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Goran Petković
University of Belgrade
Faculty of Economics and Business
Department of Business Economics and Management

Aleksandra Bradić-Martinović
Institute of Economic Sciences
Innovation Economics Department

Milena Lazić
Institute of Economic Sciences
Digital Economics Department

SKILLS DEVELOPMENT AS AN INDICATOR OF THE SERBIAN TOURISM DIGITALIZATION PROGRESS

Razvoj veština kao indikator napretka digitalizacije srpskog turizma

Abstract

In the tourism and hospitality sector, digital skills become one of the critical factors as they enable organizations and professionals to effectively utilize and adapt to the latest technological developments, improving the overall travel experience and/or operational efficiency of service providers. Based on the previous, this paper aims to evaluate the digital skills of supply-side stakeholders in Serbia's tourism and hospitality sector and to determine the main factors that influence their level of proficiency. By analyzing primary data from 418 respondents, the findings indicate a notable gap in advanced digital skills, which is particularly emphasized among administrative officers, primarily tourist inspectors. Additionally, multinomial logistic regression shows that the education and employment sector (catering, tourism agencies, tourism guides, tourism organizations, tourism inspectors and administrative officers) are factors associated with the level of digital skills. The results allow stakeholders to review the possibilities for improving skills, especially in the public sector, to address current skills gaps and prepare the workforce for future technological developments to ensure the sector's resilience and competitiveness in the global market.

Keywords: *digital skills, tourism and hospitality sector, Digital Skills Indicator, Serbia*

Sažetak

U sektoru turizma i ugostiteljstva, digitalne veštine postaju jedan od kritičnih faktora jer omogućavaju organizacijama i pojedincima da efikasno iskoriste najnovija tehnološka dostignuća, poboljšavajući ukupno iskustvo putovanja i/ili operativnu efikasnost pružalaca usluga. Cilj ovog istraživanja je procena digitalnih veština zainteresovanih strana na strani ponude u sektoru turizma i ugostiteljstva Srbije i identifikacija glavnih faktora koji utiču na nivo veština. Nakon analize primarnih podataka 418 ispitanika, nalazi ukazuju na primetan jaz u naprednim digitalnim veštinama, što je posebno naglašeno među administrativnim službenicima, pre svega turističkim inspektorima. Dodatno, multinomalna logistička regresija pokazuje da su obrazovanje i sektor zapošljavanja (ugostiteljstvo, turističke agencije, turistički vodiči, turističke organizacije, turistički inspektori i administrativni službenici) faktori povezani sa nivoom digitalnih veština. Rezultati omogućavaju zainteresovanim stranama da preispitaju mogućnosti za unapređenje veština, posebno u javnom sektoru, kako bi prevazišli nedostatke i pripremili radnu snagu za budući tehnološki razvoj, sa ciljem da osiguraju otpornost i konkurentnost sektora na globalnom tržištu.

Ključne reči: *digitalne veštine, sektor turizma i ugostiteljstva, Indikator digitalnih veština, Srbija*

Introduction

Monitoring digital progress within an organization can be done efficiently by following the established phases of technology integration, particularly digitization and digital transformation [20]. The first phase, technology integration, involves converting analog data into digital formats. Subsequently, the second phase, digitalization, introduces a paradigm shift that involves redesigning processes, changing working methods, and even shifting cultural values. The third phase, characterized by its disruptive nature, leads to a comprehensive business model restructuring, hence the term "digital transformation". Within the tourism industry context, this sector is actively transitioning into the third phase by leveraging digital technologies to generate novel experiences that offer enhanced value for visitors. It can be argued that the initial two stages are already comprehended, and now is the time when developing a new user experience can yield a competitive edge.

To facilitate this process, organizations and individuals must take collective responsibility for acquiring the knowledge and skills necessary to proficiently utilize the emerging digital tools. The speed at which new platforms and tools enter the business realm is unprecedented in the history of tourism. The main difficulty for government, individual market players, and employers is to accurately identify the emerging requirements and subsequently hire suitable professionals or upgrade the skills of current employees to meet the digital requests and needs of contemporary travelers. It is critical to regularly assess and track digital skillset of individuals involved in developing tourism services at state-level, economy-wide level and within specific business organizations. It is crucial not only to assess general digital skills but also to thoroughly assess expertise in particular areas, especially those advanced skills that are not integrated into the formal education system and are acquired through the independent engagement of individuals in the tourism industry. OECD [30] also emphasized the importance of digital skills, anticipating that digitalization in the tourism and hospitality (T&H) sector will be focused on marketing, product development, and the role of government.

