

Impact of Blockchain Enhanced Digital Marketing on Brand Awareness of Solar Panels

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ABSTRACT

This research examines the impact of digital marketing and blockchain technology on enhancing brand awareness for solar panel products offered by PT REY, with a special focus on integrating local wisdom. As the renewable energy sector grows rapidly in Indonesia, solar panels have emerged as a promising solution. However, **the challenge** of low brand awareness remains significant for PT REY. Digital marketing is a crucial strategy to overcome this challenge and expand the company's reach. In **this study**, Structural Equation Modeling (SEM) was used to analyze the relationship between digital marketing strategies, local wisdom, and brand awareness. **The findings** reveal that social media, websites, and visual content, structured strategically, effectively increase brand awareness and introduce solar panels to a wider audience. Additionally, integrating local wisdom into digital marketing campaigns enhances the emotional connection between the brand and its consumers, enriching the REY brand's value. **The results** demonstrate that both digital marketing and local wisdom play significant roles in boosting brand awareness, with their combination having a stronger impact than using each element separately. This research offers valuable insights on how combining digital marketing, blockchain, and local wisdom can create a unique brand identity and provide competitive differentiation in the growing renewable energy industry in Indonesia. The findings contribute to promoting sustainable energy solutions while supporting businesses in building stronger brand identities.

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1. INTRODUCTION

In recent years, blockchain technology has rapidly emerged as an innovative solution across various industries, including the renewable energy sector. One of the most promising products in this context is solar panels, which are seen as an environmentally friendly and renewable energy source with significant potential to reduce reliance on fossil fuels [1]. However, despite their numerous benefits, the solar panel industry faces a significant challenge in terms of brand awareness and product adoption in a competitive market. This is primarily due to the lack of consumer knowledge about the advantages and reliability of solar energy, as well

as perceptions related to initial costs and the sustainability of these products. To address these challenges, companies in the renewable energy space, such as PT REY, need to develop more effective marketing strategies. In today's digital age, digital marketing has become an essential tool for introducing products to a wider audience. Platforms like Instagram, TikTok, and YouTube provide great opportunities to engage with a larger demographic, especially the younger generation who are more open to adopting green technologies. However, despite the potential of digital marketing, consumer trust remains a significant barrier to increasing brand awareness and influencing purchase decisions [2, 3, 4].

Blockchain offers a solution to this issue by providing a secure, transparent, and decentralized platform. Blockchain technology allows for the implementation of smart contracts that ensure every transaction between the company and consumers is recorded securely and cannot be altered [5]. This provides strong proof of product authenticity, quality, and sustainability claims, which are often key concerns for consumers when purchasing renewable energy products. As such, blockchain can serve as a trust bridge, reducing consumer doubts about solar products, particularly in terms of their reliability and long-term benefits [6]. In addition, incorporating local wisdom into digital marketing strategies can enhance the emotional connection between brands and consumers. In a culturally rich country like Indonesia, where cultural values and traditions hold great significance, embedding local wisdom into marketing campaigns provides a personal and relevant touch. By emphasizing values such as mutual cooperation, sustainable resource use, and community empowerment, companies can foster stronger ties with local consumers. This approach not only resonates with the audience but also helps differentiate the brand from competitors, ultimately increasing brand awareness and consumer loyalty [7]. This research aims to explore how blockchain can be integrated into digital marketing strategies for solar panel products based on local wisdom, and how the combination of these elements can enhance brand awareness. Using Structural Equation Modeling (SEM), this study will analyze the relationship between blockchain, digital marketing, and local wisdom on brand awareness for renewable energy products, particularly solar panels. Additionally, this research will investigate how the combination of blockchain and digital marketing can create stronger brand differentiation and identify other factors that support or hinder the success of blockchain-based digital marketing strategies in the renewable energy sector [8]. This study is expected to contribute to the development of more effective digital marketing strategies for renewable energy products, particularly solar panels, by leveraging blockchain technology to build consumer trust and integrating local wisdom to create stronger emotional connections with the audience [9].

While the concept of local wisdom has been discussed, its application in digital marketing strategies, particularly in the renewable energy sector, is still underexplored. By examining case studies from similar regions and industries, this research aims to provide a deeper critique of how local cultural values can enhance the emotional connection between brands and consumers in digital campaigns [10].

