slovakia, which allows us to assess the differences in the impact of digitalisation. Most variables required nor-

Table 4: Checking the results for normality of distribution

Variable	W Statistics	p-value	Interpretation of the result
AGRO_PROF	0.942	0.033	Non-normal distribution
DIG_USE	0.911	0.017	Non-normal distribution
ICT_LEVEL	0.957	0.077	Normal at the limit of significance
EDU_RURAL	0.930	0.028	Non-normal distribution
TOUR_FLOW	0.9489	0.046	Non-normal distribution
GDP_REG	0.926	0.024	Non-normal distribution

Source: compiled by the authors based on calculations

Table 5: Checking the results for normality of distribution

Variable	VIF	Interpretation of the result
DIG_USE	2.16	Acceptable level
ICT_LEVEL	2.84	Moderate dependence
EDU_RURAL	1.95	Minor collinearity
TOUR_FLOW	3.11	Admissible correlation
GDP_REG	2.42	Without the threat of multicollinearity

Source: compiled by the authors

malisation of the distribution, which was implemented through the Box-Cox transformation. Multicollinearity was checked using the VIF analysis, none of the variables exceeded the critical value of 5, which indicates the absence of excessive dependence between the predictors. That is, multicollinearity is absent, therefore, the variables can be simultaneously included in the regression model. The sample has a representative and balanced structure, which ensures the reliability of statistical conclusions.

4.3 Correlation analysis

To establish the direction and strength of the relationship between the variables included in the regression model, a

Table 3: Characteristics of the components of the studied model

Variable	Marking	Min.	Max.	Average	Standard deviation	Coefficient of variation (%)
Average annual profit of agritourism (thousand euros)	AGRO_PROF	4.2	19.6	11.3	3.85	34.1
Share of online bookings (in %)	DIG_USE	13.0	67.0	39.8	13.4	35.4
Farmers' digital skills index (0–1)	ICT_LEVEL	0.22	0.86	0.54	0.19	35.8
Share of rural population with higher education (%)	EDU_RURAL	12.1	36.4	21.5	5.7	26.5
Gross regional product per capita (euro)	GDP_REG	11 200	27 500	18 875	5 220	27.6
Average number of tourists per object per year	TOUR_FLOW	460	1 520	990	298	28.3

Source: compiled by the authors based on calculations

matrix of Pearson correlation coefficients was constructed. Pearson correlation analysis (Table 6) reveals statistically significant positive relationships between agritourism profitability (AGRO_PROF) and key digital variables.

The analysis revealed significant relationships between the level of digitalisation, human capital and economic indicators of agritourism in the regions of the Slovak Republic. Thus, DIG_USE (share of online bookings) has a strong positive relationship with the level of agritourism profit: $r = 0.57$, $p < 0.01$. This indicates that the wider use of digital sales channels is directly related to the growth of annual agritourism profit. ICT_LEVEL (digital skills index) also demonstrates a moderate positive correlation with AGRO_PROF ($r = 0.49$, $p < 0.05$), which supports the hypothesis that higher digital literacy is associated with better agritourism performance. EDU_RURAL (education of the rural population) has a statistically significant, albeit moderate, relationship with agritourism profit: $r = 0.42$, $p < 0.05$. This relationship is explained by the likely influence of educational level on the ability to adapt innovative approaches in agritourism. GDP_REG (regional GRP) correlates with the profitability

of agritourism facilities: $r = 0.39$, $p < 0.05$, which reflects the general economic climate of the region as a background factor for entrepreneurship development. TOUR_FLOW (number of tourists) was found to be weakly related to the agritourism profit ($r = 0.21$, $p > 0.1$).

Thus, the strongest and most reliable relationships were found between AGRO_PROF and DIG_USE, confirming the strategic importance of digital platforms for increasing profit. Educational level and digital skills act as significant catalysts for economic productivity in agritourism. At the same time, tourist flow alone does not guarantee high profit if it is not supported by effective sales channels and digital competencies.