The Serbian tourism industry is becoming an important part of the economy due to its capability to capitalize on the country's rich cultural heritage and natural landscape, attracting a growing influx of international and domestic tourists [23]. The increase in tourism not only increases foreign exchange earnings but also encourages investment in local infrastructure and stimulates economic growth in the region. The hospitality industry, an integral part of tourism, creates numerous employment opportunities, thus contributing to economic diversification and strengthening economic resilience. In addition, the expansion of this industry shows that Serbia has successfully integrated into the global tourism market and established itself as an essential player in this sector [2]. On the other hand, the introduction of digital technology in Serbian tourism at the individual and national level signifies considerable progress in improving the competitiveness and attractiveness of the sector [6]. This process includes the integration of online platforms, mobile applications, social media, and considerably more into strategies for promoting tourism and attracting visitors. For Serbian tourism to be effectively digitalized, it is essential to have a workforce with adequate digital skills.

The author's research aims to determine the primary strengths and weaknesses of the Serbian T&H sector, focusing on acquiring essential digital skills [32]. In order to initiate the advancement of effective action plans for the implementation of tourism development strategies at both national and destination levels, the first crucial step is to identify the areas where the biggest gap exists between the existing and necessary digital skills [34]. It is vital to close this gap, as the digital components of marketing and management in the tourism industry are fundamental to all strategies and plans in this area. The significance of the aforementioned can be seen in the EU's agenda and announcement for 2023, which entails a substantial investment of 42 million euros in education, particularly in the domains of digital skills and digital security [16].

This research also addresses certain ambiguities in the literature related to the factors influencing the acquisition and proficiency of digital skills, such as education, employment in the private or public sector, and other related factors presented further. Although it

is commonly assumed that higher levels of education are correlate with elevated levels of digital skills, the dynamic nature of the digital domain presents a challenge. Officially defined educational programs tend to change at a reduced pace, while self-taught individuals have more freedom to identify and learn new skills. Similarly, it could be expected that individuals working in the private tourism industry, such as tour guides, agents and those involved in marketing and sales in the hospitality industry, have a higher level of adaptability and entrepreneurial spirit, making them more inclined to acquire new digital skills fast. On the other hand, government officials with access to specialized educational resources and learning time are more likely to acquire new digital skills. The research questions in this analysis are based on these dilemmas.

The research initially outlines the theoretical underpinnings of the dilemmas being studied and subsequently conducts an empirical examination of the stakeholders in the T&H sector in the Republic of Serbia.

Literature background

In today's landscape, a high level of digital maturity is essential for service providers to deliver innovative and personalized experiences [14], while technological resilience is a critical factor for their sustainable development [27]. Even small businesses leverage technology to improve decision-making, customer engagement and overall operational optimization [37]. The emergence of the digital society and digital technologies not only opens up new opportunities but also grants individuals unprecedented freedoms and rights that allow them to transcend physical and geographical boundaries and social positions. In the T&H sector, which has been an early adopter of digitalization of its business processes [26], significant changes have been observed in the roles of individual players in the value-creation process [22]. This has blurred the lines between human values and technological services and challenged the fundamental nature of hospitality and tourism experiences [12].

Digital transformation in the T&H sector goes beyond the mere improvement of specific processes in the creation and delivery of customer experiences; it involves the adoption of cutting-edge technology for innovative experiences [14]. The sector leverages digital technologies to optimize business transactions, facilitate trade and disseminate product information to consumers. Digital technologies not only facilitate efficient communication between tourists and service providers by enabling real-time updates, feedback and quick problem resolution [43], but also improve the overall customer experience [7] through offering tailored suggestions derived from individual preferences and travel history. This helps tourists make informed decisions, promote satisfaction and build loyalty. In addition, digital technologies improve marketing strategies by collecting and analyzing customer data, allowing for targeted promotional efforts tailored to specific demographics [24]. The integration of online reservation systems in the sector streamlines the booking process and provides travelers with convenient ways to plan and book trips [1]. Furthermore, digital technologies in the hotel industry play a crucial role in effectively managing employee productivity [18] and hotel revenue [8], [28].

As one of the largest industries worldwide, the ICT market is estimated to reach a volume of EUR 6 trillion in 2023 [17]. To remain competitive in the technological race, countries must invest in advanced digital technologies, technological infrastructure and the development of digital skills and competencies. Acknowledging the critical role of technological leadership in global competitiveness, the European Union has introduced a comprehensive blueprint guiding all digital-related actions – the Digital Decade. This framework encompasses the Digital Decade policy program, targets, objectives, transnational projects, and the rights and principles of the Digital Decade [15], all designed to ensure that technology and innovation align with people's needs. Europe's Digital Decade is fundamentally people-centric, focusing on equipping everyone with the skills necessary to navigate everyday technology. Consequently, one of the key areas of the Digital Decade relates to digital skills, intending to ensure that at least 80% of the EU residents possesses basic digital skills by 2030.