Based on the background that has been explained, the problem formulation in this research is as follows:

1. **RQ 1:** What digital marketing strategies are implemented by REY in promoting solar panel products based on local wisdom, and how is blockchain integrated into these strategies to enhance transparency and security?
2. **RQ 2:** To what extent is digital marketing, supported by blockchain technology, effective in increasing REY's brand awareness among the target market?
3. **RQ 3:** Which digital marketing channels are most influential in building REY's brand awareness, and how does blockchain optimize these channels for greater consumer engagement and trust?
4. **RQ 4:** What internal and external factors influence the success of REY's digital marketing strategy, particularly in integrating blockchain for enhanced security and consumer confidence?
5. **RQ 5:** What role do local wisdom values play in strengthening REY's brand image through digital marketing, and how can blockchain support this integration by ensuring the authenticity of cultural narratives and product claims?

This research aims to analyze in depth the influence of digital marketing, supported by blockchain technology, on increasing brand awareness of solar panel products offered by PT REY, especially those based on local wisdom. The main objective of this research is to understand how digital marketing strategies are

implemented by REY and how effective they are in reaching and building brand awareness in the minds of consumers [11]. Apart from that, this research also aims to identify which digital channels are the most influential, evaluate the factors that support or hinder the success of REY's digital marketing strategy, particularly the integration of blockchain technology, and examine the role of local values in strengthening the product's appeal and image in society [12, 13].

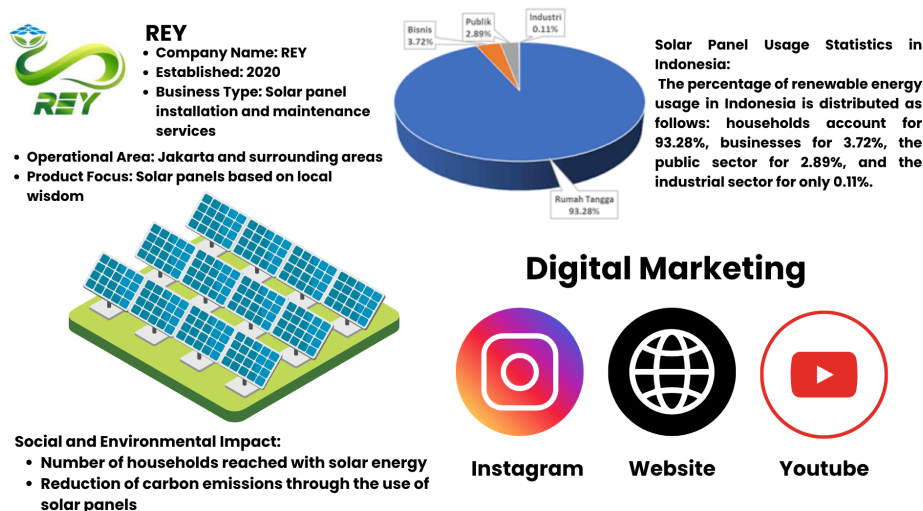


Figure 1. REY's solar panel business, digital marketing, and solar energy impact in Indonesia.

The infographic presented in Figure 1 provides a comprehensive overview of REY, a company specializing in solar panel installation and maintenance. Established in 2020, REY operates primarily in the Jakarta area and focuses on integrating local wisdom into its solar panel products. The infographic highlights key data about the use of solar energy in Indonesia, showing that 93.28% of renewable energy usage is from household solar panels, followed by business (3.72%), public (2.89%), and industrial sectors (0.11%). Additionally, it illustrates the social and environmental impacts of solar energy, including the number of households reached by solar energy and the reduction of carbon emissions from solar panel usage [14]. Furthermore, the digital marketing efforts of REY are shown with icons representing their active presence on platforms such as Instagram, their website, and YouTube, which help to spread awareness and engage with a broader audience. The data presented underscores the growing role of solar energy in Indonesia and REY's commitment to sustainability through effective digital marketing and culturally relevant product offerings [15, 16]. It is hoped that this research can make an academic contribution to the development of studies in the field of digital marketing and brand awareness, especially in the context of renewable energy businesses based on local wisdom [17]. Practically, the results of this research can be a reference for PT REY in designing more effective digital marketing strategies to increase brand awareness. Apart from that, socially, this research is also expected to encourage people to know more about and use renewable energy that is environmentally friendly and relevant to local values and culture [18]. By integrating local wisdom with digital marketing strategies, this research not only contributes to increasing brand awareness for solar panel products but also aligns with SDG 7 (Affordable and Clean Energy), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). The use of solar energy, as promoted by PT REY, offers a sustainable alternative to traditional energy sources, directly supporting the transition towards cleaner, more affordable, and environmentally responsible energy solutions [19].

