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Digital Marketing Competencies as Enablers of Inclusive and Sustainable Digital Entrepreneurship: Cross-Country Evidence from Persons with Physical Disabilities in Southeast Europe

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Abstract

Digital transformation is reshaping value creation and expanding opportunities for remote work and digitally enabled entrepreneurship, yet its contribution to sustainable development depends on whether underrepresented groups can acquire the competencies needed to participate in digital markets. Digital marketing competencies represent a form of business-relevant human capital that can support inclusive employment and participation in digitally mediated entrepreneurial activity. However, limited empirical research has examined how these competencies develop among persons with disabilities. This study addresses this gap through a cross-country analysis of digital marketing competencies among persons with physical disabilities in Serbia and Montenegro, two emerging Southeast European economies, and Croatia, an advanced-economy EU comparator. Combining self-assessment with objective knowledge- and ability-based measures, negative binomial regression is used to examine individual and contextual determinants of competency outcomes. The findings reveal generally low levels of objectively measured competencies, with comparatively stronger performance in social media marketing and the weakest results in search engine optimization (SEO) and digital strategy. Significant predictors include digital literacy, prior digital marketing experience, online learning experience, English language proficiency, training motivation and self-assessed competence, although the effect of training motivation is significant in Serbia and Montenegro but not in Croatia. Access to digital technologies alone is therefore insufficient to ensure meaningful digital inclusion. Structured, accessible and context-sensitive training pathways are needed to translate digital transformation into inclusive participation in digital labor markets and entrepreneurship, thereby supporting socially sustainable economic growth and progress toward SDGs 8 and 9.

Keywords: Digital marketing competencies; Digital entrepreneurship; Inclusive economic participation; Sustainable development; Southeast Europe; Persons with disabilities; Human capital

1. Introduction

Digital transformation is widely regarded as a driver of economic development, lowering entry barriers to markets and enabling new business models with reduced start-up costs [1]. It has reshaped marketing through data-driven decision-making, personalization, and continuous customer interaction [2-3], positioning digital marketing competencies as business-relevant human capital that directly shapes firm performance and competitive advantage [4-5]. The digital economy has also expanded remote, flexible, and platform-based work [6-8], broadening potential workforce participation for individuals who have historically faced barriers to labor-market integration [9-11] and opening pathways to digitally enabled micro-entrepreneurship less dependent on traditional organizational and spatial arrangements [12-13]. Yet this developmental dividend is conditional rather than automatic. Effective participation depends on acquiring relevant digital competencies, particularly in domains such as digital marketing, where competence is closely tied to value creation and employability [14-16].

This conditionality is especially visible for persons with disabilities (PwD). Although remote and digitally mediated work can reduce physical and geographical barriers, this has not automatically translated into labor-market inclusion. ILO evidence shows PwD continue to face substantial employment disadvantages, constrained by limited digital competencies and access to appropriate technologies [17]. Digital access alone therefore does not establish whether individuals hold the domain-specific competencies needed to convert connectivity into productive participation, a distinction directly relevant to SDG target 8.5 (full and productive employment and decent work for PwD) and SDG target 9.c (expanded, affordable ICT access). Despite this, prior digital marketing competencies research has focused mainly on students, professionals, or general employee populations [18-21], largely overlooking marginalized workforce segments such as PwD, despite growing recognition that inclusive workforce strategies enhance organizational resilience and sustainable economic development [22-23]. Conversely, existing disability-employment research has been predominantly social-policy, educational, or welfare-oriented, emphasizing barriers, accessibility, and inclusion [24-28], offering limited guidance on how PwD are integrated into digitally enabled value creation. Consequently, there is little empirical evidence on how digital marketing human capital develops among PwD, or how individual characteristics, digital literacy, experience, and motivation jointly shape competence acquisition across national contexts.

Digital marketing is a particularly relevant field for testing this gap: performance is inherently remote and digital, companies invest heavily in the domain, and it therefore offers a plausible entry point for both inclusive employment and independent, client-based work [29]. Prior research further underscores that both general digital skills and domain-specific competencies shape employability in technology-driven labor markets [30-31], yet empirical evidence on digital marketing competencies among PwD remains scarce, particularly from a cross-country business research perspective. To address this gap, the present study examines digital marketing competencies among PwD in Serbia, Montenegro, and Croatia, asking: what level of digital marketing competencies, measured objectively rather than through self-report, do PwD hold across the five domains of the Digital Marketing Competence (DMC) framework; which individual, technological, and motivational factors are associated with it; and how do

these determinants vary across national contexts? The design is deliberately asymmetric, Serbia and Montenegro as emerging, EU-accession economies and Croatia as an advanced EU member state, allowing determinants to be compared across neighboring Southeast European countries with differing institutional and digital-development contexts. The three countries correspond to the DI-MARC consortium, which provided a common assessment framework for comparable data collection [32], combining self-assessment with knowledge- and ability-based measures across digital strategy, SEO, content marketing, social media marketing, and email marketing. Negative binomial regression models identify the factors associated with competencies, both pooled and by country. The study measures the competency preconditions for digitally enabled participation, not entrepreneurial outcomes themselves, a distinction we return to as a priority for future research.

By situating digital marketing competencies within debates on digital transformation, human capital, and inclusive digital-economy participation, this study responds to calls for business research that is both theoretically grounded and societally relevant [33-34]. It contributes in three ways: it extends digital marketing competencies research with cross-country evidence from an underutilized workforce segment, clarifying the boundary conditions for competence formation beyond the student or professional samples typical of prior work; it identifies the individual and contextual determinants (digital literacy, prior experience, language proficiency, online learning exposure, motivation) with direct implications for recruitment, training, and inclusive talent strategy; and, through country-specific alongside pooled models, it tests whether competence formation operates uniformly across national settings, informing whether context-sensitive rather than uniform digital-skills policy is needed to connect expanded ICT access with productive participation under SDG targets 8.5 and 9.c. Collectively, these contributions position digital marketing competencies as a strategically relevant capability for inclusive digital-economy participation, and as a measurable precondition for socially sustainable digital transformation.

2. Theoretical Background

2.1. Digital transformation, entrepreneurship, and inclusive sustainable development in emerging economies

Digital transformation is increasingly recognized not only as a driver of business competitiveness but as a structural force reshaping who can participate in economic life and on what terms [35-36]. Digital entrepreneurship research conceptualizes digital technologies not merely as tools supporting entrepreneurial activity, but as elements that reshape entrepreneurial processes, markets, and forms of value creation [12-13]. Within this broader transformation, freelance and platform-based work represent forms of digitally mediated economic participation through which individuals can offer domain-specific competencies directly to clients on a project basis, often without the capital, infrastructure, or institutional access traditionally required to enter a market [37].