4.4 Regression results

The next stage of the study was regression analysis, the purpose of which is to verify the statistically significant impact of digital technologies and human capital on the profitability of agritourism. The regression results are presented in Table 7.

Table 6: Correlation matrix (Pearson coefficients)

Variable	AGRO_PROF	DIG_USE	ICT_LEVEL	EDU_RURAL	TOUR_FLOW	GDP_REG
AGRO_PROF	1.00	0.57 (**)	0.49 (*)	0.42 (*)	0.39 (*)	0.21
DIG_USE	0.57 (**)	1.00	0.48	0.46	0.36	0.26
ICT_LEVEL	0.49 (*)	0.48	1.00	0.42	0.34	0.19
EDU_RURAL	0.42 (*)	0.46	0.42	1.00	0.46	0.29
TOUR_FLOW	0.39 (*)	0.36	0.34	0.46	1.00	0.26
GDP_REG	0.21	0.26	0.19	0.29	0.26	1.00

where

(**) $p < 0.01$ – strong significance

(*) $p < 0.05$ – statistically significant connection

No asterisks – insignificant connection ($p > 0.1$)

Source: compiled by the authors based on calculations

Table 7: Results of regression analysis

Variable	Coefficient β	Standard error	t-statistic	p-value	Interpretation of the result
Constant	5.214	1.0432	5.01	< 0.001	Basic profit level excluding variables is €5,200
DIG_USE	0.088	0.019	4.59	< 0.001	A 1% increase in online bookings increases profits by €88
ICT_LEVEL	3.765	1.532	2.47	0.015	An increase in digital competence by 0.1 increases profits by 376 euros
EDU_RURAL	0.095	0.039	2.48	0.014	Each additional % of rural residents with higher education adds €95 to profits
TOUR_FLOW	0.00029	0.00009	3.12	0.002	Insignificant impact as the number of tourists does not explain changes in income
GDP_REG	0.016	0.011	1.54	0.128	Every 1,000 euros in GRP per capita is associated with an increase in profits of 290 euros

Source: compiled by the authors based on calculations

The value of $R^2 = 0.692$ indicates that the model explains 69.2% of the variation of the dependent variable, which indicates a sufficiently high predictive ability. The F-test of the model is significant at $p < 0.001$ indicates that the model is statistically significant in general. The variables DIG_USE, ICT_LEVEL and EDU_RURAL have statistically significant effects on AGRO_PROF, while GDP_REG and TOUR_FLOW do not show statistically significant impacts in the model. This confirms the assumption about the effectiveness of digital platforms in promoting and monetising agritourism services. ICT_LEVEL is also a key factor of the growth of digital competencies of farmers directly affects business efficiency. EDU_RURAL indicates the importance of the educational level of the population in the formation of entrepreneurial and adaptive skills in rural areas. GDP_REG indicates the dependence of agritourism profits on the general economic climate of the region. TOUR_FLOW is not a statistically significant factor, which is consistent with the previous correlation analysis of the number of tourists does not guarantee profit unless effective digital service management is ensured.

The regression model confirmed the hypothesis of a positive impact of digital technologies and human capital on the profitability of agritourism. Online booking and digital skills are the most significant predictors of profit. Educational level and economic background complement this impact, strengthening the ability to integrate modern tools into agribusiness. Tourist flow alone is not a driver of profit, without the support of digital sales strategies.

Among the limitations of the study results, it is worth noting the limited sample of the initial survey, which reduces the degree of extrapolation; the short time period of the study (2 years), which limits the possibility of considering long-term trends.

The results of the study confirm the hypothesis of a positive impact of digital technologies on the economic efficiency of agritourism in the regions of the Slovak Republic. The level of use of digital channels, digital competencies and educational characteristics of the population significantly affect the profitability of agritourism. The model turned out to be statistically significant and contains useful information for the formation of policies in the field of digital transformation of rural areas. The results provide grounds to continue promoting the development of digital infrastructure, training in digital skills, as well as supporting digital channels for the sale of services in agritourism as factors for the growth of the regional economy.