The novelty of this research lies in its unique integration of blockchain technology with digital marketing strategies and local wisdom in the promotion of solar panel products, particularly in Indonesia's renewable energy sector. While prior studies have examined the impact of digital marketing on brand awareness and the role of cultural elements in marketing, this research uniquely combines these aspects by leveraging blockchain to ensure security, transparency, and trust in marketing campaigns. By incorporating local wisdom such as traditional values, cultural symbols, and community-based narratives into blockchain-enhanced digital marketing, this study offers a fresh perspective that has been underexplored in existing literature [20].

The research not only emphasizes the importance of cultural relevance in marketing but also highlights how blockchain-supported digital strategies can effectively promote sustainable energy solutions. This approach provides new insights into how businesses in the renewable energy sector can leverage both modern digital tools, such as blockchain, and traditional cultural elements to build brand awareness and connect emotionally with consumers.

2. LITERATURE REVIEW

Digital marketing is a strategy that leverages digital technology and the internet to reach consumers efficiently and effectively. It includes using social media, websites, search engines, email marketing, and visual content to build two-way communication with the audience. For REY, digital marketing is key to promoting solar panel installation and cleaning services, especially in areas of Indonesia where awareness of renewable energy is still low. Platforms like Instagram, TikTok, and YouTube allow REY to educate potential customers, showcase their portfolio, and build brand credibility interactively [21, 22]. Brand awareness, which consists of brand recognition and recall, is critical in the consumer decision-making process. Companies like REY need targeted strategies to build awareness, particularly because their products require market education [23]. Through structured digital marketing, REY can introduce its brand identity, values, and the benefits of solar panels to solidify its presence in the renewable energy sector. Local wisdom, which encompasses cultural values passed through generations, can enhance marketing by adding a personal and relevant touch, especially in communities still deeply connected to cultural traditions. Integrating local wisdom into digital campaigns not only respects culture but also serves as a strong differentiation strategy [24]. For REY, incorporating local narratives like mutual cooperation and sustainable resource use strengthens the emotional appeal of their products and sets them apart from competitors who focus primarily on technical aspects.

Various studies show that digital marketing has a significant impact in increasing brand awareness, especially for small and medium scale businesses. Digital channels such as social media not only function as a promotional tool, but also as a means of building relationships with customers on an ongoing basis. Research also shows that the integration of local values in marketing can increase consumer confidence and accelerate the adoption of new products, especially in sectors that are still developing such as renewable energy [25]. While previous studies have explored digital marketing and its role in brand awareness, there is a notable gap in research that specifically examines the integration of digital marketing with local wisdom in the context of renewable energy branding, particularly for solar panel products like those offered by REY. Unlike prior works that focus solely on traditional digital marketing or renewable energy strategies independently, this study uniquely combines both elements of digital marketing and local wisdom to create a differentiated approach for enhancing brand awareness [26]. By emphasizing local cultural narratives and integrating them into digital marketing strategies, this research contributes to the understanding of how these two factors can be synergistically utilized to strengthen a brand's identity and consumer emotional connection. This innovative approach is particularly relevant to the renewable energy industry in Indonesia, where local wisdom plays a pivotal role in consumer decision-making. While previous studies have explored the impact of digital marketing on brand awareness, few have integrated local cultural values within the digital marketing strategies, especially in the renewable energy sector [27]. This study addresses this gap by combining digital marketing with local wisdom, which is a novel approach in the context of solar panel products. Unlike prior research, which focuses on digital marketing or renewable energy strategies independently, this study uniquely combines both elements, creating a differentiated approach to enhancing brand awareness [28].

