



Design and validation of a digital marketing measurement instrument for native product firms in Peru

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ABSTRACT

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This study aimed to design and validate a psychometrically sound instrument to measure digital marketing among firms that commercialize native products in the jungle regions of Peru, an underexplored, low-infrastructure, emerging-market context. A quantitative, non-experimental, cross-sectional design was employed. A 12-item questionnaire was developed and structured around four theoretically grounded dimensions: social media, search engine optimization (SEO), search engine advertising (SEA), and web analytics, and was administered to 60 formally registered firms in the native product commerce sector. Data were analyzed using exploratory and confirmatory factor analyses, and instrument reliability was assessed with Cronbach's alpha and McDonald's omega. Exploratory factor analysis confirmed adequate sampling adequacy across all four dimensions, with KMO values ranging from 0.728 to 0.774 and statistically significant Bartlett's tests ($p = 0.000$). Confirmatory analysis yielded an overall KMO of 0.932, and the four-factor model collectively accounted for 88.686% of total variance. Both Cronbach's alpha and McDonald's omega reached 0.983, reflecting outstanding internal consistency. The resulting 12-item, five-point Likert scale instrument offers entrepreneurs, researchers, and policymakers a scientifically validated diagnostic tool to assess digital marketing maturity, identify competitive gaps, and support evidence-based strategic decision-making within the native product commerce sector. By providing a validated measure tailored to a low-infrastructure, emerging-market setting, the study extends digital marketing measurement research beyond conventional urban and developed-market contexts and supports more evidence-based strategy among rural entrepreneurs.

Contribution/Originality: This study contributes a validated 12-item digital marketing measurement instrument for native product firms in Peru's underexplored jungle regions. It uses a novel combined exploratory–confirmatory factor analysis methodology, yielding a four-factor scale with exceptional reliability ($\alpha = \omega = .983$) that offers researchers and policymakers an empirically grounded diagnostic tool.

1. INTRODUCTION

The commercialization of native products has entered a period of rapid transformation, propelled by the widespread digitalization of markets and the evolution of consumer purchasing behaviors (Baumeister, Aadland, Linington, & Kvalheim, 2024). Enterprises in this sector now confront the imperative of establishing robust digital presences, as modern consumers, both domestic and international, increasingly rely on digital platforms to research, evaluate, and complete purchases. This behavioral shift compels native product firms to fundamentally reassess their marketing approaches and client engagement strategies (Tashtemirovich, Balbaa, Ibrohimjon, & Batirova, 2024).

Anchored in the Technology Adoption Model (TAM) and resource-based view (RBV) frameworks, digital marketing has emerged as a strategic pillar enabling firms to strengthen competitive positioning, broaden market reach, and enhance the overall customer journey (Gaol & Ichsan, 2022). TAM explains how perceived usefulness and ease of use drive technology uptake among entrepreneurs, while RBV positions digital marketing capabilities as intangible resources generating sustained competitive advantage. Despite this theoretical and practical relevance, the scholarly literature lacks rigorously validated instruments capable of systematically capturing digital marketing implementation across the commerce sector (Chen, Li, Wang, & Zhang, 2023). Without standardized measurement, entrepreneurs cannot reliably gauge their digital development level, pinpoint improvement opportunities, or ground strategic choices in empirical evidence. This gap also constrains alignment with Sustainable Development Goals 8, 11, and 12, which promote inclusive economic growth and responsible business innovation (United Nations, 2015).

This measurement gap is especially pronounced in Peru's Amazonian jungle regions, where over 3,000 businesses operate in the native product commercial sector across diverse localities. These firms display heterogeneous levels of technological adoption and digital maturity, spanning entirely analog operations to those incorporating sophisticated digital tools (Fontenla-Pedreira, Rúas-Araújo, & Puentes-Rivera, 2020). Such heterogeneity underscores the urgency for a measurement instrument capable of capturing digital marketing across its multiple dimensions and applicable regardless of firm size or technological sophistication (Sasikala, 2024).