While the evolving global technological landscape underscores the ongoing and growing demand for digital skills to meet the dynamic demands of the market, it is notable that the academic literature largely neglects

the character of work and the potential role that digital skills may participate in the digital transformation of the T&H sector [31]. Instead, academic literature has predominantly concentrated on three types of digital skills needs: fundamental computing skills for daily activities, for the broader workforce and advanced ICT expertise for specialized tech experts [19]. In the context of T&H, however, policy discussions mostly emphasize the need for a new skill mix and the need for 're-skilling' and 'up-skilling' to address the skill gaps and shortages. According to Parsons et al. [31], skills gaps refer to the mismatch between the skills required and those possessed by the current labor pool. This concerns people who are already working in the tourism industry. In contrast, skills shortages refer to a limited external supply of skills to fill vacancies due to staff turnover, newly created jobs or changing job requirements. Recruiters often encounter a persistent shortage of these skills among applicants due to an insufficient supply on the external labor market.

A comprehensive review of the main academic databases identified several studies that analyze the importance of digital skills in the T&H sector for the future development of the industry. The key findings of these studies are summarized below.

Asonitou and Kottara [3] investigated business skills that need to be strengthened in the Greek tourism sector in order to meet the evolving demands of digitally savvy customers. The identified skills in need of improvement include knowledge in tourism marketing and e-tourism marketing, expertise in the planning, advancement and implementation of e-programs and digital marketing initiatives, and competencies in marketing analytics and reporting. To close these skills gaps, the authors advocate for collaboration between the market and the country's education and research communities. Catia et al. [10] studied tourism and hospitality professionals in northern Portugal and highlighted the growing importance of personal and interpersonal skills alongside the necessary technical skills in the digital age. The authors believe that these skills not only add significant value but also enable hotel businesses to stand out from the competition. Maingi & Wachira [27] investigated the importance of digital skills in the post-COVID recovery of Kenyan small and medium-sized tourism businesses. Their findings highlight the imperative of establishing a well-structured vision, roadmap, and tourism strategy for integrating digital skills and fostering technology robustness in the T&H field as critical factors for ensuring future sector success.

In their research across six case study countries, Parsons et al. [31] found that a significant degree of policy inertia hinders effective policy development for digital transformation in tourism. A predominant concern was the lack of robust intelligence on digitalization and its associated skills needs. Notably, little consideration was given to proof of digital competency evolution in different sectors. Zaragoza-Sáez et al. [44] investigated the disparity between current and future digital skills requirements and training requirements for 2030 in Spanish tourism organizations. The study reveals that digital skills continue to challenge tourism organizations. While employees express their willingness to navigate environments in which technology plays an increasingly important role, organizations believe there is still much to be done before employees reach the required level of digital skills needed to work effectively in the tourism area.

Sanchez-Rivero et al. [38] concentrated their research on gender-related aspects of digital abilities and the intensity of ICT usage within tourism (accommodation) enterprises in Extremadura, Spain. The study reveals a digital divide in specific dimensions between male and female-run businesses in Extremadura. Typically, ICT specialist roles are more prevalent among employees in companies led by men. Male managers use platforms such as reservations and more regularly studying online comments. However, there are no discernible gender differences in managers' ICT skills. Moldovan [29] recognized the need to improve the level of knowledge of teachers providing tourism expertise to foster entrepreneurial learning and social entrepreneurship among learners – an important factor for the sector's future development. The author has described eight key competencies to create a learning outcomes framework for the T&H sector. These competencies are subsequently categorized into four distinct clusters, one of which is specifically dedicated to digital skills.

In contrast to other researchers, Carlisle et al. [9] identified the critical digital skills essential for the

sustainable development of the sector. These encompasses skills in digital marketing and communication, social media utilization, MS Office proficiency, navigating operating systems, and monitoring online feedback. The study is based on the results of a cross-sectional survey of almost 1700 companies from different sectors in eight European countries. The most significant disparities between present and prospective skill levels were discovered in artificial intelligence (AI), robots, augmented (AR), and virtual (VR) reality. Surprisingly, these talents, along with coding, were rated as the least critical digital skills. In addition, the geographic location, sector and size of the company influenced respondents' perceptions of current and future skill levels, as well as the perceived skills gap. Although the study was done before the COVID-19 pandemic, the findings are still appropriate.

In line with the above, it can be presumed that investing in the digital skills of employees in the T&H sector is imperative [33]. Supporting this, Sigala [39] contends that failing to keep up with innovations makes individual businesses and sectors uncompetitive, restricting productivity gains within organizations and across value chains.