3. RESEARCH METHOD

3.1. Types and Research Approaches

This research uses a quantitative approach to analyze the influence of digital marketing on brand awareness of local wisdom-based solar panels by REY. The study employs Structural Equation Modeling (SEM) with SmartPLS 3 software [29]. SEM is suitable for handling complex models with multiple variables, allowing analysis of both direct and indirect relationships between digital marketing, local wisdom, and brand awareness [30].

3.2. Population and Sample

The population in this research are consumers who are interested in renewable energy and solar panel products, especially those in the Jakarta area and its surroundings. Samples were taken using the technique purposive sampling, with the criteria of consumers who have interacted with REY's digital campaign via social media platforms or the company website [31]. The number of samples taken was 200 respondents who were considered representative of the population studied.

Table 1. Respondent Characteristics

Characteristic	Category	Frequency (N)	Percentage (%)
Gender	Male	120	60
	Female	80	40
Age	18-30	100	50
	31-45	75	37.5
	46+	25	12.5
Occupation	Student	50	25
	Professional	120	60
	Other	30	15
Education Level	High school	50	25
	Undergraduate	100	50
	Graduate	50	25
Social Media Engagement	Instagram	110	55
	Tiktok	90	45
Engagement with REY	Followed REY Campaign	150	75
	Did not follow REY Campaign	50	25

The table presents the demographic and behavioral characteristics of the respondents who participated in the study, as shown in Table 1. It highlights key factors such as gender, age, occupation, education level, social media engagement, and involvement with REY's digital marketing campaigns. The data reflects a diverse sample, with a majority of respondents being professionals (60%), followed by students (25%). In terms of social media engagement, Instagram was the most commonly used platform, with 55% of respondents reporting active interaction. The table also emphasizes the significant proportion of respondents who have followed REY's digital marketing campaigns (75%), suggesting a strong engagement with the brand's online presence. These characteristics provide essential context for understanding how different consumer segments perceive and interact with digital marketing efforts, especially in the context of renewable energy and solar panel products [32].

3.3. Data Collection Techniques

Data collection for this study was conducted through an online questionnaire distributed via WhatsApp, email, and social media. The questionnaire was divided into four sections: the first gathered demographic information such as age, gender, and occupation; the second focused on Digital Marketing, exploring participants' experiences with REY's campaigns and perceptions of various digital channels [33]. The third section assessed Brand Awareness, measuring recognition and recall of the REY brand, while the final section examined the integration of Local Wisdom in REY's branding and its influence on consumer perceptions. This approach provided insights into how digital marketing, brand awareness, and local cultural elements combine to shape consumer perceptions of the REY brand [34].

3.4. Research Variables

To ensure the validity and reliability of the indicators for local wisdom and brand awareness, a pre-test was conducted with a small sample of 30 respondents who shared similar characteristics to the target population. Feedback from this pre-test was used to refine the questionnaire items. Local wisdom indicators were operationalized through dimensions such as cultural symbols, traditional stories, and regional language usage in digital campaigns, while brand awareness was measured through recognition and recall metrics [35].

The final questionnaire was then validated using expert judgment from three marketing scholars to ensure that the indicators accurately represented the constructs. The variables used in this research are as follows:

1. The independent variables in this research are Digital Marketing (DM) and Local Wisdom (LW). Digital Marketing refers to the use of various digital channels, such as social media, websites, and email marketing, to promote REY products. The dimensions measured for Digital Marketing include content, interactivity, and the frequency of digital campaigns. Local Wisdom, on the other hand, involves the use of local cultural elements such as symbols, language, and traditional stories in REY's promotional materials to build emotional connections with consumers.
2. The dependent variable in this study is Brand Awareness (BA), which is measured by the level of recognition and recall of the REY brand among consumers. The dimensions of Brand Awareness include brand recognition and brand recall.