For emerging economies, this shift carries particular weight. Digitally mediated entrepreneurship offers a comparatively low-barrier pathway to economic participation in contexts where formal labor markets remain constrained [38], and it aligns closely with the sustainable development agenda [39]: SDG 8 (Decent Work and Economic Growth) calls explicitly for the promotion of inclusive and sustainable economic growth

and full, productive employment for all, while SDG 9 (Industry, Innovation and Infrastructure) frames technological upgrading and inclusive innovation as preconditions for that growth. Read together, these goals position digital competency development not as a peripheral skills issue but as infrastructure for inclusive and sustainable economic transformation.

PwD are a critical test case for this proposition. Their labor-market inclusion is not only a matter of social justice but a marker of whether digital transformation in emerging economies is genuinely inclusive and sustainable, or whether it reproduces existing inequalities in a new, digital form. The remainder of this section develops this argument in three steps: first, by situating digital marketing competencies as a form of human capital relevant to employability and entrepreneurship; second, by reviewing the specific barriers and opportunities digital transformation presents for the inclusive employment of PwD; and third, by connecting these two strands through the literature on digital entrepreneurship and digital inequality, from which the study's research gap is derived.

2.2. Digital marketing competencies as human capital for employability and entrepreneurship

Possession of general and field-related competencies represents a crucial factor for competitiveness and employability among graduates and employees at all stages of their careers [14-15]. Digital marketing competencies are a particularly relevant form of business-relevant human capital: they enable organizations and individuals to deploy digital tools for customer acquisition, engagement, and retention, directly contributing to value creation and competitive performance [40-41]. As personalized, targeted communication with customers has become a business necessity, these competencies have moved from a specialized skill set to a mainstream requirement of marketing practice [42], making their acquisition and recognition increasingly consequential for employability and self-employment alike.

The academic literature has not converged on a single, definitive set of digital marketing competencies, and the field remains under-explored in depth [21]. Several studies, based on industry interviews, job-advertisement analysis, and surveys of professionals and graduates, converge nonetheless on a recurring core: competencies related to social media, search engine optimization, e-commerce, content creation, digital analytics, and mobile platforms consistently emerge as the most valued, alongside complementary soft skills such as communication and language proficiency [43-44, 21, 45-48]. More recent accounts extend this core toward data-driven and AI-assisted competencies, reflecting the pace at which the field continues to evolve [49].

At the same time, evidence of a persistent competency gap tempers optimism about the pace of digital upskilling: assessments of marketers in mature digital economies have found general digital marketing competencies to be low even among ostensibly digitally native cohorts [20], while self-employed individuals have tended to outperform employed peers on the same measures. The COVID-19 pandemic accelerated the shift of economic activity online [50], but subsequent gains in digital marketing competencies have been modest relative to organizational and market needs, underscoring that closing this gap requires deliberate competency development rather than passive exposure to digital tools. This gap is the point at which questions of

employability intersect with questions of inclusion: if digital marketing competencies are unevenly acquired even in favorable contexts, their distribution among structurally disadvantaged groups, such as PwD, warrants explicit attention.

2.3. Inclusive employment of persons with disabilities in the digital era

The development of an inclusive labor market is not only a matter of social justice and equality, leading to personal development and a better position for PwD. It also represents an opportunity for economic and social development consistent with the sustainability agenda outlined above [51-52]. Digitalization has begun to erode some of the physical and communication barriers that previously constrained the employment of PwD, enabling more flexible access to work and to the acquisition of new, digitally applicable competencies [53]. True digital transformation within organizations therefore implies adopting models of digital work that are also suitable for PwD, providing the resources and opportunities needed to build digital competencies [25].

The Convention on the Rights of Persons with Disabilities [54] establishes the right of PwD to equal participation in an open and inclusive labor market, free of employment discrimination, with access to self-employment and vocational training. Progress against this standard has been uneven: the position of PwD in the labor market remains worse than that of people without disabilities, a gap that is especially pronounced for young and female PwD [55]. The COVID-19 pandemic illustrates the double-edged nature of this transformation. It created new opportunities for remote employment for groups such as PwD, some of which persisted after the pandemic through continued use of digital technologies [56]. Yet International Labour Organization data show that employment among PwD actually declined during the pandemic, driven by job losses in retail and hospitality and by health risks associated with in-person work [57]. This apparent paradox indicates that the expansion of digitally mediated work alone is insufficient to overcome the employment disadvantages faced by PwD: the skills and capabilities required to use digital technologies productively constitute a distinct and necessary dimension of inclusion [58].

Research on integrating PwD into employment has focused largely on improving the effectiveness of educational pathways [24, 59], which for this group are often comparatively weak in both formal and informal settings [24]. Improving the digital literacy of PwD supports their employability, financial independence, and overall quality of life [11], enabling fuller participation in the labor market according to individual capability [24]. Digital competency development is, in this sense, a prerequisite for participation not only in employment but in education, social, cultural, and political life more broadly [9, 25] identifies three areas in which the benefits of digital transformation are particularly evident for PwD: accessibility, adaptability, and financial independence, each supported by continued progress in assistive technology that allows PwD to work remotely or within adapted workplace environments across a range of fields. Access to ICT is central to this process [60, 9], but in practice PwD often face limited availability of adapted or accessible digital technology, limited availability of applications in languages other than English, insufficient training in assistive technologies, and inadequate accessibility legislation [9].

These barriers and opportunities converge on a broader point: inclusivity is increasingly understood as a condition for, rather than a byproduct of, sustainable development, fostering equal opportunity, innovation, and resilience through the empowerment of all social groups. Improving the digital competencies of vulnerable social groups is accordingly seen as an effective mechanism for strengthening their social and economic inclusion [61].

2.4. Digital entrepreneurship and digital competencies: bridging inclusion and sustainable economic participation

The literature reviewed above suggests that digitally mediated entrepreneurial pathways are particularly relevant for PwD, since remote forms of work can reduce physical and geographical constraints and offer greater flexibility in how work is organized. Digital marketing is especially well suited to this mode of participation, as many of its core activities can be performed and delivered remotely [61]. The central question this raises for sustainable and inclusive digital transformation is therefore not simply whether digitally mediated employment and entrepreneurial pathways exist, but whether PwD possess the competencies required to participate in them effectively.

Research on digital inequality suggests this question cannot be answered by examining technological access alone [62]. A well-established distinction separates inequality in access to digital technologies from inequality in the skills and usage patterns that determine what individuals can actually accomplish with that access, sometimes referred to as the first- and second-level digital divides [63-64]. Applied to digitally mediated work, this distinction points to an additional capability dimension: even where access to digital technologies is available, the domain-specific competencies required for productive and economically meaningful participation may remain unevenly distributed. Digital inclusion therefore depends not only on connectivity and access, but on the capacity to convert that access into competencies applicable to concrete economic activities [65], a distinction with direct implications for socially sustainable digital transformation in emerging economies.

For vulnerable groups, the development of digital competencies has been identified as an important mechanism for strengthening social and economic inclusion [61]. From this perspective, technological access and competency development should be understood as complementary dimensions of inclusion rather than as interchangeable indicators of progress. Establishing whether domain-specific digital marketing competencies are being acquired by PwD, and identifying the individual and contextual factors associated with their development, is therefore necessary for assessing whether digital transformation in Southeast Europe's emerging economies can translate into meaningful, inclusive, and sustainable economic participation. This is the empirical task undertaken in the present study.