Considering Serbia's strategic commitment to becoming a member of the European Union, the importance of investing in sophisticated digital technologies and AI has become one of the strategic priorities of the Government of the Republic of Serbia and has been incorporated into the national legal framework. The Strategy for the Development of Digital Skills in the Republic of Serbia for the period 2020-2024 [40] regulates the promotion of digital skills linked to the usage of ICT in order to improve the quality of life, promote employability, increase operational efficiency and, consequently, stimulate economic growth in society. In addition, the Program for the Empowerment of Women in the Field of Information and Communication Technologies for the period 2019-2020 [35] was developed to address gender issues. This program outlines specific goals for increasing women's participation in the ICT industry, as well as measures and activities aimed at reducing the gender gap, improving the regional representation of women in the sector and promoting their social and economic empowerment. Digitalization is also an important cornerstone of the Strategy for the Development of Tourism in the Republic of Serbia for the period 2016-2025 [41].

Although the necessity to develop digital skills in the Serbian T&H industry has been acknowledged as crucial for the future expansion of the sector, research-based proof regarding digital skill levels of the sector's stakeholders in Serbia is limited. Some authors [4], [5], [26] underline the crucial role of digital transformation and particularly emphasize the need to develop digital literacy and improve the digital skills of employees in the T&H sector. Bradic-Martinovic et al. [5], for example, see this strategic orientation as a proactive measure to mitigate the progressive scarcity of natural and tourism resources. Examining data from the Statistical Office of the Republic of Serbia, the authors found a notable deficit in basic and advanced digital skills among employees in the Serbian T&H industry. Moreover, the recorded skill levels were discovered to be consistently lower compared to European Union countries.

The study carried out by Lazic et al. [26] is one of the few studies that deals with measuring the digital skills of employees in Serbia's T&H industry and identifying the factors that influence this level. This pilot study demonstrates that, on average, T&H employees possess fundamental digital skills that empower them to execute basic to more complex activities within a digital setting. The results indicate that the identified level of digital skills in the T&H industry is insufficient to ensure robust long-term growth and development. In addition, the findings suggest that there are significant correlations between digital skills levels, education and occupational status. As a result, the study highlights the need for targeted training programs and educational initiatives to enhance digital skills among T&H sector employees. It emphasizes that investing in continuous learning and upskilling can help bridge the gap and enable the sector to adapt to the rapidly evolving digital landscape.

The research in this paper leverages global developments and aligns with the strategic direction of both the European Union and the Republic of Serbia [14]. It addresses identified gaps in the literature by quantifying the digital skills of T&H stakeholders at the sub-sector level and identifying

the influencing factors. Consequently, the paper builds on Lazic et al.'s [26] research by expanding the sample size and including all sector stakeholders, not just employees. While the focus is on measuring the digital skills of key stakeholders in the Serbian T&H sector, the use of a standardized methodology such as the DSI index ensures international comparability and raises the importance of the topic beyond Serbia's borders.

To obtain a thorough understanding of this significant yet insufficiently studied field, the following research questions were raised:

RQ1: Is there a distinction between the skillsets required for certain aspects of digitalization in T&H in Serbia, and which skills are overlooked?

RQ2: Do stakeholders in Serbia's T&H sector differ in their level of digital skills?

RQ3: What factors are associated with relevant digital skills?

Methods

Study design

In creating the new Serbian strategy for the tourism development, a comprehensive research was undertaken to assess the digital skills of supply-side stakeholders (individuals employed in catering, tourism organizations, tourism agencies, travel guides, tourism inspectors and administrative officers). To enhance stakeholder diversification, we categorized administrative staff and included employees in tourism organizations, tourism inspectors and officials at national and local (municipality) levels. The decision was based on a complementary research study by Van Deursen & Van Dijk [42].

To collect primary data, an online survey was conducted using the Microsoft Office 365 Forms tool. The Ministry of Tourism and Youth of the Republic of Serbia distributed the questionnaire to stakeholders (as presented in Table 1), through local authorities and internally among the Ministry's employees. The data was collected between March 01 and April 14, 2023. The sample comprises 422 participants from a total of 119 cities and municipalities. After the initial analysis, four outliers were identified, namely one participant with a primary school degree and three participants who were over 65 years old. After excluding the outliers, the analysis was performed on 418 responses. The survey was anonymous and voluntary to participate in.

Measures and variables

The presented research is based on the Digital Competences Framework – DigComp 1.0 methodology [36], which is used to evaluate the digital skills of the European Union, including components for assessing individuals' proficiency in digital abilities. The core component of the concept is the Digital Skills Indicator (DSI), which encompasses four dimensions: Information Skills (IS), Communication Skills (CS), Problem Solving Skills (PSS) and Software Skills for Content Manipulation (SSCM) [21]. To maintain the comparability of statistics across Europe and for practical purposes, EU countries, including those in the process of accession, collect annual data from a representative sample of individuals aged 16-74. The acquired results are subsequently utilized to compute the DSI, whose progression has been tracked since 2015. The process of completing the questionnaire entails a self-assessment of the participants' digital skills but also encompasses a substantial quantity of inquiries that are not included in the DSI. For this research, only those questions included in the DSI were extracted from the original questionnaire, as presented in Table 3, with data about gender, age, education, and T&H sector.