3.5. Research Hypothesis

Based on the literature review and the conceptual framework developed for this study, several hypotheses were proposed to examine the relationships between digital marketing, local wisdom, and brand awareness of REY's solar panel products [36]. The research aims to determine the extent to which digital marketing strategies influence brand awareness and how the integration of local cultural elements enhances this impact. In addition, the study investigates whether the combination of these two factors produces a stronger effect on brand awareness compared to their individual implementation [37, 38]. The following hypotheses have been formulated to guide the analysis and provide a clearer understanding of these dynamics:

1. **(H1)**: Digital marketing has a positive and significant influence on brand awareness of REY solar panel products.
2. **(H2)**: Local wisdom has a positive and significant influence on brand awareness of REY solar panel products.
3. **(H3)**: More intensive digital marketing (through various channels) can strengthen the influence of local wisdom in increasing REY brand awareness.
4. **(H4)**: The combination of digital marketing and local wisdom can produce a greater influence on brand awareness than if only one aspect is applied

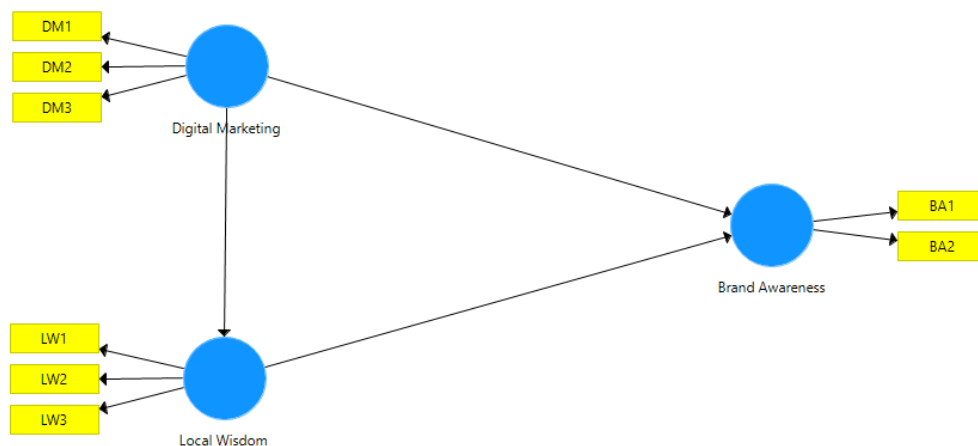


Figure 2. Hypothesis framework

Based on Figure 2, the hypothesis framework model in this study shows the relationship between the variables Digital Marketing and Local Wisdom, and their influence on Brand Awareness. Each latent variable

is measured through several indicators; Digital Marketing is measured by DM1, DM2, and DM3, while Local Wisdom is measured by LW1, LW2, and LW3. Brand Awareness, on the other hand, is measured using the BA1 and BA2 indicators [39]. This model illustrates that both Digital Marketing and Local Wisdom directly influence Brand Awareness, reflecting the combined impact of digital strategies and cultural elements on the consumer's recognition and recall of the REY brand. The relationships between variables, which are visualized in the form of path diagrams, are analyzed using Partial Least Squares – Structural Equation Modeling (PLS-SEM) through the SmartPLS 3 application. This method allows for the testing of the strength and significance of the relationships between the variables, providing a detailed understanding of how digital marketing efforts and local wisdom integration contribute to increasing brand awareness [40]. The analysis not only confirms the direct impact of these variables but also highlights the interdependence between digital marketing and local wisdom, emphasizing their collective role in reinforcing the REY brand's presence in the market [41, 42].

4. RESULT AND DISCUSSION

The results of this research were analyzed using Structural Equation Modeling (SEM) to explore the relationship between digital marketing strategies, local wisdom, and brand awareness for REY's solar panel products. The findings provide significant insights into how digital marketing, combined with local cultural elements, contributes to building brand awareness [43]. The measurement model analysis shows that both Digital Marketing and Local Wisdom positively influence the recognition and recall of the REY brand, highlighting their individual importance in the branding strategy. The structural model analysis emphasizes the strong explanatory power of the combined variables, with Digital Marketing significantly influencing Local Wisdom, and both factors collectively impacting Brand Awareness. Integrating local cultural values into digital marketing campaigns enhances the emotional connection with consumers, boosting brand visibility and recall [44]. Additionally, the use of blockchain technology in these strategies can provide added security and transparency, further strengthening consumer trust. This section interprets how combining digital marketing strategies and local wisdom can improve REY's position in the market, particularly in Indonesia's evolving renewable energy sector, where cultural relevance plays a key role in consumer decision-making [45].

4.1. Results of Measurement Model Analysis (Outer Model)

Outer model analysis was carried out to test the validity and reliability of each indicator used in the research.

