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Analyzing Blockchain Adoption for Copyright Certification in Lombok's Woven Industry: An Extended TAM Perspective

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Abstract

This research explores the Extended Technology Acceptance Model (TAM) and Partial Least Squares Structural Equation Modelling (PLS-SEM) to investigate the acceptability of blockchain-based digital copyright certification among traditional woven fabric SMEs (Small and Medium Enterprises) in Lombok. This research develops a blockchain-based certification system using NFTs, IPFS, and ECDSA to secure ownership, metadata, and authentication of traditional woven fabrics in Lombok. The problem addressed is the lack of understanding and acceptance of blockchain technology for copyright certification among SMEs, which can impede the protection of their innovations. The aim of this study is to analyze the variables that influence this technology's acceptance and to provide strategies for increasing its adoption. This study explores blockchain-based copyright certification adoption among Lombok's woven fabric SMEs using an Extended TAM with novel variables: Perceived Trust, Privacy, and Government Regulations. Findings from PLS-SEM reveal these, alongside traditional TAM factors, significantly impact adoption. By addressing digital literacy gaps and regulatory challenges, this research provides insights into promoting blockchain adoption through targeted training and outreach, contributing to innovation protection for traditional artisans. A quantitative method was implemented with a validated and reliable surveys distributed both online and offline to SMEs in three main woven villages in Lombok. Data analysis using PLS-SEM revealed significant impacts of perceived usefulness (PU), perceived ease of use (PEOU), Perceived Trust (PT), Government Regulations (GR), Perceived Protection (PP), attitude towards using (ATU), and behavioral intention to use (BITU) on the acceptance of blockchain technology. This study concludes that TAM factors are crucial in evaluating these SMEs' acceptance of blockchain-based copyright certification. Recommendations are provided to enhance SMEs understanding and skills in applying this technology through targeted training and outreach.

Keywords : *Blockchain, Copyright Certification, Lombok SMEs, PLS-SEM, Technology Acceptance Model, Traditional Weaving.*

1. INTRODUCTION

The growth of information system technology has led to the development of third-generation web technologies. With the emergence of this third-generation web, also known as Web3, the dissemination of information has evolved to become more widely distributed [1]. A prominent example is blockchain-based cryptocurrency, where information and transactions occur across a distributed network securely and transparently, without a central authority controlling the entire system [2]. Blockchain technology offers immense potential in the context of copyright protection for businesses. Each time a creative work is produced, information about the copyright can be recorded on the blockchain, creating an immutable and tamper-proof digital trail [3]. Moreover, blockchain technology can also automate royalty payments, ensuring that creators are fairly compensated for their work in a direct and transparent manner [4]. By utilizing blockchain technology for copyright systems, businesses can enhance the protection of their works, build trust with creators, and foster broader innovation within the creative industry [5].

Lombok Island, West Nusa Tenggara, is renowned for its rich tourism sector [6]. One key element supporting this sector is the traditional Sasak woven crafts, which are highly sought after by tourists. These crafts are produced on a small scale, known as Micro, Small, and Medium Enterprises (SMEs), and use natural materials from the surrounding environment. However, large industries with mass production and synthetic materials pose a serious threat to traditional Sasak woven SMEs. Protecting these SMEs is crucial, and one step towards this is providing product authenticity certification. However, creating a trustworthy certification requires significant resources and infrastructure. Therefore, it is suggested to establish a product authenticity certification system based on blockchain technology, which is known for its security and serves as the foundation for cryptocurrency networks [7]. This study aims to design and build a certification system for traditional Sasak woven products using blockchain technology [8].