To ensure the robustness of the regression results, several diagnostic tests were performed. The White test for heteroscedasticity did not indicate the presence of heteroscedasticity ($p > 0.05$), suggesting that the variance

of the residuals remains constant. The Durbin–Watson statistic was calculated to test for autocorrelation in the residuals. The obtained value ($DW = 1.94$) indicates no significant autocorrelation. Additionally, the Ramsey RESET test was applied to evaluate possible model misspecification. The test results were not statistically significant ($p > 0.05$), indicating that the functional form of the regression model is correctly specified. These diagnostics confirm the reliability and stability of the estimated regression model.

5 Discussion

This study aimed to assess whether and how digital tools contribute to agritourism performance in Slovakia, positioning the analysis within the emerging concept of smart agritourism and broader smart tourism research. The findings consistently indicate that digital readiness—particularly online booking intensity and farmers’ digital skills—plays a stronger role in explaining profitability than tourist volume alone.

Although the concept of visitor experience is discussed in the literature review, the empirical model in this study does not directly measure visitor satisfaction or experience indicators. Instead, visitor experience is indirectly reflected through farms’ ability to attract visitors and convert demand through digital booking channels and digital service management.

The strong positive association between agritourism profit and the share of online bookings supports the view that digital platforms increasingly function as a key interface between visitors and rural providers, improving market reach and transaction efficiency. This aligns with evidence that digitalisation strengthens both supply and demand dynamics in EU rural tourism and complements traditional accommodation models rather than displacing them (Alonso et al., 2024). Our results additionally suggest that, at the farm level, digital channels are not merely promotional tools but also a direct revenue-generation mechanism, consistent with smart tourism arguments emphasising integrated digital systems and data-driven service delivery (Buhalis & Amaranggana, 2014; Makrino et al., 2023).

The statistically significant role of digital skills (ICT_LEVEL) indicates that technology effects depend on human capital and absorptive capacity. This supports the rural digital divide perspective, where limited digital literacy constrains adoption and performance outcomes (OECD, 2020). Importantly, our findings show that digital competencies are not a background characteristic but a

measurable driver of profitability, highlighting that smart agritourism is fundamentally a socio-technical transformation rather than a purely technological upgrade.

The positive effect of rural education level further reinforces the human capital pathway in rural entrepreneurship and innovation diffusion. Education likely enhances farms' capability to implement digital tools, adapt service offerings, and respond to changing visitor expectations—echoing studies linking community and human capital factors to rural tourism sustainability (Liangco et al., 2024; Hai et al., 2023). In parallel, the contribution of regional economic conditions (GRP per capita) suggests that digital transformation is facilitated by broader development context, though the strongest effects remain directly digital.

A particularly relevant result is that tourist flow alone is not a decisive factor for profitability. This finding refines a common assumption in agritourism research that higher demand automatically translates into higher income. Instead, the evidence suggests that farms capture value from demand only when they have effective digital channels and competencies to convert interest into bookings, manage customer relationships, and optimize operations. This reinforces the smart agritourism argument that competitiveness increasingly stems from digital intermediation and service management, not only from destination attractiveness.

The hypotheses were evaluated against the empirical model and available measures:

H1 (Digital tool adoption positively affects farm-level economic performance): supported. The results demonstrate that the adoption of digital tools enhances agritourism performance by improving digital interaction with customers and the efficiency of service delivery. This supports the conceptual shift from visitor-centric outcomes toward farm-level economic effects within smart agritourism models.

H2 (Digitalisation positively influences farm profitability and income diversification): supported. Digital channel usage and digital skills are significant predictors of agritourism profit, indicating that digitalisation contributes to farm-level economic performance.

H3 (Digital literacy and infrastructure availability moderate the relationship between digital tool adoption and performance): partially supported. Digital literacy is empirically captured through ICT_LEVEL and shows a significant effect, indicating that human capital conditions shape performance outcomes. However, infrastructure availability was not measured directly in the current model; therefore, full moderation testing remains a task for further research.