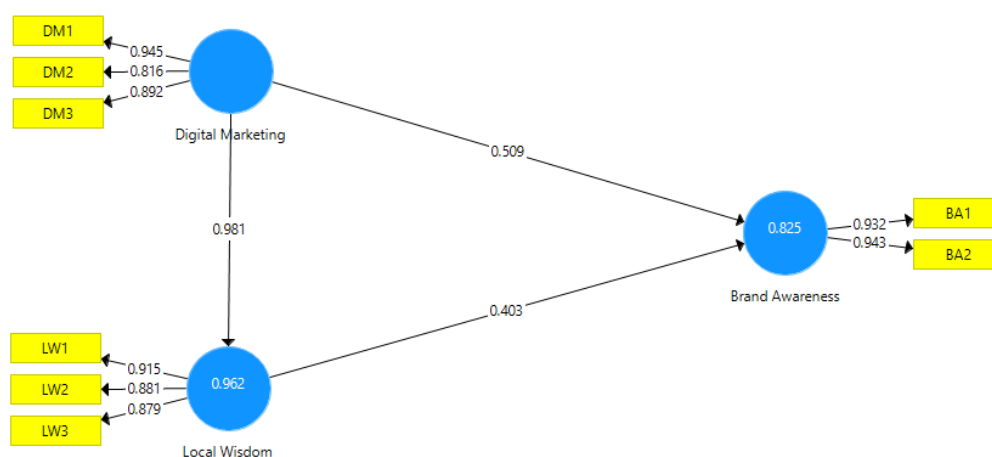


Figure 3. SmartPLS-SEM

Based on Figure 3, the results of data processing using SmartPLS 3 show that all indicators have a loading factor value above 0.8, which indicates that the validity of the indicators is very good. R-Square Value (R^2) for variables Brand Awareness as big as 0.825 indicates that the variable Digital Marketing and Local wisdom is able to explain Brand Awareness variability of 82.5%. Path of influence from Digital Marketing on

Brand Awareness has a coefficient of 0,509, the influence of Local Wisdom on Brand Awareness was found to be 0.403, indicating a moderate positive impact, both of which showed positive effects. Additionally, influence of Digital Marketing on Local Wisdom is also quite strong with value 0,981, indicating that REY's digital marketing strategy significantly contains elements of local wisdom [46]. These results confirm that the combination of a strategic digital approach and local cultural content has an important role in increasing brand awareness of REY solar panel products [47].

Table 2. Construct Reliability

	Cronbach Alpha	rho_A	Composite Reliability	Average Variance Extracted	Significance
Brand Awareness	0.862	0.867	0.936	0.879	Significant
Digital Marketing	0.861	0.868	0.916	0.785	Significant
Local wisdom	0.872	0.880	0.921	0.795	Significant

Based on Table 2, the results of the construct reliability test show that all variables in the model have value Cronbach's Alpha, rho_A, And Composite Reliability above the minimum threshold of 0.70, which indicates that the construct is reliable. Variable Brand Awareness obtained a Cronbach's Alpha value of 0.862 and Composite Reliability of 0.936, shows excellent internal consistency. Likewise with Digital Marketing which has a Cronbach's Alpha value 0.861 and Composite Reliability 0.916, as well as Local wisdom with Cronbach's Alpha 0.872 and Composite Reliability 0.921. Apart from that, all variables also show values Average Variance Extracted (AVE) above 0.5, which means each construct has strong convergent validity. Thus, all indicators in this research were proven to be statistically valid and reliable in measuring their respective constructs [48, 49]. Based on the findings, it is recommended that PT REY and similar businesses focus on further integrating local wisdom into their digital marketing campaigns by emphasizing cultural narratives, regional collaborations, and community-based initiatives [50]. A strategic framework for digital marketing in the renewable energy sector could include the following key elements: (1) leveraging local storytelling in social media and visual content, (2) building partnerships with local influencers and community leaders, and (3) creating educational campaigns that highlight the cultural relevance and environmental benefits of solar energy. These strategies will not only strengthen brand awareness but also build deeper emotional connections with consumers [51].

4.2. Structural Model Analysis Results (Inner Model)

After the measurement model meets the validity and reliability criteria, the next step is to carry out an analysis of the structural model (inner model) to test the relationship between variables [52].