The absence of validated digital marketing assessment tools carries substantial practical repercussions for the sector (Boustani & Chammaa, 2023). Business owners currently have no objective reference points against which to benchmark their digital performance, while academic institutions lack reliable instruments for conducting sector-specific research. Industry-promoting organizations similarly face constraints in formulating evidence-based policies (Henningsson & Eaton, 2023). Compounding these challenges, the accelerating evolution of the digital environment, now incorporating artificial intelligence, big data analytics, and novel marketing platforms, heightens measurement complexity and reinforces the imperative for scientifically current and robust assessment instruments (Kraus, Kraus, Shtepa, Hryhorkiv, & Kuzmuk, 2022).

Against this backdrop, the present study poses the following research question: In what way can a reliable, multi-dimensional instrument be designed and validated to comprehensively assess digital marketing implementation among firms selling native products? Addressing this question requires developing a scale that captures the inherent complexity of digital marketing while meeting rigorous psychometric standards of validity and reliability.

In response, this study sets out to design and validate a digital marketing measurement instrument for companies in the native product sales sector through exploratory and confirmatory factor analysis, covering four dimensions: social media, search engine optimization (SEO), search engine advertising (SEA), and web analytics. The resulting scale will equip researchers, entrepreneurs, and policymakers with a standardized, evidence-based diagnostic tool for gauging digital marketing maturity, detecting performance gaps, informing improvement strategies, and enriching scientific knowledge within emerging market contexts (Kovaleva & Kanke, 2021).

The relevance of this research extends across both scholarly and applied domains. Scientifically, the validated instrument enables replicable measurement in future studies of digital marketing within the native product sector, thereby facilitating cross-study comparisons and advancing cumulative knowledge. Practically, it furnishes entrepreneurs with a self-assessment mechanism to objectively quantify their digital maturity level and make well-

informed strategic decisions (Li & Samsurijan, 2025). The paper is structured as follows: Section 2 reviews the relevant literature; Section 3 presents the hypotheses; Section 4 describes the methodology; Section 5 reports results; and Section 6 draws conclusions with implications and limitations.

2. LITERATURE REVIEW

The DM was divided into four dimensions, named and conceptualized as follows: *Social media*, which consists of using platforms such as Facebook, Instagram, and YouTube to provide products and interact with customers. This includes creating and sharing content, publishing paid ads, and interacting with followers to increase brand recognition and loyalty (Saphira & Sugiat, 2025); *Search engine optimization (SEO)*: which focuses on improving the visibility of a website in organic search engine results. It consists of optimizing the content, structure, and technical aspects of the website to rank higher in search engines (Achen, 2024); *Search engine advertising (SEA)*: known as search engine marketing or pay-per-click advertising, it consists of paying for ads to appear at the top of search engine results (Jindal, Anshika, & Simriti, 2023); *Web analytics*: involves collecting, measuring, and analyzing web data to understand and optimize web usage. It helps track user behavior, measure campaign effectiveness, and make data-driven decisions (Jin, Zhong, & Zhao, 2024).

3. HYPOTHESIS

H₀: The instrument designed to measure digital marketing in companies selling local products does not possess adequate psychometric properties of validity and reliability.

H_a (General Hypothesis): The instrument designed to measure digital marketing in companies selling native products possesses adequate psychometric properties of construct validity and reliability, making it a valid and reliable tool for evaluating the level of digital marketing implementation in that sector.

HE₁: The digital marketing measurement instrument exhibits exploratory construct validity, with KMO indices greater than .700 and statistically significant Bartlett's sphericity tests ($p < .001$) in each of its four dimensions: social media, search engine optimization (SEO), search engine advertising (SEA), and web analytics.

HE₂: Each dimension of the digital marketing instrument exhibits a robust unidimensional structure, individually explaining more than 85% of the total variance through principal component analysis.

HE₃: The digital marketing measurement instrument demonstrates confirmatory construct validity, with an overall KMO value greater than .900 and a four-factor structure that collectively explains more than 85% of the total cumulative variance.

HE₄: The factor loadings of the items in the digital marketing instrument show high and significant associations with the overall construct, with values greater than .597 in the factor matrix, confirming the relevance of each item within its corresponding dimension.

HE₅: The digital marketing measurement instrument exhibits exceptional reliability, with internal consistency coefficients (Cronbach's alpha and McDonald's omega) exceeding .900, demonstrating that the items measure the construct consistently and stably.

