Waste to Wealth: The Mediating Role of Eco-Craft Product Innovation in the Effect of Digital Literacy on the Export Readiness of Shell-Waste Crafts among Coastal MSMEs in Sanur

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Abstract. The adoption of a circular economy through a "waste to wealth" approach provides coastal Micro, Small, and Medium Enterprises (MSMEs) with opportunities to develop products that are competitive in international markets. However, shell-craft MSMEs in Sanur, Bali, continue to encounter challenges in penetrating export markets. This study investigates whether eco-craft product innovation mediates the relationship between digital marketing literacy and MSME export readiness. Using a quantitative approach, data were collected through a survey of shell-waste handicraft MSMEs operating in coastal Sanur and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS, complemented by Importance-Performance Map Analysis (IPMA). The findings indicate that digital marketing literacy has a positive and significant influence on both eco-craft product innovation and export readiness. In addition, eco-craft product innovation contributes positively to export readiness. The structural model accounts for 57.2% of the variance in export readiness, while eco-craft product innovation demonstrates a partial mediating effect in the relationship between digital marketing literacy and export readiness, with an indirect effect of 0.378 ($p < 0.001$). The IPMA results further indicate that processing techniques and design creativity require particular attention because of their high importance but comparatively lower performance. These findings support the proposed "Shore to Store" pathway, which promotes the transformation of coastal shell waste into innovative and environmentally oriented products with greater potential for international markets.

Keywords: Circular Economy, Coastal MSMEs, Digital Marketing Literacy, Eco-Craft Innovation, Export Readiness.

1 Introduction

As the mid-2020s unfold, the global trade environment is experiencing significant structural changes, shaped by increasing international demand for environmental sustainability and greater efficiency in digitally enabled supply chains. As the world economy shifts toward the circular "waste to wealth" paradigm, waste is increasingly viewed not as an ecological burden but as a strategic economic asset, in line with the

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Sustainable Development Goals (SDGs), particularly SDG 14 (Life Below Water) and SDG 12 (Responsible Consumption and Production).

Digital transformation has become a key enabling factor by removing traditional geographical barriers for Micro, Small, and Medium Enterprises (MSMEs). Global e-commerce platforms, business social media, and digital traceability enable MSMEs to independently penetrate international markets (Ilyas et al., 2025). However, technology adoption alone does not guarantee internationalization success unless it is accompanied by the organizational capability to create unique and adaptive product value. Therefore, environmentally based product innovation (eco-craft) becomes an important differentiator in a global market that is increasingly selective toward sustainability standards (Nasir, 2025).

At the national level, the "Golden Indonesia 2045" vision and the "Asta Cita" agenda position the downstream processing of natural resources as the center of community-based economic growth, including transforming marine waste into creative industry products. The national target of a 17% MSME export contribution remains a challenge, given that the current figure stands at around 15.6%, far below neighbouring countries such as Singapore (41%) and Thailand (29%). The main obstacle is low "export readiness," including issues of legality, quality standardization, and limited knowledge of foreign markets.

This condition is highly relevant in Bali, as the face of Indonesia's tourism and handicraft industry. According to the Bali Provincial Statistics Agency (BPS), Bali's export value fell 10.04% year-on-year in September 2025, and the 2024 Indonesia Blue Economy Index (IBEI) placed Bali in Quadrant III (Potential Pressure), reflecting high maritime economic growth accompanied by significant environmental pressure. One pressing manifestation is the abundance of shell waste from fishery and culinary activities on the Sanur coast waste that, if unmanaged, degrades the aesthetics of the beach in a world tourism hub, yet holds high aesthetic potential when down streamed into premium eco-craft products such as interior decorations and art accessories.

Field observations on the Sanur coast identified a critical phenomenon termed the "domestic market trap." Shell-craft MSMEs in Sanur produce competitive products with unique designs that attract foreign tourists in physical galleries, yet their sales strategies remain passive, relying almost entirely on direct tourist visits or supplying local art shops, without an independent digital strategy for international marketing. This gap stems for in low export readiness, driven by limited digital literacy in managing cross-border transactions and a high psychic distance toward foreign customs regulations.

Although research on the relationship between digital literacy and MSME performance has been extensive in 2021–2025, a significant research gap remains in the literature on maritime MSME internationalization. Most prior studies focus on the direct effect of technology on the performance of already-active exporters; few target the pre-export phase of potential (non-exporting) MSMEs in coastal tourism hubs, while simultaneously positioning eco-craft product innovation as a strategic mediator linking technological capability with export readiness. Table 1 summarizes this study's position relative to prior research.