3. Data and methods

3.1. Research design

This study employs a quantitative, cross-country design to assess the digital marketing competencies of persons with physical disabilities (PwPD). The quantitative research design enables the statistical analysis of objective and measurable data on PwPD's digital marketing competencies. The cross-country aspect of the research design

allows for the identification of patterns, similarities, and differences in digital marketing competencies levels across different socioeconomic and technological environments.

3.2. Participants

The data for this study were collected within the DI-MARC project [32], funded by the European Social Fund Plus. The project aims to enhance the digital marketing competencies of PwPD and strengthen their opportunities for participation in remote work. The dataset includes responses from 398 PwPD across Serbia, Montenegro, and Croatia. Participants were recruited through national associations of PwPD that are members of the DI-MARC consortium; consequently, a convenience sampling approach was used.

Only participants with physical disabilities were eligible for inclusion in the study. This eligibility criterion reflects the specific focus of the DI-MARC project on developing digital marketing competencies for remote work among PwPD, whose training and accessibility needs may differ from those of persons with other types of disabilities.

Table 1 presents the disability-related characteristics of the participants. Overall, 44% of participants reported minimal obstacles in daily activities, with the highest proportion observed in Montenegro (50%). Conversely, 20% reported significant obstacles, with the highest proportion observed in Croatia (36%). Acquired disabilities were more common overall, accounting for 56% of participants, with the highest proportion observed in Serbia (64%). Among participants with acquired disabilities, 65% had lived with their disability for more than 10 years, with the highest proportion observed in Croatia (76%).

Table 1
Disability Profile of the Participants

Variable	Category	n	Total (%)	Montenegro	Croatia	Serbia
Functional assessment of daily activities	Minimal obstacles in daily activities and do not require additional support	175	44%	50%	28%	49%
	Moderate obstacles that may require occasional assistance or the use of assistive technology	133	33%	35%	31%	34%
	Significant obstacles in daily activities and usually require constant support	78	20%	13%	36%	14%
	Extremely difficult obstacles and require intensive support and assistive technology	12	3%	2%	5%	3%
Disability type	Acquired	221	56%	49%	47%	64%
	Congenital	177	44%	51%	53%	36%
Duration of acquired disability	Less than 1 year	3	1%	2%	0%	2%
	1-5 years	43	20%	12%	8%	27%

Variable	Category	n	Total (%)	Montenegro	Croatia	Serbia
	6-10 years	31	14%	23%	16%	9%
	More than 10 years	144	65%	63%	76%	62%

3.3. Digital Marketing Competencies Assessment (DMCA) Tool

The DMC Framework proposed and validated by Papageorgiou and Marneros [66] served as the basis for the development of the DMCA tool. Each competence category in the DMC Framework encompasses different digital marketing specializations. To formulate specific learning outcomes (LOUTs) for these categories, the requirements of relevant digital marketing specializations were considered using the classification provided by the remote-work platform MarketerHire [67]. Each DMC competence category was then linked to the corresponding digital marketing specializations identified in the MarketerHire classification.

The questionnaire was developed following the approach proposed by Kluzer and Pujol [68] and included two types of assessment questions:

1. Self-assessment questions (SA-Q), in which participants assessed their ability to perform specific activities using a 4-point Likert scale.
2. Knowledge and ability questions (KA-Q), in which participants were presented with practical problems and situations and asked to identify an appropriate response or expected outcome. These questions assessed factual knowledge ("knowing that"), procedural knowledge ("knowing how"), or both.

The formulation of both SA-Q and KA-Q items was based on specific LOUTs identified for each DMC competence category and its associated digital marketing specializations. For each LOUT, one SA-Q and one KA-Q item were developed. The formulation of the LOUTs followed Bloom's taxonomy and reflected the requirements of the digital marketing specializations assigned to the respective DMC competence categories. Table 2 presents the complete list of LOUTs and their correspondence with the DMC competence categories and associated digital marketing specializations.

Table 2

Full List of LOUTs by DMC Competence Category and Digital Marketing Specialization

Competence category	Digital marketing specialization	Learning Outcomes (LOUTs)
Strategy	Fractional CMO	1.1. Setting marketing priorities
		1.2. Identifying target audiences
		1.3. Overseeing marketing channels
	Brand Marketer	1.4. Conducting competitive analysis
		1.5. Conducting customer research
		1.6. Working on audience development
		1.7. Brand guideline development
	Growth Marketer	1.8. Optimizing landing pages by running A/B tests
		1.9. Exploring new marketing channels
	Marketing Analyst	1.10. Analyzing the effectiveness of marketing initiatives

Competence category	Digital marketing specialization	Learning Outcomes (LOUTs)
		1.11. Translation of big data into actionable dashboards and data visualizations 1.12. Designing and interpreting A/B and multivariate tests 1.13. Finding new, compliant ways to collect relevant performance data 1.14. Forecasting future marketing performance
SEO	SEO Marketer	2.1. Assessing SEO Performance 2.2. Conducting competitive SEO analysis 2.3. Conducting keyword research 2.4. Sitemap management and indexing 2.5. Performing local SEO 2.6. Implementing linking strategy 2.7. Conducting snippet optimization 2.8. Performing platform-specific SEO
Content Marketing	Content Marketer	3.1. Developing the content strategy 3.2. Writing the content 3.3. Editing the content 3.4. Managing content design
	Paid Search Marketer	3.5. Planning and executing PPC campaign 3.6. Managing bids, ad formats, and paid search advertising budgets
	Programmatic Marketer	3.7. Developing media strategies for reaching the target audience 3.8. Run paid display, search, YouTube, and Amazon campaigns 3.9. Buy placements via DSPs like DV360 and Trade Desk 3.10. Set targeting and bid parameters aligned with business goals 3.11. Report on campaign performance 3.12. Implement best practices for optimization and campaign setup
Social Media Marketing	Social Media Manager	4.1. Managing social media accounts 4.2. Community building in social media 4.3. Creative strategy development 4.4. Performing social listening
	Paid Social Media Expert	4.5. Conducting paid social media campaign on Facebook 4.6. Conducting paid social media campaign on Instagram 4.7. Conducting paid social media campaign on other social media
Email Marketing	Email Marketer	5.1. Email campaign setup and management 5.2. Email management 5.3. Email deliverability 5.4. Email newsletters and list growth

Both SA-Q and KA-Q covered all five competence categories of the DMC Framework. The DMCA tool was structured into five groups of questions corresponding to these categories. Specifically, the instrument included 14 SA-Q and 14 KA-Q items on Strategy, 8 of each on SEO, 12 of each on Content Marketing, 7 of each on Social Media Marketing, and 4 of each on Email Marketing, resulting in a total of 90 assessment items. The maximum achievable score on the knowledge and ability component was 45.