4. METHODOLOGY

4.1. Type, Approach, Methodological Design, Population, and Instruments

A quantitative study of exploratory descriptive scope was carried out (Hernández-Sampieri & Mendoza-Torres, 2018). The study universe consisted of 60 formal companies in the native products sector, which was one of the main limitations of the study, given the availability of entrepreneurs in the sector. In view of this, the ethical principles of free participation, respect, and justice were respected (Organisation for Economic Co-operation and Development & Eurostat, 2018). A non-experimental cross-sectional design was applied. Since this study is non-experimental, descriptive, and focuses on psychometric validation, the hypotheses are formulated in terms of the instrument's

properties (validity and reliability) rather than causal relationships between variables. This is consistent with the study's stated objective and with international standards for measurement scales.

4.2. Instrumental Design

The first stage of the digital marketing (DM) instrument design consisted of four dimensions and 20 indicators; for the second stage, based on the components of the explained variance, the application of four dimensions and 12 indicators was determined for the final design of the instrument. The study was developed in three fundamental steps in terms of its validity and reliability (Supo Condori & Zacarías, 2024); for its validity, the data were structured based on exploratory factor analysis (sphericity analysis using the KMO and Bartlett test: social media = .728; search engine optimization SEO = .774; search engine advertising SEA = .763; and web analytics = .762), and confirmatory factor analysis (theories) for the digital marketing variable yielded a KMO and Bartlett = .932. For reliability, two coefficients were applied (Cronbach's alpha = 0.983 and McDonald's omega = 0.983), which showed highly significant and similar results, both demonstrating high reliability of the instruments. Two techniques were used to collect the data. The first was the creation of a Google Form distributed via social networks (WhatsApp and Facebook) to entrepreneurs selling native products. The second technique was the face-to-face method (application of the instruments in situ). This technique allowed the actual behavior of the respondents to be reflected through observation, adding value to the study.

For operational purposes, digital marketing was defined as the application of electronic platforms and digital technologies to amplify business value and foster consumer participation (Patil, Panchapakesan, & Chirputkar, 2024). This domain is currently undergoing transformation driven by artificial intelligence, which equips organizations to harvest and interpret large-scale consumer datasets, enabling more precisely targeted campaigns and data-driven strategic decisions. Decomposing this broad construct into measurable sub-components is a methodological prerequisite for valid measurement; the following subsection therefore presents the operationalization of DM through its four constituent dimensions, each linked to specific behavioral indicators and questionnaire items.

4.3. Operationalization of Variables and Dimensions

In consideration of the interest in the design and validation of the instrument, a methodological process was followed to design the questionnaire and thus measure the DM (Figure 1). In addition, to achieve greater technical and operational consistency for the DM, indicators were distributed for each dimension (Table 1), allowing the researcher to deepen the significance of the variable.

Table 1. Mapping of variables, dimensions, indicators, and items.

Variables	Dimensions	Indicators	Items
Digital marketing	Social media	Relevant content	1. The company selling native products provides you with relevant content through digital media.
		Informative content	2. The native advertising company provides you with informative content through digital media.
		Entertaining content	3. The native advertising company provides you with entertaining content through digital media.
	Search engine optimization (SEO)	Content positioning	4. The digital content of the native product sales company is readily available.
		Relevant links	5. The digital content of the company selling native products provides you with external links that direct you to relevant sites.
		Social media engagement	6. The digital content of the native product sales company has a large social media presence.
	Search engine advertising (SEA)	Geographic segmentation	7. The digital content promoted by the native product sales company is related to your location.
		Gender segmentation	8. The digital content promoted by the company selling native products is tailored to your gender and age.

Variables	Dimensions	Indicators	Items
	Web analytics	Lifestyle segmentation	9. The digital content promoted by the company selling native products is tailored to your lifestyle.
		Type of visitor	10. The company selling native products through its digital channels has occasionally consulted your characteristics as a user.
		Link used	11. The company selling native products through its digital channels has occasionally consulted which link you used to find out about its brand.
		Time spent	12. The company that sells native products through its digital channels has occasionally asked how long you usually spend visiting its social media pages.

The ordinal rating scale with Likert measurement for each item was designed based on the behavior of its dimension; therefore, it was configured as follows: value 1 represented by the response strongly disagree (SD), value 2 represented by the response disagree (D), value 3 represented by the response neutral (N), value 4 represented by the response agree (A), and value 5 represented by the response strongly agree (SA).