Table 1. Summary of Prior Research.

No.	Author & Year	Summary of Findings	Difference from This Study
1	(Wulandari et al., 2026)	Digital marketing literacy, government support, and process innovation significantly affect MSME export competitiveness, mediated by strategic agility.	Uses strategic agility as a mediator; this study uses eco-craft product innovation as a mediator specific to craft waste.
2	(Masyruroh et al., 2024)	Processing green mussel shell waste into value-added products creates jobs and supports the coastal blue economy.	Is a participatory community service activity; this study is an explanatory causal study using SmartPLS.
3	(Ilyas et al., 2025)	Higher digital literacy significantly increases MSME turnover, efficiency, and competitiveness.	General MSMEs in the Jabodetabek region; this study targets Sanur coastal artisans trapped in the domestic market.
4	(Ananda, 2025)	Product innovation strongly mediates market orientation toward marketing performance through unique differentiation.	Its independent variable is market orientation; this study uses digital marketing literacy as the driver of innovation.
5	(Hasnin et al., 2025)	Identifies gaps in the linkage between digital technology, governance, and export readiness in developing countries.	A global bibliometric study; this study is an empirical field-based study in the Sanur craft sector.
6	(Nasir, 2025)	Unique design innovation and local materials strengthen craft competitiveness and regional brand identity abroad.	Based in Makassar with a focus on general performance; this study targets the export readiness of shell-waste handicrafts in Bali.

The novelty of this study lies in positioning eco-craft product innovation as the mediating mechanism that converts digital marketing literacy into export readiness among shell-waste artisans, by integrating the Resource-Based View (RBV), which views digital literacy as a valuable and hard-to-imitate human capital resource (Lubis et al., 2026); Dynamic Capabilities Theory, which explains that innovation reconfigures internal resources to meet dynamic foreign market demands (Adriyanto & Hendayana, 2026); and the Uppsala Model, which views export readiness as a gradual pre-internationalization learning process shaped by psychic distance. Accordingly, this study assesses digital marketing literacy and export readiness, examines the mediating role of eco-craft innovation, and develops a “Waste to Wealth” pathway for coastal MSMEs. The conceptual framework is shown in Figure 1.

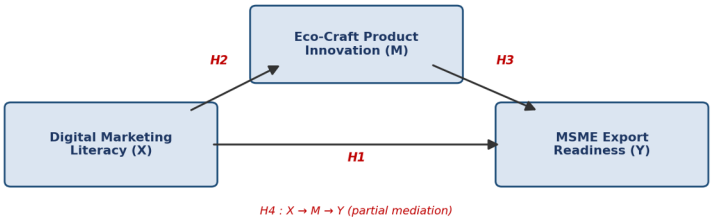


Figure 1. Conceptual Framework of The Study.

Based on the proposed framework, four hypotheses are developed: H1–H3 propose positive relationships among digital marketing literacy, eco-craft product innovation, and MSME export readiness, while H4 proposes that eco-craft product innovation mediates the relationship between digital marketing literacy and export readiness.

2 Methodology

This explanatory quantitative study was conducted in coastal Sanur, Denpasar, a major tourism area where local artisans engage with global markets while shell-waste management remains limited. The population comprised MSMEs processing shell waste in the area. As the population size was unknown, the Lemeshow formula was applied at a 95% confidence level and 10% margin of error, resulting in a minimum sample of 96 respondents. This number was then rounded up to 100 respondents to optimize the PLS-SEM analysis. The sample was selected through purposive sampling with the criteria that the MSME had been actively processing shell waste for at least two years and had an active business social media account. Although this non-probability sampling technique limits statistical generalization to the population, this approach ensures that respondents have experience and characteristics relevant to the research objective.

Primary data were collected through a structured questionnaire administered door-to-door with direct assistance to explain technical terms (e.g., traceability and digital presence), using a 1–5 Likert scale. Secondary data were obtained from the 2024–2025 BPS Bali handicraft export reports. The independent variable (X), digital marketing literacy, was assessed through technical competence, content management, and data analysis. The mediating variable (M), eco-craft product innovation, was measured by design creativity, processing techniques, and green circular economy practices. The dependent variable (Y), MSME export readiness, was evaluated based on legality and documentation, product standardization, and commitment to global markets.