In addition to the SA-Q and KA-Q items, the introductory section of the instrument included informed consent and a set of questions concerning participants' disability-related, sociodemographic, digital, technological, and training characteristics.

Before its use in the main study, the DMCA tool underwent a preliminary validation process involving freelancers with experience in remote and freelance work. For this purpose, a virtual round table was organized with 13 freelancers and representatives of three national associations of PwPD from Serbia, Croatia, and Montenegro to discuss different aspects of the DMCA tool and provide feedback and suggestions for potential revisions.

The aspects of the DMCA tool considered during the round-table review and the corresponding types of feedback are summarized in Table 3.

Table 3
DMCA tool expected feedback from stakeholders

Assessment tool aspect	Expected feedback
Coherence with LOU	How to improve
Completeness with respect to the LOU	Additions
Clarity of SA-Q and KA-Q	How to improve
Difficulty of SA-Q and KA-Q from respondents' perspective	How to improve
Multiple shortcomings	Alternative SA-Q and KA-Q

During the round table, stakeholders suggested revisions to 12 items in the DMCA tool. Following discussion, revisions to eight items were considered justified and were incorporated into the instrument.

The revised DMCA tool was subsequently piloted on a sample of 49 freelancers from Serbia ($n = 19$), Croatia ($n = 15$), and Montenegro ($n = 15$), representing diverse demographic and professional backgrounds in terms of age, education, and specialization. The self-assessment component demonstrated excellent internal consistency (Cronbach's $\alpha = 0.981$). The questionnaire integrated paired self-assessment and objective knowledge test items across five digital marketing domains: Strategy, SEO, Content Marketing, Social Media Marketing, and Email Marketing, enabling the analysis of gaps between perceived and objectively measured competencies. Item-total correlations, factor loadings, and expert review identified five items with limited discriminatory power or potential redundancy, indicating areas for further refinement of the instrument.

3.4. Data collection procedure

Data collection for this study took place at the premises of the national associations of PwPD in the participating countries. The questionnaire was administered through Google Forms. Representatives of the national associations of PwPD, who had been previously trained by the research team, assisted with questionnaire administration by

explaining the purpose and objectives of the research and providing clarification on specific items when necessary. This support was important given the specific health conditions of the participants, helping to ensure their comfort during the data collection process and providing assistance when needed. All participants in the study gave their written consent to participate in this research.

To accommodate participants' needs, data collection was organized in small groups of up to 10 participants at a time. This arrangement facilitated greater individual attention during questionnaire completion.

The research received ethical approval from the Institute of Economic Sciences as the lead research institution, and all procedures adhered to the principles of the Declaration of Helsinki.

3.5 Data analysis

The collected data were systematically analyzed using a variety of appropriate statistical methods. The mean and standard deviation were calculated for numerical variables, while categorical variables were described by calculating frequencies and percentages.

The dependent variable in this research is the digital marketing competencies score of PwPD, derived from a comprehensive data collection tool. The total score was calculated as the sum of correct answers across all DMC competence categories. Participants earned one point for each correct response, resulting in a cumulative score that reflects their overall digital marketing competencies:

$$Score_i = \sum_{j=1}^{14} Strategy_{ij} + \sum_{j=1}^8 SEO_{ij} + \sum_{j=1}^{12} Content_{ij} + \sum_{j=1}^7 SocialMedia_{ij} + \sum_{j=1}^4 Email_{ij}$$

where each item was coded 1 for a correct response and 0 otherwise.

To model the dependent variable, that is, the digital marketing competency score of PwPD, we initially considered a Poisson regression model, which is commonly used for count data and assumes that the mean and variance of the dependent variable are equal. However, our data exhibited significant overdispersion, with the variance far exceeding the mean, thereby violating the assumptions of the Poisson model. To address this issue, we employed a negative binomial regression (NBR) model. The NBR model is an extension of the Poisson model that introduces an additional parameter to account for the extra variability in the data.

The model is specified as:

$$\ln(\mu_i) = x_i^T \beta$$

where μ_i represents the expected digital marketing competency score for participant i , x_i is the vector of explanatory variables, and β is the corresponding vector of regression coefficients.

Under the negative binomial specification, the conditional variance is given by:

$$Var(Y_i) = \mu_i + \alpha\mu_i^2$$

where α denotes the overdispersion parameter. This adjustment enables the model to account for additional heterogeneity in the data that the Poisson model cannot accommodate. Standard model validation tests were performed, and the results of the NBR model are reported using p-values and incidence rate ratios (IRRs).

4. Results

4.1. Socio-demographic profile

The sociodemographic profile of the participants was examined in terms of age, gender, education, employment status, living arrangements, and household income.

Participants ranged in age from 13 to 71 years, with an overall mean age of 38.60 years (SD = 11.899). Serbian participants had the highest mean age at 42.24 years (SD = 11.342, range = 18 to 68), followed by Croatian participants with a mean age of 38.78 years (SD = 12.507, range = 13 to 71). Montenegrin participants were the youngest group, with a mean age of 31.94 years (SD = 9.157, range = 17 to 57). The Croatian sample showed the greatest age variability, with both the largest standard deviation and the widest age range.

Table 4 presents the sociodemographic characteristics of the study participants. Females accounted for 55% of the total sample, with relatively small differences across Montenegro (51%), Croatia (55%), and Serbia (57%).

Regarding education, high school was the most common level of attainment, reported by 47% of participants. This proportion was 50% in both Serbia and Croatia and 37% in Montenegro. Bachelor's degree holders accounted for 32% of the total sample, with the highest proportion in Montenegro (43%), followed by Serbia (30%) and Croatia (24%). Master's degree holders represented 15% of the sample, with the highest proportion again observed in Montenegro (18%), followed by Croatia (17%) and Serbia (11%). PhD holders accounted for only 2% of the total sample. Notably, 49% of participants held a bachelor's, master's, or PhD degree, indicating a substantial representation of tertiary-educated participants in the sample.

Employment status shows that most participants are not employed (57%), though this varies significantly by country. Montenegro has the highest employment rate (60%), especially in contrast to Serbia (33%).

Living arrangements were broadly similar across the three country samples, with 80% of participants living with others. This proportion was highest in Montenegro (84%) and stood at 79% in both Croatia and Serbia.

Household income showed more pronounced cross-country variation. Overall, the largest proportion of participants reported a monthly household income between 401 and 700 EUR (31%), with this category most prevalent in Serbia (40%) and Montenegro (33%), compared with 15% in Croatia. Participants reporting a monthly household income above 1,000 EUR accounted for 26% of the total sample, but this proportion reached 51% in Croatia, compared with 30% in Montenegro and only 9% in Serbia. At the other end of the distribution, household incomes below 400 EUR were reported by 18% of the total sample, with the highest proportion observed in Serbia (29%) and the lowest in Montenegro (6%). Overall, these patterns indicate substantial socioeconomic variation across the three country samples.