This research utilizes technology designed to create a blockchain-based certification system specifically for traditional woven fabrics, which serves as the object of study in analyzing blockchain adoption in Lombok's woven industry through an Extended TAM perspective. The technology integrates Non-Fungible Tokens (NFTs) for ownership representation, the InterPlanetary File System (IPFS) for decentralized metadata storage, and the Elliptic Curve Digital Signature Algorithm (ECDSA) for authentication verification. Each woven product is digitized into an NFT with metadata securely stored on IPFS and verified using ECDSA to ensure transparency and trust. This system allows artisans to generate e-certificates and facilitates secure transactions through a blockchain-enabled marketplace, enhancing traceability and preserving cultural heritage in a verifiable and decentralized manner [9].

This study introduces the innovative application of blockchain technology for copyright protection and product authenticity certification within Lombok's traditional woven SMEs, addressing challenges like limited resources and complex legal processes. The study expands Technology Acceptance Model (TAM) to include fresh variables such as Perceived Trust, Protection, and Government Regulations, capturing unique adoption drivers in this setting. Furthermore, the study implemented Partial Least Squares Structural Equation Modeling (PLS-SEM) as a sophisticated analytical method to evaluate the acceptance of blockchain technology in complex models with limited data samples [10][8]. Beyond technological advancement, this research highlights blockchain's potential in preserving cultural heritage and empowering traditional SMEs by enhancing product authenticity, trust, and competitiveness in local and global markets [11]. This dual focus on cultural sustainability and economic empowerment positions the study as a unique contribution to both academic literature and practical blockchain applications, in the previous research is directly studied about the acceptance of blockchain technology in general use, not specifically in a certain industry for example like in traditional weaving industry to support the digital copyright certification that is never been used in this current situation. Further more, this paper offers a new point of view by including some new variables to the general structure of TAM such as Perceived Trust that divided into Perceived Protection and Government Regulation Which has been adapted for the traditional weaving industry with the geographical conditions in Lombok, West Nusa Tenggara, a region still lagging behind in terms of technology [12] [13].

Several quantitative studies have highlighted the relevance of TAM and Partial Least Squares Structural Equation Modeling (PLS-SEM) in predicting blockchain adoption across various industries. For instance, Legesse et al. (2024) employed a TAM-TOE framework using PLS-SEM to examine blockchain adoption in national quality infrastructure, revealing that trust and regulatory support significantly influence adoption decisions [14][15][16]. Similarly, Sohaib et al. (2020) applied PLS-SEM combined with neural networks to investigate cryptocurrency adoption, emphasizing the role of ease of use and perceived security [2]. In the construction sector, Obidallah et al. (2024) used an extended TAM to identify perceived trust and regulatory support as key determinants of blockchain

adoption [17]. These studies demonstrate that PLS-SEM is an effective analytical method for exploring technology acceptance in contexts characterized by regulatory uncertainties and trust concerns.

The challenges of copyright protection for Lombok's traditional woven SMEs involve several complex aspects. First, the issue of legality often becomes a barrier for SMEs in obtaining legal protection for their works. The complicated and costly copyright registration process can be a hindrance, especially for SMEs with limited resources. Additionally, product authenticity is a major concern, where SMEs often face challenges in ensuring that their products are genuine and not affected by duplication or counterfeiting, which can cause financial loss and damage their market reputation [18]. Thus, to strengthen copyright protection for Lombok's traditional woven SMEs, a comprehensive approach is needed that encompasses legal, technological, and community support aspects to address the challenges faced by SMEs in maintaining their business sustainability.

The acceptance of blockchain-based copyright certification technology plays a crucial role for Lombok's traditional woven SMEs. By adopting this technology, SMEs can enhance their market reputation as consumers gain greater confidence in the authenticity of the products they purchase. Furthermore, having a guaranteed and transparently verified copyright certification through blockchain can improve SMEs' competitiveness in both local and global markets [19]. The trust placed in certified products can help SMEs attract more customers and increase sales. Additionally, blockchain-based copyright certification technology provides stronger protection against copyright infringement, reducing the risks of product duplication or counterfeiting [20]. Thus, the acceptance of blockchain-based copyright certification technology not only brings significant economic benefits to Lombok's traditional woven SMEs but also strengthens their foundation in preserving cultural heritage and expanding their market share.