Data were analyzed using PLS-SEM in SmartPLS, including evaluation of the measurement and structural models. The measurement model examined outer loadings, reliability, and convergent and discriminant validity, while the structural model evaluated R^2, path coefficients, and mediation effects. IPMA was then applied to identify priority indicators for improving the mediating and dependent constructs.

3 Result and Discussion

3.1 Result

Descriptive analysis of respondents' mean scores on the 1–5 Likert scale is presented in Figure 2. Eco-craft product innovation recorded the highest mean (2.68), followed by export readiness (2.50) and digital marketing literacy (2.36). All three mean values fall below the scale midpoint, indicating that digital capability, innovation, and export readiness among Sanur's shell-waste artisans remain relatively low and require strengthening.

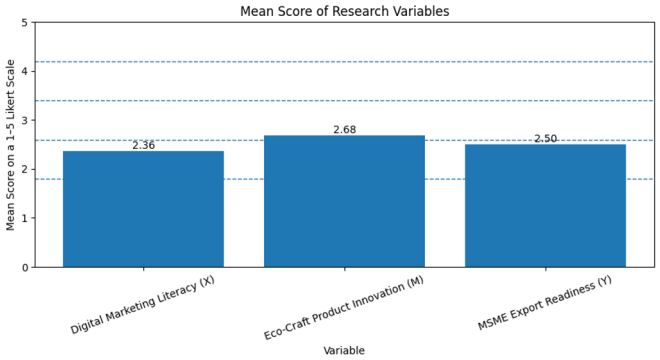


Figure 2. Mean Scores of The Research Variables.

The measurement and structural models are presented in Figure 3. All indicator outer loadings exceed 0.70 (digital marketing literacy 0.724–0.893; eco-craft product innovation 0.812–0.873; export readiness 0.850–0.887), indicating that the indicators validly represent their constructs and that no items need to be dropped.

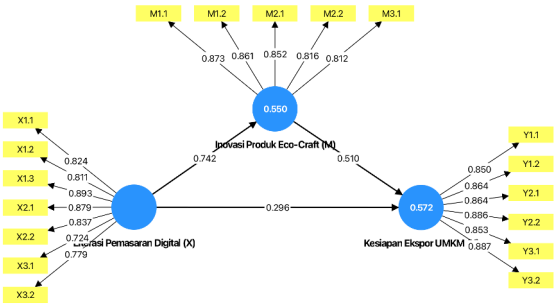


Figure 3. Outer Loadings and Structural Model (PLS-SEM).

Construct reliability and convergent validity are summarized in Table 2. All constructs exceed the required thresholds (Cronbach's Alpha, rho_a, and Composite Reliability

rho_c > 0.70; AVE > 0.50; HTMT < 0.90), confirming that the measurement model is reliable and valid.

Table 2. Construct Reliability and Convergent Validity.

Construct	Cronbach's Alpha	rho_a	rho_c	AVE
Digital Marketing Literacy (X)	0.920	0.926	0.936	0.677
Eco-Craft Product Innovation (M)	0.898	0.900	0.925	0.711
MSME Export Readiness (Y)	0.934	0.935	0.948	0.753

As shown in Table 2, all constructs are reliable and valid: the Cronbach's Alpha, rho_a, and rho_c for X, M, and Y all exceed 0.70 (ranging from 0.898 to 0.948), while the AVE values of 0.677, 0.711, and 0.753 exceed the 0.50 threshold. The measurement model therefore satisfies the requirements for internal consistency reliability and convergent validity.

Table 3. Discriminant Validity (HTMT).

	X	M	Y
Digital Marketing Literacy (X)	–		
Eco-Craft Product Innovation (M)	0.813	–	
MSME Export Readiness (Y)	0.720	0.791	–

The discriminant validity test results using the Heterotrait-Monotrait Ratio (HTMT) are presented in Table 3. All HTMT values fall within the range of 0.720–0.813, below the 0.90 threshold and even the stricter 0.85 criterion. The highest value is found in the relationship between Digital Marketing Literacy (X) and Eco-Craft Product Innovation (M) at 0.813, indicating a conceptual relatedness while the two remain empirically distinguishable. The HTMT values between M–Y (0.791) and X–Y (0.720) likewise satisfy both criteria. All constructs therefore demonstrate satisfactory discriminant validity with no measurement overlap issues.

Table 4. Effect Sizes (f-square).