Statistical analysis

Statistical analysis in this research encompasses both descriptive analysis and multinominal logistic regression. Descriptive statistics are employed to examine the personal attributes of stakeholders, while logistic regression aims to estimate associations between participant's characteristics (predictors) and the level of digital skills (dependent). The EU DSI methodology [21] is employed to quantify the level of digital skills. However, to gain a more comprehensive understanding of potential relationships, the analysis utilized the sub-indicator values for IS, CS, PSS, and SSCM.

Multinomial logistic regression is a statistical model used to predict the outcome of a dependent variable when there are multiple categories to choose from.

Unlike binary logistic regression, which applies to binary outcomes, multinomial logistic regression is used when the dependent variable is nominal and has three or more levels. Furthermore, multinomial logistic regression models the probability of each category of the dependent variable as a function of the independent variables (in this case, participants' characteristics). It is particularly useful to understand the relationship between predictor variables (like age, education, etc.) and a categorical outcome (level of digital skills). This model calculates the probabilities of each potential outcome of the dependent variable based on a given set of independent variables. The logistic regression results are presented as odds ratios (ORs) and adjusted odds ratios (AORs) with 95% confidence intervals (Cis). A $p<0.05$ indicates statistical significance. Stata version 16.0 was used for the statistical analysis.

Results

Table 1 comprehensively describes the attributes of the individuals who completed the online survey.

Table 1: Sociodemographic characteristics of the sample

Characteristics	Categories	*n* (%)
Gender	Female	244 (58.4)
	Male	174 (41.6)
Age	16-28	23 (5.5)
	29-45	246 (58.9)
	46-65	149 (35.6)
Education	Secondary	71 (17.0)
	Higher	270 (64.7)
	Master or PhD	149 (35.6)
Supply-side stakeholders	Catering	101 (24.2)
	Tourism organization	156 (37.4)
	Tourism agency	33 (7.9)
	Travel guide	24 (5.8)
	Tourism inspector	32 (7.7)
	Administrative officer*	71 (17.0)

* Include persons employed in municipalities in the tourism sector and the Ministry of Tourism and Youth RS

Within the study sample, women (58.4%) outnumber men (41.6%), while the proportion of participants aged 29-45 is also predominant (58.9%) compared to participants aged 45-65 (35.6%) and 16-28 (5.5%). The highest percentage of participants have a bachelor's degree or above (64.7%), followed by those with a master's or doctorate degree (35.6%), and the lowest percentage have only completed high school (17.0%). Finally, most participants are employed in Tourism Organizations (37.4%) or the Catering sub-sector (24.2%). A smaller percentage hold positions as Administrative Officers (17.0%), work in Travel Agencies (7.9%), serve as Tourism Inspectors (7.7%), or operate as Tour Guides (5.8%).

Evaluation of the DSI's Dimensions and Individual Indicators

The following part of the research focuses on analyzing four fundamental dimensions that enable the calculation of the DSI. These dimensions are IS, CS, PSS, and SSCM. Table 2 illustrates the distribution of respondents based on their proficiency levels in specific dimensions and sectors of employment.

From the given sub-indicator values, it is clear that the respondents have attained a high level of proficiency in IS and CS. Nevertheless, the administrative officer shows a minimal requirement for enhancement in Information skills, with only 5.6% of respondents indicating that they have not mastered all the skills in this category. Similarly, CS also has a relatively low percentage of respondents in the same sector (1.4%) who do not possess mastery in all the skills in this category.

However, the scenario changes when more sophisticated skills are considered – in particular, PSS and SSCM. Within the PSS dimension, an average of 18% of respondents lack

Table 2: Sector-specific frequencies of digital skill dimensions (%)

Sector	IS		CS		PSS		SSCM	
	Lack	Possess	Lack	Possess	Lack	Possess	Lack	Possess
Catering	1.0	99.0	1.0	99.0	15.8	84.2	42.6	57.4
Tourism organization	0.0	100.0	0.0	100.0	12.2	87.8	23.1	76.9
Tourism agency	3.0	97.0	0.0	100.0	18.2	81.8	36.4	63.6
Travel guide	0.0	100.0	0.0	100.0	8.3	91.7	25.0	75.0
Tourism inspector	0.0	100.0	0.0	100.0	40.6	59.4	46.9	53.1
Administrative officer	5.6	94.4	1.4	98.6	14.1	85.9	38.0	62.8
Average	1.6	98.4	0.4	99.6	18.2	81.8	35.3	64.8

the necessary skills, with Tourism inspectors (40.6%) being particularly notable in this regard. The situation is even worse when looking at the dimension that includes the necessary skills to manage software that enables users to create content. Of all respondents, 35.3% need more skills in almost every sector. In particular, 46.9% of Tourism inspectors and 38.0% of Administrative officers are not sufficiently skilled.