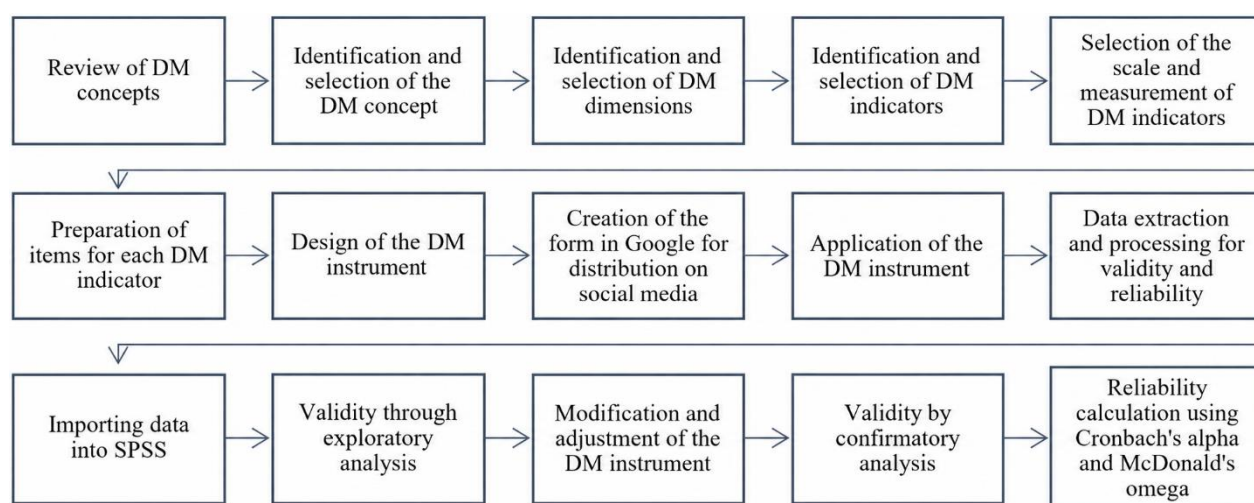


Figure 1. Process for designing the DM instrument.

Table 2. KMO and Bartlett's exploratory factor analysis by principal variable and DM dimension.

KMO and Bartlett's Test	Social Media	SEO	SEA	Web Analytics
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.728	0.774	0.763	0.762
Bartlett's Sphericity Test Approx. Chi-square	183.373	183.874	157.886	169.670
df	3	3	3	3
Sig.	0.000	0.000	0.000	0.000

5. RESULTS

5.1. Step 1: Exploratory Factor Validity (Sphericity Analysis / Principal Component Analysis)

The KMO indices obtained for each dimension of the instrument demonstrate adequate sampling between acceptable and good (social media = 0.728; search engine optimization SEO = 0.774; search engine advertising SEA = 0.763; and web analytics = 0.762). All values exceed the minimum threshold of 0.700, indicating that the data are partially appropriate for factor analysis. Bartlett's sphericity test was statistically significant (p -value = 0.000) in all four dimensions, confirming that the correlations between items are sufficiently high to proceed with factor analysis (Table 2).

Table 3. Total variance explained by the Social Media dimension.

Component	Total	% Variance	Cumulative %	Extraction Total	Extraction %	Extraction Cumulative
1	2.725	90.828	90.828	2.725	90.828	90.828
2	0.201	6.716	97.544	—	—	—
3	0.074	2.456	100.000	—	—	—

Table 4. Total variance explained for the SEO (Search Engine Optimization) dimension.

Component	Total	% Variance	Cumulative %	Extraction Total	Extraction %	Extraction Cumulative
1	2.755	91.827	91.827	2.755	91.827	91.827
2	0.144	4.813	96.640	—	—	—
3	0.101	3.360	100.000	—	—	—

Table 5. Total explained variance of the SEA (Search Engine Advertising) dimension.

Component	Total	% Variance	Cumulative %	Extraction Total	Extraction %	Extraction Cumulative
1	2.686	89.517	89.517	2.686	89.517	89.517
2	0.192	6.398	95.914	—	—	—
3	0.123	4.086	100.000	—	—	—

Table 6. Total variance explained by the Web Analytics dimension.