Table 4
Socio-demographic profile of participants

Variable	Category	n	Total (%)	Montenegro	Croatia	Serbia
Gender	Male	180	45%	49%	45%	43%
	Female	218	55%	51%	55%	57%
Education	Elementary school	21	5%	2%	8%	5%
	High school	186	47%	37%	50%	50%
	Bachelor	127	32%	43%	24%	30%
	Master	58	15%	18%	17%	11%
	PhD	6	2%	0%	1%	3%
Employment status	Employed	173	43%	60%	45%	33%
	Not Employed	225	57%	40%	55%	67%
Who do you live with?	Alone	78	20%	16%	21%	21%
	Not Alone	320	80%	84%	79%	79%
Monthly Household Income	Less than 400 EUR	72	18%	6%	10%	29%
	401 to 700 EUR	125	31%	33%	15%	40%
	701 to 1,000 EUR	98	25%	30%	24%	22%
	More than 1,000 EUR	103	26%	30%	51%	9%

4.2. English proficiency, digital experience, technology use, and training profile

As shown in Table 5, 81% of participants reported some level of English proficiency, including basic (32%), intermediate (30%), and advanced (19%) proficiency. Croatia had the highest proportion of participants reporting advanced English proficiency (26%), while Serbia had the highest proportion reporting no English proficiency (24%).

Basic digital marketing experience was the most commonly reported level, accounting for 54% of the total sample and more than half of participants in each country. A further 27% reported no previous digital marketing experience, while 16% reported an intermediate level. Advanced and professional experience were uncommon, reported by only 3% and 1% of participants, respectively.

Basic digital literacy was the most commonly reported level, accounting for 42% of the total sample, followed by intermediate digital literacy at 36%. Beginner-level digital literacy was reported by 13% of participants, while 10% reported an advanced level. Montenegro had the lowest proportion of participants at the beginner level (9%).

Computers (desktops or laptops) were the predominant digital devices used by participants, accounting for 64% of the total sample. Their use was most common in Montenegro (70%) and least common in Croatia (61%). Mobile phones were the second most commonly used devices (35%), with the highest proportions reported in Croatia and Serbia (37% each). Tablet use was rare, accounting for only 1% of the total sample.

Experience with online learning platforms was mixed. One-third of participants (33%) reported no previous experience, with the highest proportion observed in Serbia (43%). A further 32% reported occasional use of online learning platforms, while 22% had limited experience. Regular use was reported by only 12% of participants, with the highest proportion in Croatia (19%).

Overall, 78% of participants reported being motivated to engage in digital marketing training. The highest proportion was observed in Serbia (88%), followed by Montenegro (70%) and Croatia (66%).

More than half of participants (52%) reported receiving no support in achieving their educational and career goals. The proportion reporting no support was particularly high in Montenegro (79%) and Serbia (66%). In contrast, 16% of the total sample reported receiving a very high level of support, with this response concentrated in Croatia, where it was reported by 58% of participants.

Table 5

English proficiency, digital experience, technology use, and training profile of participants

Variable	Category	n	Total (%)	Montenegro	Croatia	Serba
English level	I don't speak English	77	19%	11%	19%	24%
	Basic	126	32%	38%	21%	34%
	Intermediate	120	30%	30%	34%	28%
	Advanced	75	19%	21%	26%	13%
Digital Marketing experience	No previous experience	107	27%	20%	19%	35%
	Basic	215	54%	59%	51%	53%
	Intermediate	62	16%	18%	24%	10%
	Advanced	12	3%	3%	6%	2%
	Professional	2	1%	0%	1%	1%
Digital Literacy level	Beginner	51	13%	9%	10%	17%
	Basic	166	42%	41%	38%	44%
	Intermediate	142	36%	39%	41%	31%
	Advanced	39	10%	11%	11%	8%
Digital devices use	Computer	255	64%	70%	61%	62%
	Mobile phone	139	35%	29%	37%	37%
	Tablet	4	1%	1%	2%	1%
Online Learning Platforms experience	I had no experience	133	33%	20%	29%	43%
	I had limited experience	87	22%	24%	15%	25%
	I had used it for occasional learning	129	32%	45%	37%	23%
	I regularly use online learning platforms	49	12%	11%	19%	9%
Motivation to engage in digital marketing training	Yes	310	78%	70%	66%	88%
	No	88	22%	30%	34%	12%
Support in achieving educational and career goals	Very supportive	64	16%	0%	58%	0%
	Slightly supportive	28	7%	1%	11%	9%
	Partially supportive	99	25%	20%	29%	25%
	Not supportive at all	207	52%	79%	2%	66%

4.3. Self-assessed and objectively measured digital marketing competencies

The overall mean self-assessment score for digital marketing competencies was 2.02 on a 4-point scale (1 = no skills, 4 = sufficient skills to operate independently). At the country level, participants from Montenegro reported the highest mean self-

assessment score (2.07), followed closely by Serbia (2.05), while Croatia had a somewhat lower mean score (1.90).

Differences were also observed across digital marketing competence categories. Participants rated their competencies highest in Social Media Marketing (M = 2.29), followed by Email Marketing (M = 2.16) and Strategy (M = 2.07). The lowest self-assessment scores were recorded for Content Marketing (M = 1.76) and SEO (M = 1.79). Table 6 presents the self-assessed proficiency levels across the five competence categories by country.

Table 6

Self-assessed proficiency levels in the observed DMC areas by country

Country	Strategy	Content Marketing	Social Media Marketing	Email marketing	SEO	Total
Montenegro	2.08	1.78	2.47	2.21	1.82	2.07
Croatia	2.03	1.74	2.00	2.01	1.71	1.90
Serbia	2.10	1.76	2.35	2.22	1.82	2.05
Total	2.07	1.76	2.29	2.16	1.79	2.02

Figure 1 presents the percentage of correct answers across the five DMC competence categories by country. Overall performance was lowest in Serbia, where participants achieved 16% correct answers across all competence categories, compared with 20% in both Croatia and Montenegro. Across the three countries, Social Media Marketing showed the highest proportion of correct answers, ranging from 29% in Serbia to 39% in Montenegro. SEO consistently showed the lowest performance, with 12% correct answers in Serbia, 10% in Croatia, and 11% in Montenegro. Performance in Strategy was also relatively low and similar across countries, ranging from 16% to 18%, while Content Marketing and Email Marketing showed somewhat higher scores, particularly in Montenegro.

Correct answers (%)



DMC area	Serbia	Croatia	Montenegro
DMC Total	16%	20%	20%
Strategy	16%	18%	17%
Social Media Marketing	29%	32%	39%
SEO	12%	10%	11%
Content Marketing	19%	18%	21%
Email Marketing	16%	22%	24%

Fig. 1 Distribution of correct answers across DMC competence areas by respondents' country of residence

Comparing the two sets of results reveals both similarities and differences between participants' self-assessments and their objectively measured performance. Social Media Marketing showed the clearest correspondence, as it was the highest-rated domain in the self-assessment and also showed the strongest objective performance across all three countries. At the lower end, however, the patterns diverged. Content Marketing received the lowest self-assessment score, whereas SEO showed the lowest objective performance in all three countries. Strategy was also self-assessed more favorably than its comparatively low objective performance would suggest.