Table 3 presents the frequencies of individual skills grouped into corresponding dimensions of the DSI indicator, providing a more precise understanding of the specific skills lacking among the respondents.

Based on the obtained values, there are no skills in the first two dimensions (IS and CS) that would cause difficulties for participants in the hospitality and tourism sector, except for using the internet or cloud storage to store digital content. Almost 50% of participants lack this particular skill. In the field of PSS, the situation is not highly favorable, as a considerable proportion of respondents lack the skills needed to modify software settings, such as those of the operating system or security programs (51.7%), participate in online sales (64.2%), utilize online learning resources (59.2%), and engage in internet banking (64.0%). In the realm of SSCM, a comparable scenario is witnessed where respondents demonstrate a deficiency in the requisite expertise for utilizing spreadsheet programs (41.5%) and the more advanced functionalities of spreadsheets to organize and analyze data (58.5%). Almost all respondents (92.7%) have a deficiency in knowledge regarding programming code writing.

The associations between characteristics of employees in the T&H sector and the level of digital skills in selected dimensions

Based on the self-assessment results of the respondents, who indicated room for further improvement in skill acquisition in two of the four dimensions – PSS and SSCM, a more in-depth multinomial logistic regression analysis was conducted to examine the factors associated with the possession of the relevant skills, within confidence interval CI 95% (see Table 4 and Table 5).

Adjusted odds ratios (AORs) show that two (Education and Employment) of the four characteristics included in the logistic model are associated with the level of PSS, while at the same time, Gender and Age are not associated with skills. Individuals who have completed higher school and faculty are 2.5 times more likely to possess higher level of PSS relative to respondents with secondary education, which is a reference category (AOR = 2.46; 95%, CI: 1.24-4.85; $p < 0.05$). Furthermore, individuals with a master's or Ph.D. level of education are even 3 times more likely to have higher levels of skills compared to the same

Table 3: Distribution of respondents according to individual indicators within the DSI dimensions

Dimensions and indicators	Skills		Dimensions and indicators	Skills	
	Lack (%)	Possess (%)		Lack (%)	Possess (%)
Dim. 1. IS			**Dim. 2. CS**		
• Relocate files or folders (copy or move)	11.6	88.4	• Exchange email messages	1.7	98.3
• Store documents in cloud storage	49.3	50.7	• Engage in online social platforms	14.5	85.5
• Access data from government agencies' online portals	19.7	80.1	• Make voice or video calls via the internet	36.5	63.3
• Search for products or services online	10.2	89.8	• Post original content online for sharing	27.1	79.1
• Search for medical or wellness information	35.8	64.2			
Dim. 3. PSS			**Dim. 4. SSCM**		
A – Problem solving			*A – Basic*		
• Move data across different devices or computers	11.1	88.4	• Utilize text editing applications	11.6	88.4
• Set up programs and mobile applications	37.9	62.1	• Employ spreadsheet applications	41.5	58.3
• Modify configurations for various applications, including OS and security software	51.7	48.3	• Engage in multimedia editing with software for images, videos, or audio	33.2	66.6
B – Familiarity with online services			*B – Above basic*		
• E-commerce in last 12 m (buy)	21.6	78.4	• Develop documents or presentations incorporating text, images, and graphical elements	39.1	60.9
• E-commerce in last 12 m (sell)	64.2	35.8	• Leverage complex spreadsheet features for data management and analysis, including sorting, filtering, formula application, and charts	58.5	41.5
• Utilize web-based educational materials	59.2	40.8			
• Conduct financial transactions online	64.0	36.0	• Authored code using a programming language	92.7	7.3

reference category (AOR = 3.23; 95%, CI: 1.17-8.94; $p < 0.05$). Additionally, the findings suggest that respondents classified as Tourism inspectors are five times less likely to have a satisfactory level of these skills compared to respondents in the reference category, which in this case is Catering (AOR = 0.17; 95%, CI: 0.06-0.47; $p < 0.05$).