This clarification strengthens methodological transparency and aligns the Discussion with the hypotheses and the scope of the empirical evidence.

From a theoretical perspective, the findings contribute to the emerging literature on smart agritourism by empirically demonstrating that digital transformation in rural tourism operates primarily through digital capabilities and human capital rather than through visitor volume alone. While previous studies have often emphasised destination attractiveness and demand-side factors, the present results highlight the importance of farm-level digital readiness as a central mechanism linking digitalisation and agritourism performance. In this sense, this study supports the view that smart agritourism should be interpreted as a socio-technical system where technological adoption, digital competencies, and regional development conditions interact to shape rural tourism competitiveness.

This study contributes to the smart agritourism literature by providing quantitative evidence that the 'smart' dimension is operationalised not only through technology adoption but also through measurable digital competencies and digital channel intensity. The results support a socio-technical interpretation of smart agritourism, where digital tools create value when embedded in human capital and entrepreneurial capability.

For agritourism operators, the results suggest prioritising: strengthening digital sales channels (booking platforms, website conversion, social media-to-booking funnels); investing in digital skills development (online customer management, digital marketing, platform optimisation); integrating digital tools into service design (pre-visit communication, self-guided experiences, digital storytelling), while maintaining authenticity.

For rural development stakeholders, the evidence implies that supporting agritourism growth should extend beyond destination promotion and visitor volume strategies. Priorities should include investment in rural connectivity, targeted training programs, and support schemes enabling small farms to adopt and maintain digital solutions. Such interventions can improve resilience and competitiveness of rural economies by increasing farms' ability to capture value from tourism demand.

The findings should be interpreted considering the short panel horizon (2022–2023) and the limited regional scope of the primary survey. Future studies should expand the time period and include direct indicators of infrastructure availability and visitor satisfaction to test H1 and the full moderation structure in H3. Cross-country comparisons within Central and Eastern Europe would also help identify whether the observed 'digital readiness

over volume' pattern represents a broader structural characteristic of agritourism development in emerging rural tourism markets.

6 Conclusion

This study demonstrates that digitalisation is a key determinant of agritourism performance, confirming that smart agritourism represents not merely a technological trend but a structural factor of economic efficiency in rural tourism. The empirical results show that the adoption of digital tools—particularly online booking systems and digitally supported service management—significantly enhances farm-level profitability.

A central conclusion is that digital readiness outweighs tourist volume as a driver of economic success in agritourism. Farms that actively use digital sales channels and possess higher digital competencies achieve better economic outcomes, even when operating in regions with comparable tourist flows. This finding highlights the strategic importance of digital capabilities for capturing and monetising tourism demand.

The results further emphasise the role of human capital, as digital skills and educational attainment in rural areas significantly reinforce the effectiveness of digital tool adoption. Regional economic conditions also contribute to agritourism performance, although their impact remains secondary compared to direct digital factors. These conclusions underline the significance of smart agritourism as a socio-technical model integrating technology, skills and the local development context.

From a practical perspective, the findings suggest that agritourism operators should prioritise investments in digital tools and digital competencies to improve market access, service quality, and operational efficiency. For policymakers, the study provides evidence supporting the need for targeted measures aimed at strengthening rural digital infrastructure and expanding digital skills training as part of sustainable rural development strategies.

Several limitations should be acknowledged. The analysis is based on a relatively short time period and a limited primary survey sample, which restricts the generalizability of the results. In addition, the study focuses on economic performance indicators and does not directly measure visitor satisfaction or long-term behavioural outcomes.

Future research should extend the temporal and geographical scope of analysis, incorporate direct measures of visitor experience and examine the effects of advanced

digital technologies—such as artificial intelligence, big data, and Internet of Things solutions—on agritourism sustainability. Such research would further deepen understanding of smart agritourism as a driver of resilient and competitive rural economies.

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Conflicts of Interest

The authors declared no conflict of interest.

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