A similar divergence was evident at the country level. Croatian participants reported the lowest overall mean self-assessment score while achieving a joint-highest overall objective score, whereas Serbian participants reported a higher mean self-assessment score but had the lowest overall objective performance.

4.4. Score modeling

A negative binomial regression model was estimated for the pooled sample to examine the sociodemographic, digital, technological, and training-related factors associated with participants' digital marketing competency scores. Separate models were also estimated for Montenegro, Croatia, and Serbia to examine whether these associations varied across the three country samples.

Table 7 presents the Omnibus test results for the pooled model and the three country-specific models. The likelihood ratio chi-square tests were statistically significant for all four models ($p < 0.001$), indicating that the models including the specified predictors provided a significantly better fit than the corresponding null models.

Table 7
Omnibus test results

Model	Likelihood Ratio Chi-Square	df	p-value
Total	1168.011	12	< 0.001
Montenegro	397.036	12	< 0.001
Croatia	320.104	12	< 0.001
Serbia	493.173	12	< 0.001

Modeling results are given in Table 8.

Table 8
Negative binomial regression results

	Pooled sample		Montenegro		Croatia		Serbia	
	IRR	p-value	IRR	p-value	IRR	p-value	IRR	p-value
Gender	1.125	0.014	1.231	0.016	1.168	0.093	1.018	0.818
Age	0.986	0.000	0.982	0.043	0.996	0.577	0.978	0.001
Employment status	0.966	0.494	0.940	0.530	0.970	0.777	0.893	0.199
Income	1.022	0.360	0.985	0.760	1.060	0.228	1.020	0.632
Training motivation	1.280	0.000	1.311	0.002	1.105	0.307	1.360	0.002
Education level	1.068	0.029	1.091	0.125	1.057	0.413	1.064	0.164
English level	1.172	0.002	1.157	0.115	1.081	0.457	1.213	0.019
Digital marketing experience	1.198	0.007	1.051	0.058	1.388	0.007	1.355	0.007
Digital literacy level	1.272	0.000	1.106	0.048	1.595	0.000	1.244	0.036

Online platform experience	1.116	0.036	1.253	0.019	1.150	0.138	1.069	0.435
Support	1.012	0.562	0.958	0.450	1.045	0.455	1.025	0.546
Self-assessment	2.394	0.000	2.272	0.000	2.295	0.000	2.485	0.000

5. Discussion

The findings speak to a question that is central to the sustainability agenda's treatment of digital transformation: whether expanding digital access and engagement is sufficient to deliver inclusive economic participation, or whether it must be accompanied by deliberate investment in domain-specific competencies. The discussion below is organized to foreground that question. It begins with the study's central finding, a divergence between general digital engagement and domain-specific digital marketing competencies, before turning to the individual, motivational, and educational factors associated with digital marketing competencies, the extent to which these factors operate differently across an emerging-economy (Serbia, Montenegro) and an advanced-economy (Croatia) context, and finally the implications of these patterns for inclusive and socially sustainable digital transformation.

5.1. From general digital engagement to domain-specific capability

Considered together, the findings point to a divergence between general digital engagement and domain-specific digital marketing capability in the samples studied. Most participants reported at least a basic level of digital literacy, used digital devices, and had some prior exposure to digital marketing, yet objectively measured digital marketing competencies remained low in all three countries, ranging from 16% to 20% correct answers overall. Even in the strongest domain, Social Media Marketing, the highest country-level result was 39%. These findings indicate that general digital engagement and basic digital capabilities do not necessarily translate into the domain-specific competencies required for economically meaningful participation in digital markets. This distinction is important for assessing inclusive digital participation, since indicators focused primarily on technological access or general digital use may not capture whether individuals possess competencies that can be applied in employment or entrepreneurial activity [65].

The pattern across competence categories is consistent with this distinction. Social Media Marketing showed the strongest objective performance across all three countries, while SEO consistently showed the weakest performance and Strategy also remained comparatively low. One possible interpretation is that activities encountered more frequently in everyday digital environments may be more familiar to participants than competencies that depend more heavily on specialized training or professional experience. Informal exposure to digital environments may therefore support familiarity with some digital marketing activities without necessarily producing the broader set of competencies required for independent professional or client-based work. The divergences between self-assessed and objectively measured competence reported in Section 4.3 further show that perceived and demonstrated competence do not align uniformly across categories. Strategy, for example, was self-assessed relatively favorably despite comparatively low objective performance, whereas Content Marketing received the lowest self-assessment score despite somewhat stronger objective performance.

5.2. Demographic determinants of digital marketing competencies

Several sociodemographic, digital, and training-related factors were significantly associated with participants' digital marketing competency scores in the pooled negative binomial regression model.

Gender was a significant predictor of digital marketing competency scores (IRR = 1.125, $p = 0.014$), with male participants scoring approximately 12.5% higher than female participants. Although directly comparable studies on digital marketing competencies among PwD remain scarce, this finding can be considered in relation to the broader literature on gender differences in digital competencies and technology use. Kalogeratos et al. [69] found that male respondents reported higher levels of knowledge and skills in using digital learning platforms than female respondents. Similarly, Jiménez-Hernández et al. [70], using an instrument based on the DigComp framework, reported lower digital competence scores among women. Several other studies have also identified gender-related differences in digital access, skills, and technology use [71-77], including among marginalized and disadvantaged groups such as PwD [16, 61, 76];. These findings provide a broader context for the gender difference observed in the present study, although the mechanisms underlying this association cannot be established from the available data.

Age was negatively associated with digital marketing competency scores in the pooled model (IRR = 0.986, $p < 0.001$), indicating an approximately 1.4% lower expected score with each additional year of age. This finding is consistent with previous research showing that older individuals often have lower levels of digital skills and engagement with digital technologies than younger individuals [63, 78]. Cantú-Ballesteros et al. [79] similarly found higher levels of digital skills and greater ability to use digital tools among younger participants. Kalogeratos et al. [69] reported more limited knowledge and skills in using digital platforms among participants aged 40 and older, while Jiménez-Hernández et al. [70] identified age as a significant predictor of digital competence, with younger participants achieving higher scores across the DigComp competence areas. The Chartered Institute of Marketing [80] also reported age-related differences in digital skills among professional marketers and linked these differences to lower levels of training and upskilling among older professionals. Together with evidence that older adults may face a greater risk of digital exclusion [78], these findings suggest that older PwPD may face additional challenges in acquiring and maintaining the digital marketing competencies required for participation in digitally mediated work.