Component	Total	% Variance	Cumulative %	Extraction Total	Extraction %	Extraction Cumulative
1	2.712	90.413	90.413	2.712	90.413	90.413
2	0.185	6.179	96.592	—	—	—
3	0.102	3.408	100.000	—	—	—

PCA identified a single dominant component within each dimension: social media (90.828%, eigenvalue = 2.725), SEO (91.827%, eigenvalue = 2.755), SEA (89.517%, eigenvalue = 2.686), and web analytics (90.413%, eigenvalue = 2.712). All values exceeded the 85% threshold established in HE2, confirming robust unidimensional structures. These figures surpass those reported by Saphira and Sugiat (2025), whose social media marketing scale explained 78.3% of variance, and align with Jin et al. (2024) web analytics dimension (88.9%), suggesting that the instrument's items share a particularly high degree of conceptual homogeneity (Tables 3–6).

Table 7. Confirmatory factor analysis of digital marketing.

KMO and Bartlett's Test		Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.932
Bartlett's Sphericity Test	Approx. Chi-square	1053.994
	df	66
	Sig.	0.000

5.2. Step 2: Confirmatory Factor Validity (Principal Axis Factoring / Sphericity Analysis)

The confirmatory analysis of the complete construct of the digital marketing variable (central axis) yielded a KMO = 0.932, indicating excellent sample adequacy (>0.90), and a Bartlett's test using the chi-square = 1053.994 with a df = 66 and a p-value of 0.000. Therefore, this KMO greater than 0.90 indicates exceptional data quality for factor analysis, suggesting that the items are highly interrelated and appropriate for identifying underlying factors (Table 7).

Table 8. Total variance explained by digital marketing.

Factor	Initial Total	Initial % Var.	Cumulative %	Extraction Total	Extraction % Var.	Extraction Cumulative	Rotation Total
1	10.090	84.082	84.082	9.977	83.145	83.145	9.579
2	0.391	3.259	87.341	0.304	2.532	85.677	8.212
3	0.317	2.643	89.984	0.204	1.703	87.380	0.568
4	0.248	2.066	92.050	0.157	1.306	88.686	9.152
5	0.219	1.828	93.877	—	—	—	—
6	0.202	1.684	95.561	—	—	—	—
7	0.175	1.460	97.021	—	—	—	—
8	0.098	0.815	97.836	—	—	—	—
9	0.090	0.747	98.583	—	—	—	—
10	0.073	0.612	99.195	—	—	—	—
11	0.055	0.460	99.655	—	—	—	—
12	0.041	0.345	100.000	—	—	—	—

The analysis reveals a four-factor structure in which dimension 1 (Factor 1 – social media) explains 83.145% of variance with an eigenvalue of 9.977; dimension 2 (Factor 2 – SEO) explains an additional 2.532% with an eigenvalue of 0.304; dimension 3 (Factor 3 – SEA) explains an additional 1.703% with an eigenvalue of 0.204; and dimension 4 (Factor 4 – web analytics) explains an additional 1.306% with an eigenvalue of 0.157. This accumulates a total variance of 88.686%. The four factors extracted theoretically correspond to the dimensions of social media, SEO, SEA, and web analytics, confirming the proposed conceptual model (Table 8).

Table 9. Digital marketing factor matrix.

Items	Factor 1	Factor 2	Factor 3	Factor 4
Relevant content	0.918	-0.209	-0.110	-0.051
Informative content	0.938	-0.210	-0.014	-0.190
Entertainment content	0.887	0.012	0.180	-0.219
Content positioning	0.904	0.033	-0.105	-0.012
Relevant links	0.903	0.173	-0.111	0.045
Social media engagement	0.940	0.132	-0.199	0.000
Geographic segmentation	0.902	-0.009	0.027	0.003
Segmentation by gender	0.921	-0.062	-0.051	0.099
Segmentation by lifestyle	0.907	-0.298	0.119	0.228
Type of visitor	0.947	0.086	0.004	-0.007
Link used	0.893	0.178	0.000	0.063
Length of stay	0.879	0.189	0.282	0.045

The loadings for Factor 1 are exceptionally high (0.879–0.947), indicating that all items share a strong association with the general construct of digital marketing, highlighting its indicators of visitor type = 0.947; social media engagement = 0.940; and informative content = 0.938 (Table 9).