AORs in the case of SSCM show the same associations (Education and Employment sector) as for PSS. Individuals with a master's or Ph.D. level of education are 2 times more likely to have a higher level of skills compared to those with only a secondary level of education, which serves as the reference category (AOR = 3.23; 95%, CI: 1.17-8.94; $p < 0.05$). It can be concluded from this that even in this dimension of digital skills, respondents with a Higher level of education are almost twice as likely to have a satisfactory level of skills compared to the reference category, even if the OR value for Higher education is statistically significant, while the AOR value for the same category is not (OR = 1.72; 95%, CI: 1.01-2.94; $p < 0.05$). Finally, respondents employed in Tourism organizations are also two times more likely to have a sufficient level of SSCM compared to those who are engaged in the Catering sector, which is a reference category in this case (AOR = 1.83; 95%, CI: 1.02-3.30; $p < 0.05$).

Discussion and conclusion

In the last twenty years, the Republic of Serbia has made significant investments and strategic endeavors to foster the growth of the T&H sector, which includes the use of digital technologies. The research in this paper has shown the supply-side stakeholders' capacity to contribute to this

Table 4: Factors identified with assessed level of digital skills of stakeholders in PSS dimension, logistic regression results

Characteristics	Categories	OR (95% CI)	AOR (95% CI)
Gender	Female (Ref.)		
	Male	0.8307 (0.4835 - 1.4270)	0.7375 (0.4058 - 1.3404)
Age	16-28 (Ref.)		
	29-45	1.9265 (0.6666 - 5.5674)	2.0359 (0.6696 - 6.1901)
	46-65	1.1018 (0.3779 - 3.2121)	1.5936 (0.5107 - 4.9728)
Education	Secondary (Ref.)		
	Higher	1.9220 (1.0086 - 3.6625)*	2.4630 (1.2493 - 4.8556)*
	Master or PhD	1.8602 (0.8023 - 4.3129)*	3.2386 (1.1731 - 8.9412)*
Employment sector in tourism	Catering (Ref.)		
	Tourism organization	1.3734 (0.6690 - 2.8194)	1.0077 (0.4666 - 2.1761)
	Tourism agency	0.8571 (0.3045 - 2.4125)	0.6323 (0.2125 - 1.8810)
	Travel guide	2.0952 (0.4469 - 9.8220)	1.5832 (0.3425 - 7.3172)
	Tourism inspector	0.2783 (0.1147 - 0.6753)*	0.1703 (0.0604 - 0.4799)*
	Administrative officer	1.1619 (0.4930 - 2.7379)	0.7912 (0.3227 - 1.9394)

Table 5: Factors identified with assessed level of digital skills of stakeholders in SSCM, logistic regression results

Characteristics	Categories	OR (95% CI)	AOR (95% CI)
Gender	Female (Ref.)		
	Male	1.3699 (0.9078 - 2.0671)	1.2162 (0.7868 - 1.8802)
Age	16-28 (Ref.)		
	29-45	1.216 (0.4938 - 2.9940)	1.2182 (0.4770 - 3.1111)
	46-65	0.8857 (0.3526 - 2.2247)	1.1041 (0.4184 - 2.9133)
Education	Secondary (Ref.)		
	Higher	1.7259 (1.0125 - 2.9417)*	1.6101 (0.8979 - 2.8871)
	Master or PhD	2.2974 (1.1487 - 4.5945)*	2.3398 (1.0755 - 5.0903)*
Employment sector in tourism	Catering (Ref.)		
	Tourism organization	2.4137 (1.3994 - 4.1632)*	1.8364 (1.0289 - 3.3037)*
	Tourism agency	1.2672 (0.5615 - 2.8596)	1.0670 (0.4541 - 2.5072)
	Travel guide	2.1724 (0.7937 - 5.9459)	1.8195 (0.6483 - 5.1064)
	Tourism inspector	0.8206 (0.3684 - 1.8279)	0.5757 (0.2411 - 1.3746)
	Administrative officer	1.1800 (0.6328 - 2.2004)	0.8867 (0.4512 - 1.7422)

process with their knowledge and digital skills and enable full inclusion in digital tourism, which would promote the sector's growth and enhance competitive advantages.

The analysis shows a clear distinction in the digital abilities required for various aspects of digital technology use and points out to stakeholders' groups with the lowest level of skills. Information and Communication skills are generally well-developed, indicating a solid foundation in basic digital literacy. However, there is a notable deficiency in more complex skills like Problem solving and Software skills for content manipulation.

These results are aligned with those of Lazic et al. [26], who suggest that Serbian T&H employees possess enough digital skills to do basic tasks but, on average, do not have advanced skills, which may pose a considerable obstacle to the deployment of modern digital innovations. Carlisle et al. [9] also found that the largest gaps between current and future skill levels are in the areas of AI, robotics, AR and VR, which are considered more advanced. Further, according to Cedepof report [11], irrespective of industry (tourism included), over 85.0% of positions require at least basic digital skills to perform routine tasks that do not need interaction with other humans. More advanced skills are necessary for more complex tasks and activities, which, on the other hand, is expected in tourism, as a service sector characterized by a large number of contacts with clients.