5.3. Motivation, prior experience, and self-assessment as levers of competence development

Motivation has been identified as an important factor in the acquisition and continued development of digital skills [81] and in engagement with digital marketing tools and platforms [82]. Previous research also suggests that motivation to acquire new knowledge and skills through training may support the development of digital marketing competencies relevant to contemporary employment [83-84]. Studies by ElSayary [85] and Ng et al. [86] further linked willingness to participate in digital capacity-building activities with improvements in digital competencies, while Lilian [87] reported a positive relationship between personal motivation and digital literacy competency. Consistent with this literature, training motivation was significantly associated with

digital marketing competency scores in the pooled model ($IRR = 1.280$, $p < 0.001$), with motivated participants scoring approximately 28% higher.

Online platform experience was significantly associated with competency scores in the pooled model ($IRR = 1.116$, $p = 0.036$), with higher levels of online platform experience associated with higher scores. Calderón et al. [88] found that previous technology-use experience was associated with individuals' perceptions of their digital skills. Nygren et al. [89] similarly examined the role of prior online-platform experience in students' experiences with online learning, while Tomczyk et al. [90] identified relationships between previous e-learning experience and self-assessed digital literacy. Although these studies do not focus specifically on digital marketing competencies among PwD, they provide relevant evidence that prior engagement with online learning environments may be associated with broader digital capability development.

Self-assessment showed the strongest association with digital marketing competency scores in the pooled model ($IRR = 2.394$, $p < 0.001$). Participants who rated their digital marketing competencies more highly also tended to achieve higher objectively measured scores. Maderick et al. [91] cautioned that subjective self-assessment should not be treated as an objective measure of digital competence, although it may still be related to confidence and willingness to engage in further learning. Jiménez-Hernández et al. [70] similarly identified self-perceptions of technological skills as relevant to digital competency outcomes, while Synnott et al. [77] reported a positive relationship between self-reported and measured digital skills. Martzoukou et al. [92] also found relationships between self-perceived competencies across different digital domains, and Rosales-Márquez et al. [93] reported that greater confidence in digital skills was associated with more advanced digital skill levels. The present findings are consistent with this broader literature, while also showing that self-assessment should not be interpreted as equivalent to objective competence.

5.4. Education, language, and digital literacy as enabling resources

Education level was significantly associated with digital marketing competency scores in the pooled model ($IRR = 1.068$, $p = 0.029$), with higher levels of education associated with higher competency scores. This finding is consistent with broader evidence linking formal education to digital skills and professional digital competencies. According to CareerExplorer [94], 75% of digital marketing specialists hold a bachelor's degree and 21% hold a master's degree, suggesting a strong representation of tertiary education within the profession. van Deursen et al. [63] found that formal education was significantly related to both medium-related and content-related digital skills. Similarly, Barboutidis and Stiakakis [95] identified education level as a factor associated with competence in digital content creation. Earlier research by Mbarika et al. [96] also identified education as an important correlate of digital competencies and reported that highly educated female participants could outperform their male counterparts in digital competency measures. More recently, Moreira-Choez et al. [97] reported significant relationships between academic degree level, digital competencies, and the intensity of digital technology use.

English language proficiency was significantly associated with digital marketing competency scores in the pooled model ($IRR = 1.172$, $p = 0.002$), with higher English proficiency associated with higher competency scores. One possible explanation lies in the prominent role of English in online communication and digital resources [98],

which may facilitate access to digital marketing tools, learning materials, and professional content. Agustina et al. [99] similarly emphasized the importance of English for effective communication in the global business environment, including digital marketing. Alsmari [100] reported a positive relationship between English language proficiency and digital literacy among students, while Rajović and Denić [101] found that individuals with stronger English language skills demonstrated greater confidence in using digital technologies and navigating digital environments. Isnaniah and Ningsih [102] also reported higher digital skill levels among students with stronger English language proficiency. Although directly comparable studies among PwD remain scarce, this literature provides a broader basis for considering English proficiency as a potentially relevant resource for acquiring digital marketing competencies.

Digital marketing experience (IRR = 1.198, $p = 0.007$) and digital literacy level (IRR = 1.272, $p < 0.001$) were also positively associated with competency scores in the pooled model. Participants reporting higher levels of digital marketing experience and digital literacy achieved higher scores, which is consistent with the expectation that prior exposure to digital marketing and broader digital capabilities are relevant to the development of domain-specific competencies.

The importance of digital literacy is also supported by previous research. Socially vulnerable groups may face barriers to developing digital skills and accessing digital technologies [103], while digital literacy has been identified as an important foundation for the effective use of digital marketing tools and practices [104]. Calderón et al. [88] found that digital literacy was associated with individuals' perceptions of their digital skill levels. Puro and Achmad [105] reported positive relationships between digital literacy, digital skills, and marketing practices in SMEs, while Moorthy and Sahid [106] identified a positive relationship between digital literacy in marketing and entrepreneurial tendencies among students. Although these studies focus on different populations, their findings are consistent with the present results, in which higher digital literacy was associated with higher digital marketing competency scores in the pooled model and across all three country samples.

5.5. National context: competency formation across an emerging- and advanced-economy setting

The pooled-model associations reviewed above did not hold uniformly across the three national samples. This section brings that variation together in one place, both to avoid restating individual coefficients across multiple subsections and because the pattern of divergence itself is informative for a comparative reading of digital transformation in Southeast Europe.

Two determinants (self-assessment and digital literacy) were significant in the pooled model and in every country model, indicating that these associations are relatively robust to national context (Section 5.3, 5.4). Two others, household income (pooled IRR = 1.022, $p = 0.360$) and perceived support in achieving educational and career goals (pooled IRR = 1.012, $p = 0.562$) were not significant in the pooled model or in any country model, despite pronounced descriptive variation in both measures across the three samples. The remaining determinants, however, showed a country-dependent pattern that is worth examining as a group.

Gender was a significant predictor only in Montenegro, where male participants scored approximately 23.1% higher than female participants (IRR = 1.231, $p = 0.016$). It was not significant in Croatia or Serbia. Kovačević and Kaščelan [107] identified gender differences in Internet usage patterns in Montenegro specifically and linked them to the country's sociodemographic, cultural, and economic context, while Bradić-Martinović et al. [108] similarly found gender to be a non-significant predictor of digital skill levels in the Serbian tourism sector, broadly consistent with the pattern observed here.

Age was significantly, and negatively, associated with competency scores in Montenegro (IRR = 0.982, $p = 0.043$) and Serbia (IRR = 0.978, $p = 0.001$) but not in Croatia. In the Serbian context, Stojanović et al. [109] identified barriers associated with digitalization among older adults, including limited labor market access and inadequate institutional support, which may provide relevant context for the pattern observed here. Estrella et al. [110], in a systematic review of digital health literacy, highlighted the role of sociodemographic, economic, and cultural factors in shaping digital competencies across different contexts, consistent with the absence of an age effect in the more digitally mature Croatian sample.