Relationship	**f-square**	**Category**
Digital Marketing Literacy (X) → Eco-Craft Innovation (M)	1.222	Large
Eco-Craft Innovation (M) → Export Readiness (Y)	0.273	Medium
Digital Marketing Literacy (X) → Export Readiness (Y)	0.092	Small

Table 4 shows the effect size (f^2) of each structural relationship, illustrating the magnitude of an exogenous construct's contribution to its endogenous construct. Based on Cohen's criteria, f^2 values of 0.02, 0.15, and 0.35 respectively indicate small, medium, and large effects. The effect of Digital Marketing Literacy on Eco-Craft Innovation is large ($f^2 = 1.222$), indicating that digital marketing literacy contributes

strongly to product innovation. Meanwhile, Eco-Craft Innovation has a medium effect on Export Readiness ($f^2 = 0.273$), while the direct effect of Digital Marketing Literacy on Export Readiness is small ($f^2 = 0.092$). This pattern indicates that Digital Marketing Literacy's contribution to Export Readiness is stronger through the Eco-Craft Innovation pathway than through the direct effect.

Table 5. Path Coefficients and Hypothesis Testing (bootstrapping).

Path	Original Sample	Sample Mean	STDEV	T-statistic	P-value	Decision
H1: X → Y	0.296	0.300	0.122	2.419	0.016	Supported
H2: X → M	0.742	0.745	0.053	13.881	0.000	Supported
H3: M → Y	0.510	0.510	0.114	4.474	0.000	Supported
H4: X → M → Y	0.378	0.380	0.091	4.152	0.000	Supported

The analysis results in Table 5 show that Digital Marketing Literacy (X) has a positive and significant effect on Eco-Craft Product Innovation (M) with a path coefficient of 0.742 ($T = 13.881$; $p < 0.001$). Furthermore, Eco-Craft Product Innovation (M) has a positive and significant effect on MSME Export Readiness (Y) with a coefficient of 0.510 ($T = 4.474$; $p < 0.001$). The indirect effect of X on Y through M is also significant, with a coefficient of 0.378 ($T = 4.152$; $p < 0.001$). Meanwhile, the direct effect of X on Y remains positive and significant at 0.296 ($T = 2.419$; $p = 0.016$). Eco-Craft Product Innovation therefore mediates the relationship between Digital Marketing Literacy and MSME Export Readiness. Because both the direct and indirect effects are significant and share the same positive direction, the mediation that occurs is complementary partial mediation.

The structural model (Figure 3) indicates that digital marketing literacy strongly influences eco-craft product innovation (0.742), while its direct effect on export readiness is weaker (0.296). Eco-craft product innovation, however, has a strong positive effect on export readiness (0.510). The model accounts for 55.0% of the variance in eco-craft product innovation ($R^2 = 0.550$) and 57.2% in export readiness ($R^2 = 0.572$).

Importance-Performance Map Analysis was conducted for two target constructs. Figure 4 maps the antecedents of eco-craft product innovation, while Figure 5 maps the antecedents of export readiness. For eco-craft product innovation (Figure 4; mean importance 0.089, mean performance 34.096), the digital literacy indicators X1.3 (product content design; importance 0.101, performance 32.4) and X1.1 (social media promotion; 0.090, 33.6) fall in the high-importance, low-performance region and thus become the top priorities for improvement, while X2.1 (product information updates), X2.2 (product storytelling), and X3.2 (market trend searching) combine high importance with above-average performance and should be maintained.

For export readiness (Figure 5; mean importance 0.0845, mean performance 37.402), several digital literacy indicators (X1.3, X3.1, X2.2) again appear in the high-importance, low-performance region, while innovation indicators such as M1.2 combine high importance with high performance. This consistent pattern indicates that

strengthening the digital literacy attributes that feed into eco-craft innovation is the most effective intervention for improving export readiness.

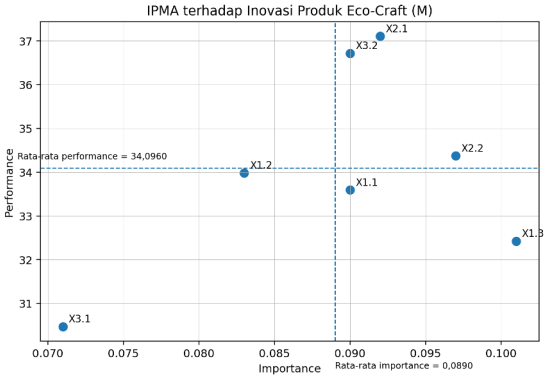


Figure 4. IPMA for eco-craft product innovation (M).