Table 3. R Square

	R Square	R Square Adjusted
Brand Awareness	0.825	0.804
Local wisdom	0.962	0.960

Based on Table 3, mark R Square (R^2) shows how much the independent variable is able to explain the dependent variable in the model. R^2 value for Brand Awareness is 0.825, which means that the combination of variables Digital Marketing And Local wisdom able to explain the amount 82,5% variations that occur in Brand Awareness. This shows the model has very strong explanatory power. Meanwhile, the R^2 value for the variable Local wisdom as big as 0.962, indicates that the variable Digital Marketing alone can explain 96,2% variations in the Local Wisdom variable. These two values indicate that the structural model built has very good predictive quality, with a strong influence of the independent variable on the dependent variable [53]. The research results show that neither Digital Marketing nor Local wisdom made a significant contribution to the increased Brand Awareness REY solar panel products. This means that REY's creative, interactive and consistent digital campaigns are able to strengthen consumers' memory of the brand. In addition, the use of elements of local wisdom such as regional languages and cultural symbols not only strengthen the brand image, but also create emotional closeness with consumers, especially in the domestic market. The combination of these two factors has proven to be able to encourage recognition and recall of the REY brand amidst increasingly fierce competition for renewable energy products [54]. These results also support the

theoretical model which states that adapting local culture in digital marketing strategies is able to create strong brand differentiation.

5. MANAGERIAL IMPLICATIONS

1. Prioritize Digital Marketing Strategy

Managers should focus on crafting effective digital campaigns through platforms such as social media, websites, and email marketing to boost brand awareness and maintain consistent consumer engagement.

2. Integrate Local Wisdom into Branding

Utilize local cultural elements such as traditional symbols, languages, and stories to create emotional resonance with the target audience and enhance brand authenticity.

3. Leverage Blockchain for Trust and Transparency

Combine local cultural narratives with blockchain technology to strengthen consumer trust, ensure transparency, and establish a competitive edge in the renewable energy market.

4. Evaluate and Optimize Digital Channels

Continuously assess the performance of various digital platforms to allocate resources efficiently toward those that generate the highest return in engagement and brand visibility.

5. Collaborate with Local Influencers and Leaders

Partner with community figures or local influencers to expand reach, build credibility, and amplify brand messaging in culturally relevant ways.

6. CONCLUSION

Based on the analysis using SmartPLS 3, this research concludes that Digital Marketing has a significant positive influence on the Brand Awareness of REY solar panel products. The digital strategies implemented, such as social media campaigns, educational content, and interactive promotions, have proven effective in increasing brand awareness. Additionally, Local Wisdom plays a key role in shaping brand awareness. Integrating local cultural values into digital marketing strategies provides a unique touch that differentiates REY from competitors, while fostering emotional connections with consumers.

Furthermore, it was found that Digital Marketing has a very strong influence on Local Wisdom, with an R-Square value of 0.962. This demonstrates that REY's digital strategy not only focuses on technology but also successfully incorporates local cultural values. Meanwhile, the R-Square value of 0.825 for Brand Awareness indicates that the combination of Digital Marketing and Local Wisdom accounts for most of the variance in Brand Awareness.

Given these findings, it is recommended that REY continue to maintain and enhance a digital marketing strategy integrated with local wisdom to create a distinctive and authentic brand image. Collaboration with local communities or figures can further increase engagement and support for REY products. Additionally, integrating blockchain technology into these strategies could enhance transparency and trust, further boosting brand credibility. Future researchers are encouraged to explore other variables, such as Customer Engagement or Purchase Intention, to expand and deepen the scope of the study. This research also supports SDG 7, SDG 12, and SDG 13, contributing to global efforts to promote sustainable energy, encourage responsible consumption, and mitigate climate change through the adoption of solar energy solutions.

7. DECLARATIONS

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7.2. Author Contributions

Conceptualization: AF, NS, and NN; Methodology: NP; Software: AA; Validation: MM and AF; Formal Analysis: NS and NN; Investigation: NP; Resources: AA; Data Curation: MM; Writing Original Draft Preparation: AF and NS; Writing Review and Editing: NN; Visualization: NP; All authors, AF, NS, NN, NP, AA and MM, have read and agreed to the published version of the manuscript.

7.3. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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7.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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