Table 10. Digital marketing pattern matrix.

Items	Factor 1	Factor 2	Factor 3	Factor 4
Relevant content	0.313	-0.283	-0.197	-0.409
Informative content	0.056	-0.145	-0.152	-0.814
Entertainment content	0.030	0.033	0.123	-0.904
Content positioning	0.701	-0.070	-0.054	-0.172
Relevant links	0.969	0.007	0.032	0.048
Social media engagement	1.036	0.077	-0.074	-0.008
Geographic segmentation	0.431	-0.224	0.039	-0.282
Segmentation by gender	0.561	-0.379	-0.031	-0.036
Segmentation by lifestyle	0.014	-0.942	0.017	-0.040
Type of visitor	0.632	-0.097	0.069	-0.238
Link used	0.805	-0.084	0.131	-0.006
Time spent	0.338	-0.223	0.369	-0.291

The presence of unique factor loadings is evident after oblique rotation for factors (Factor 1, social media engagement = 0.969; Factor 2, segmentation by lifestyle = -0.942; Factor 3, time spent = 0.369; and Factor 4, entertaining content = -0.904 and informative content = -0.814) (Table 10).

Table 11. Digital marketing structure matrix.

Items	Factor 1	Factor 2	Factor 3	Factor 4
Relevant content	0.881	-0.874	-0.055	-0.899
Informative content	0.883	-0.868	-0.002	-0.963
Entertainment content	0.840	-0.764	0.269	-0.923
Content positioning	0.904	-0.793	0.107	-0.854
Relevant links	0.926	-0.759	0.200	-0.825
Social media engagement	0.966	-0.785	0.110	-0.866
Geographic segmentation	0.878	-0.822	0.179	-0.866
Segmentation by gender	0.902	-0.873	0.104	-0.857
Segmentation by lifestyle	0.835	-0.989	0.093	-0.851
Type of visitor	0.939	-0.827	0.229	-0.900
Link used	0.903	-0.766	0.285	-0.823
Time spent	0.853	-0.776	0.493	-0.843

The total correlations between items and factors are shown. All loadings on Factor 1 are high (.835–.966), confirming a strong general factor. The distribution of loadings on Factors 2–4 suggests the specific dimensions of the model (Table 11).

Table 12. Digital marketing factor correlation matrix.

Factor	Factor 1	Factor 2	Factor 3	Factor 4
1	1.000	-0.830	0.183	-0.901
2	-0.830	1.000	-0.071	0.844
3	0.183	-0.071	1.000	-0.159
4	-0.901	0.844	-0.159	1.000

The correlations between factors reveal that Factor 1 and 2 ($r = -0.830$, high negative correlation); Factor 1 and 4 ($r = -0.901$, very high negative correlation); Factor 2 and 4 ($r = 0.844$, high positive correlation); and Factor 1 and 3 ($r = 0.183$, low positive correlation). High inter-factor correlations (>0.80) suggest that, although specific dimensions exist, they all converge toward a general digital marketing construct. This justifies both separate dimensional analysis and the use of a total score for the instrument (Table 12).

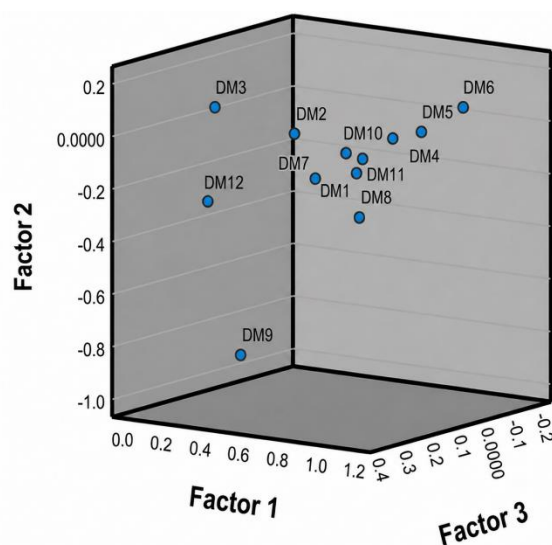


Figure 2. Factor graph in rotated factor space of digital marketing.