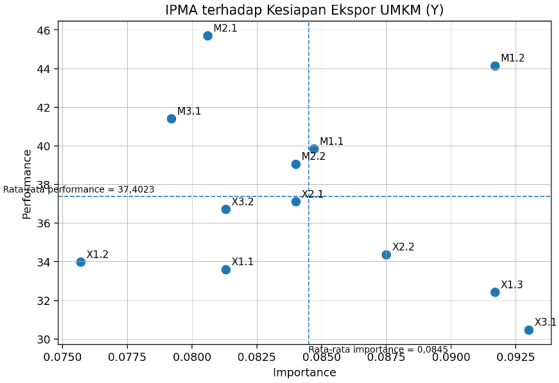


Figure 5. IPMA for MSME export readiness (Y).

3.2 Discussion

All four hypotheses are statistically supported (Table 5): digital marketing literacy significantly increases export readiness directly (H1; $\beta = 0.296$, $p = 0.016$) and, with a stronger effect, increases eco-craft product innovation (H2; $\beta = 0.742$, $p < 0.001$); innovation significantly increases export readiness (H3; $\beta = 0.510$, $p < 0.001$); and a significant indirect effect alongside a direct effect that remains significant confirms partial mediation (H4; $\beta = 0.378$, $p < 0.001$). These findings support the integration of RBV and Dynamic Capabilities Theory in the context of coastal MSMEs. Consistent with RBV, digital marketing literacy is a valuable and hard-to-imitate knowledge resource; however, its relatively small direct effect on export readiness (0.296) indicates that this resource largely remains latent. In line with Dynamic Capabilities Theory, this resource becomes productive when reconfigured into eco-craft product innovation, which has the strongest effect on export readiness (0.510) and constitutes

the dominant indirect pathway. This finding is consistent with (Ananda, 2025), who found that product innovation is a strong mediator, and extends (Wulandari et al., 2026) by replacing strategic agility with an innovation mechanism specifically grounded in craft waste.

The dominance of the mediating pathway over the direct pathway clarifies the domestic market trap: digital skills alone cannot bring Sanur's artisans into the global market unless embodied in standardized, differentiated eco-craft products. This is consistent with the Uppsala Model, in which export readiness accumulates through learning that reduces psychic distance, and with (Hasnin et al., 2025), who noted the weak linkage between technology readiness and export readiness in developing countries. Practically, the IPMA results direct limited resources toward the digital literacy attributes with high importance but low performance (content management and data analysis) that drive innovation, rather than spreading effort evenly.

3.3 Limitation

This study has several limitations. First, the study was conducted only among shell-waste handicraft MSMEs on the Sanur coast, so the results cannot yet be generalized to other regions or types of coastal MSMEs. Second, purposive sampling of 100 respondents limits statistical generalization. Third, the data were obtained through a questionnaire, leaving room for respondent subjectivity. Fourth, the research model explains 57.2% of the variation in export readiness, meaning 42.8% is still attributable to other factors not examined. Future research is therefore recommended to use a larger, probability-based sample and to add other relevant variables.

4 Conclusion

This study examined the mediating role of eco-craft product innovation in the relationship between digital marketing literacy and export readiness among shell-waste handicraft MSMEs in Sanur. The results indicate that digital marketing literacy strongly influences eco-craft product innovation (0.742), which subsequently enhances export readiness (0.510), while its direct effect on export readiness is comparatively weaker (0.296). With the model explaining 57.2% of export readiness variance and the indirect effect exceeding the direct effect, eco-craft product innovation emerges as the key mechanism linking digital knowledge to export readiness, supporting the proposed “Waste to Wealth” pathway from coastal shell waste to global markets.

Theoretically, this study enriches the RBV Dynamic Capabilities linkage by showing that digital resources require innovation capability to generate international competitive advantage. Practically, this study offers a prioritized roadmap for Sanur's artisans to strengthen content-management and data-analysis literacy that feeds into eco-craft innovation, in line with Politeknik Negeri Bali's "Green Tourism" vision and SDGs 8, 12, and 14. Future research needs to validate the model on a larger probability sample, compare commodities and coastal regions, and incorporate a complete measurement model and bootstrapping statistics to confirm construct validity and the significance of the mediation effect.

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