Training motivation was significant in Montenegro (IRR = 1.311, $p = 0.002$) and Serbia (IRR = 1.360, $p = 0.002$), where motivated participants scored approximately 31.1% and 36.0% higher, respectively, but not in Croatia. Jugović and Doolan [111] noted Croatia's comparatively low early school-leaving rate and relatively strong educational outcomes, providing broader contextual evidence of a more consistent educational environment, though this does not directly explain the absent motivation effect. This caution is reinforced by Divjak et al. [112], who examined digital skill gaps and motivation for learning among vulnerable groups using the DigComp framework but did not find sufficient evidence to confirm the expected relationship, underscoring that the motivation–competence link should be treated as context-dependent rather than assumed.

Online platform experience was significant only in Montenegro (IRR = 1.253, $p = 0.019$), not in Croatia or Serbia, suggesting that the relevance of prior online-learning exposure may itself depend on national context, though the present data cannot establish the mechanism.

English proficiency showed the reverse pattern. Significant only in Serbia (IRR = 1.213, $p = 0.019$), not in Montenegro or Croatia. This may reflect the extent to which access to digital marketing resources, online courses, and professional networks depends on English-language content in some national contexts more than others, although the study did not directly measure the availability of localized resources, so this explanation should be treated cautiously.

Education level, significant in the pooled model, did not reach significance in any individual country model, and digital marketing experience was significant in Croatia (IRR = 1.388, $p = 0.007$) and Serbia (IRR = 1.355, $p = 0.007$) but not Montenegro (IRR = 1.051, $p = 0.058$).

Taken together, this pattern of divergence tracks the study's three-country design, which deliberately paired two emerging, EU-accession economies (Serbia, Montenegro) with one advanced EU member state (Croatia) [113]. Motivation, age,

gender, and prior online experience all carried more explanatory weight in Serbia and Montenegro than in Croatia, suggesting that where structured training and digital infrastructure are less consistently available, individual differences do more of the work in determining who acquires domain-specific digital competence. In the more digitally mature Croatian context, by contrast, competence formation appears less differentiated by these individual factors, potentially reflecting more uniform access to formal training and digital infrastructure across the population, though this interpretation cannot be confirmed with the present cross-sectional data. These findings point to the value of context-sensitive, rather than uniform, digital-skills policy for PwD across Southeast Europe.

6. Conclusion

This study provides cross-country evidence on digital marketing competencies among PwPD in Serbia, Montenegro, and Croatia, identifying the individual, digital, and training-related factors associated with objectively measured competency outcomes. Across all three countries, objectively measured competence was low. Social Media Marketing was the strongest domain, yet even its highest country-level result stayed below 40%, while SEO and Strategy consistently scored weakest. Self-assessed and objectively measured competence did not align uniformly across DMC categories or countries, underscoring the need to assess digital competencies directly rather than through self-report alone.

The regression analyses confirm that competency development is multifactorial. In the pooled model, gender, age, education, English proficiency, training motivation, digital marketing experience, digital literacy, online platform experience, and self-assessment were all significantly associated with competency scores, with self-assessment showing the strongest association. Most of these associations varied by country. Self-assessment and digital literacy held everywhere, but gender, age, motivation, English proficiency, and online platform experience each held in some countries and not others, indicating that competency formation is shaped by national context and that the underlying mechanisms cannot be established from the present data. Taken together, the findings show that general digital engagement does not automatically translate into the domain-specific competencies required for digitally mediated economic participation. Digital marketing competencies represent a relevant form of human capital for remote employment, freelance work, and digital entrepreneurship among PwD, but this study assesses them as a *precondition* for such participation, not as evidence of employment or entrepreneurial outcomes themselves. Realizing that potential requires accessible, structured, and context-sensitive pathways for competency development, directly relevant to SDG target 8.5 (decent work and productive employment for PwD) and complementary to the access-oriented aims of SDG target 9.c, since access alone cannot be assumed to produce productive participation.

Implications for business. The uneven distribution of competencies, particularly weak performance in SEO and Strategy, points to the value of targeted upskilling, modular training pathways, and mentoring rather than assuming uniform digital readiness. Recognizing PwD as a talent pool also supports more inclusive recruitment and remote-work practices.

Implications for policy and training. The low overall competency levels call for structured, competency-based programs rather than general digital-skills initiatives, with attention to language support where English proficiency mattered (Serbia) and to accessible online-learning exposure where that mattered most (Montenegro). Because the significant factors differed by country, one-size-fits-all training design is unlikely to work equally well everywhere. Regional cooperation, including through initiatives such as the DI-MARC consortium, may help adapt practices across contexts.

Implications for sustainability. These findings speak directly to whether digital transformation can be considered socially sustainable rather than merely technologically advanced. The gap between widespread general digital engagement and low domain-specific competence shows that expanding access, the focus of SDG target 9.c, is not sufficient on its own to deliver the full and productive employment envisioned for PwD under SDG target 8.5. Access is a necessary but not sufficient condition for productive digital-economy participation. This has two concrete implications for sustainability policy and practice. First, monitoring frameworks for inclusive digital transformation should track competency acquisition alongside connectivity and device-access indicators, since the latter can mask persistent gaps in economically applicable skills. Second, the pronounced cross-country variation in which factors predicted competencies, more individual-level factors mattered in the emerging economies of Serbia and Montenegro than in EU-member Croatia, indicates that sustainable digital-inclusion strategies cannot be transplanted uniformly across national contexts; they require calibration to each country's institutional and digital-development stage if they are to translate digital access into durable, inclusive economic participation for PwD.

Limitations and future research. The findings should be interpreted with several limitations in mind. Convenience sampling through national PwPD associations limits generalizability, as participants may differ from the broader PwPD population in motivation or institutional engagement. The study covers only physical disabilities, not sensory, cognitive, or multiple disabilities. Its cross-sectional design precludes causal inference regarding the direction of the associations identified. The study also measures competency as a precondition for digitally mediated participation, not participation or its economic outcomes directly. Finally, the rapid integration of AI tools into digital marketing practice means competency frameworks will require periodic updating to remain current.

These limitations point to clear directions for future work: longitudinal and experimental studies evaluating targeted training interventions (including AI-supported and work-integrated learning), comparative studies extending beyond the present three countries, and qualitative or mixed-method research connecting competency development to actual employment, freelance, or entrepreneurial outcomes.

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Ethics approval and consent to participate

The protocol was approved by the ethics committee of the Institute of Economic Sciences. The study was carried out in accordance with the ethical guidelines of the Declaration of Helsinki for research involving human participants. Participation was voluntary, informed consent was obtained from all participants, and respondents were informed of their right to withdraw at any time without consequence. No personally identifiable information was collected, and all responses were kept anonymous and used solely for academic purposes. Informed consent was obtained from all participants involved in the study.

Declaration of generative AI use

During the preparation of this work, the author(s) used ChatGPT (OpenAI) to assist in organizing content, refining language, and improving clarity. After using this tool, the author(s) reviewed, edited, and adapted the content thoroughly and take(s) full responsibility for the accuracy, interpretation, and originality of the published article.

Clinical trial number: not applicable.

Consent for publication

Not applicable. The manuscript does not contain any individual person's data or images.

Competing interests

The authors declare no competing interests.