When examining the individual stakeholder groups, tourism inspectors show the least advanced digital knowledge, particularly in Problem solving skills. This greatly limits the ability to effectively analyze and plan (managerial skills), thus endangering the effective monitoring of activities on the tourist market. Nevertheless, when examining Software skills for content manipulation, the results are unfavorable for most stakeholder groups. Tourist inspectors are again in the least favorable position, but there is also evident among individuals employed in the catering industry and administrative officers. The results also offer an understanding of the specific skills that have the most potential for improvement in terms of knowledge, which are familiarity with online services, including the use of the cloud and skills for utilization of basic and advanced functions in spreadsheet applications.

Additionally, two primary factors are associated with the level of digital skills – level of education and the employment sector. Education was also discovered to be a significant influence factor in the inquiry conducted by Lazic et al. [26]. In contrast, Carlisle et al. [9] found that geographic location, sector, and company size influenced respondents' perceptions of current and future skill levels, as well as the perceived skills gap. Higher educational attainment is strongly correlated with higher levels of digital skills, particularly in Problem solving skills and Skills for software manipulation. This indicates that formal education plays a crucial role in equipping individuals with the necessary digital competencies. Furthermore, the type of employment within the tourism sector also influences digital skill levels. The logistic regression analysis results confirm that individuals employed in certain sectors, notably tourism inspection, show a lower level of advanced digital skills than those in other sectors like catering or tourism organizations.

The study provides a critical understanding of the present condition of digital skills in the Serbian tourism and hospitality industry. It underlines the importance of targeted measures to close skills gaps, especially in the advanced digital areas, especially for the public sector. This could mean revising curricula to provide more in-depth digital training and providing continuous upskilling opportunities for those already in the workforce. The aim should be not only to address current skill gaps but also to prepare the workforce for future technological developments to ensure the sector's resilience and competitiveness in the global market [29]. Subsequently, it is essential to overcome the limitations of this research and investigate in more detail the indications that administrative officers have a certain level of ignorance of information skills, especially of saving content on cloud storage, which can be linked to weaker abilities to place self-created content on a website.

Finally, the main limitation of this study lies in the methodology of data collection, although self-assessment is the predominant form of competence assessment in science. However, assessing digital skills is challenging, and the process of knowledge determination can be expensive and time-consuming. Since the European Union has been conducting regular self-assessment polls

among European residents for the past fifteen years, which serve as the foundation for calculating the DSI, it seems reasonable to use the same method. We propose that subsequent investigations should focus on introducing experimental method or performance test to achieve more precise results, in line with Van Deursen & Van Dijk [42].

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Goran Petković

is professionally engaged at the Faculty of Economics and Business, University of Belgrade. His teaching and research interests include marketing channels, retail marketing and management, as well as tourism. Goran Petković is author of two books ("Positioning of Trade Companies" and "Models for Decision-Making in Trade"), coauthor of sections in six relevant books, and author of many chapters in other books and proceedings. In addition to this, he is also author and coauthor of more than fifty articles in domestic and international scientific journals.

Aleksandra Bradić-Martinović

is a senior research associate at the Institute of Economic Sciences. Her scholarly pursuits are predominately centered on innovations, digital competencies, and skills within the tourism industry. As a researcher and data analyst at Horwath HTL Beograd, she contributed to developing several national and regional tourism-related public policies. Aleksandra assumed the leadership of the national scientific infrastructure for collecting, archiving, and disseminating primary research data, the Data Centres Serbia in Social Sciences (DCS), in 2014. In addition to serving as the national representative of the Republic of Serbia in the Consortium of European Social Science Data Archives (CESSDA ERIC), she is the author of professional papers concerning data management and preservation. She participated in numerous projects financed within the EC program frameworks (FP7, H2020, and Tempus), as well as other international organizations (GIZ, SCOPES, RRPP, RCC).

Milena Lazić

received her PhD in Economics in 2021. She is a research associate at the Institute of Economic Sciences in Belgrade (since October 2021) and a visiting professor at the Belgrade Banking Academy – Faculty of Banking, Insurance and Finance (since February 2022). Her research interests revolve around digital transformation and digital skills, tourism and hospitality, macroeconomics and competitiveness. Milena has been involved in several research and development projects, projects involving collaboration with industry and higher education capacity-building projects at national and international levels. She has more than ten years of experience in teaching at the university level. Her publications include articles in renowned journals and thematic collections dealing with key aspects of the above-mentioned fields. She is a member of the Serbian Scientific Society of Economists, the Serbian Marketing Association and the Society of Belgrade Economists.