Figure 2 illustrates the factor graph in rotated space, showing the distribution of items in a three-dimensional space. The grouping of points suggests the presence of clusters that correspond to the theoretical dimensions, although with some overlap due to the high correlations observed.

Table 13. Reliability of the digital marketing variable.

Reliability	Coefficient
Cronbach's alpha	0.983
McDonald's omega	0.983

5.3. Step 3: Construct Reliability (Cronbach's Alpha and McDonald's Omega)

Both coefficients are practically identical and well above the threshold of 0.700, indicating excellent internal consistency. Values above 0.900 are considered exceptional in psychometric literature. The agreement between α and ω confirms that the assumptions of tau equivalence are reasonably met (Table 13).

Table 14 presents the mean and standard deviation for each of the twelve items comprising the digital marketing instrument, complementing the reliability estimates reported above.

Table 14. Descriptive statistics of the digital marketing items (Mean and standard deviation).

Indicator	Mean	SD
Relevant content	3.350	1.287
Informative content	3.383	1.236
Entertaining content	3.217	1.316
Content positioning	3.150	1.300
Relevant links	3.083	1.306
Social media engagement	3.250	1.297
Geographic segmentation	3.250	1.244
Segmentation by gender	3.250	1.244
Segmentation by lifestyle	3.200	1.232
Type of visitor	3.200	1.325
Link used	3.100	1.337
Length of stay	3.033	1.353

6. CONCLUSIONS

The results of the design and psychometric validation process provide robust evidence of the quality of the instrument for measuring digital marketing in companies selling native products. Exploratory factor analysis revealed that each of the four proposed dimensions has a solid unidimensional structure, with percentages of explained variance exceeding 89% in all cases. The KMO indices obtained range from 0.728 to 0.774 for the individual dimensions and reach an exceptional value of 0.932 for the complete instrument, confirming the adequacy of the sample and the relevance of the data for factor analysis. Likewise, the level of statistical significance of Bartlett's sphericity tests in all dimensions supports the existence of substantial correlations between the items that justify factor extraction.

In addition, confirmatory factor analysis corroborated the four-factor structure of the instrument, identifying four factors that together explain 88.686% of the total variance. The preponderance of factor 1 alone explains 83.145% of the variance, suggesting the existence of a general digital marketing construct underlying the dimensions of social media, search engine optimization, search engine advertising, and web analytics. The internal consistency of the instrument was exceptional in both cases (Cronbach's alpha and McDonald's omega = 0.983), demonstrating that the items in the instrument measure the construct coherently and consistently.

Triangulating factorial validity, reliability, and descriptive statistics, the instrument satisfies international psychometric standards (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 2014) and constitutes a robust diagnostic tool for assessing digital

marketing maturity in native product firms. Its strong psychometric properties address the measurement gap identified in the introductory literature review and respond directly to calls by Kraus et al. (2022) and Chen et al. (2023) for empirically validated sector-specific digital marketing scales in emerging economies.

6.1. Practical Applications

For firm managers, the instrument enables systematic self-diagnosis of digital marketing maturity across four actionable dimensions, supporting prioritization of investment in social media, SEO, SEA, or analytics capabilities. For policymakers and regional development agencies, the scale provides a standardized benchmarking tool to design targeted digital inclusion programs for rural and emerging-market entrepreneurs in Peru's Amazonian regions. For academic institutions, the validated instrument offers a replicable research tool for longitudinal and comparative studies of digital marketing adoption in indigenous and artisanal product sectors.

6.2. Limitations and Future Research

Several limitations warrant acknowledgment. First, the sample of 60 firms, while meeting minimum EFA requirements, restricts generalizability beyond Peru's jungle region. Future studies should replicate validation with larger, multi-region samples. Second, the cross-sectional design precludes assessment of instrument stability over time; longitudinal validation would strengthen psychometric evidence. Third, the instrument's self-report format may introduce social desirability bias, and future research could complement survey data with objective digital performance metrics. Finally, future work might extend the instrument to other emerging-market sectors and explore measurement invariance across firm size and industry type.

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Informed Consent Statement: Informed verbal consent was obtained from all participants prior to their participation in the study. All collected data were anonymized to ensure participant confidentiality and privacy.

Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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