The introduction PLS-SEM is essential in this study as an innovative analytical tool to measure the acceptance of blockchain-based copyright certification technology by Lombok's traditional woven SMEs [21][22]. PLS-SEM is an analytical approach that enables the examination of factors influencing technology adoption, including psychological, social, and contextual factors, with its advantage in handling complex models with limited data samples [14][23]. Meanwhile, The TAM will also be utilized as a conceptual structure to understand technology adoption, focusing on perceptions of the usefulness and ease of use of blockchain-based copyright certification technology by Lombok's traditional woven SMEs [24][21].

The primary goal of this study is to identify the characteristics that affect the acceptance of blockchain-based copyright certification technology by Lombok's traditional woven SMEs and measure its impact on copyright protection and economic growth. This research aims as the following points:

1. Provides new references for blockchain researchers and developers. This paper offers guidance for implementing blockchain technology in areas with similar characteristics, such as traditional SMEs.
2. Presents a case study of blockchain application. It demonstrates the practical use of blockchain in regions with unique challenges, including complex regulations and low technological literacy.
3. Provides an analysis of technological acceptance. This research examines significant elements that affects the adoption of blockchain technology among certain user groups.
4. Introduces new variables to the TAM framework. Novel variables like *Perceived Trust*, *Privacy*, and *Government Regulations* enrich the TAM framework for better understanding adoption behavior.

The expected benefits of this research include increased technology adoption among SMEs, which will help improve their business sustainability and protect their copyrights. Additionally, with the blockchain-based copyright certification system, stronger protection against duplication or counterfeiting is expected for SMEs. Thus, this research has the potential to generate significant positive

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impacts in the development of technology and economic growth in Lombok. The justification of this research is highly relevant in the context of the creative industry and SMEs copyright protection, as it provides innovative solutions that can enhance SMEs business sustainability while protecting local cultural heritage and creativity. The contribution of this research is expected to benefit not only Lombok's traditional woven SMEs but also serve as a model that can be applied in other creative industries in Indonesia and worldwide.

The paper is organized as follows: Section 1 discusses the study's context, issue formulation, and aims, as well as the theoretical framework, which includes the Extended Technology Acceptance Model (ETAM) and previous blockchain adoption research. Section 2 explains the research methodology, which includes the study design, data collection techniques, and analysis methodologies. Section 3 presents the research findings in a structured manner. Section 4 examines the findings by relating them to existing ideas and considering their consequences. Section 5 wraps up the report with an overview of the findings and recommendations for further research.

2. METHOD

This study adopts a multi-phase methodological approach combining blockchain system development, user acceptance evaluation using the Extended Technology Acceptance Model (TAM), and quantitative analysis through Partial Least Squares Structural Equation Modelling (PLS-SEM).

1. Phase 1: System Design and Development.

The initial phase involves designing and developing a blockchain-based certification system tailored to the traditional woven fabric industry in Lombok. This system integrates Non-Fungible Tokens (NFTs) to represent fabric ownership, the InterPlanetary File System (IPFS) for decentralized metadata storage, and the Elliptic Curve Digital Signature Algorithm (ECDSA) to verify authenticity and ensure secure transactions. Each woven fabric product is digitized as an NFT, with its metadata securely stored on IPFS and verified using ECDSA. This phase includes developing a web-based prototype and conducting unit testing to ensure functionality and reliability [9].

2. Phase 2: Data Collection

Upon prototype completion, data collection is conducted to evaluate user acceptance. Surveys are distributed to SMEs in three key weaving villages: Bayan (North Lombok), Sukarara (Central Lombok), and Pringgasela (East Lombok). Respondents, primarily SME owners and managers, assess the prototype's usability and effectiveness. The survey is based on the Extended TAM framework, covering variables such as Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude Toward Using (ATU), Behavioral Intention to Use (BITU), Perceived Protection (PP), Perceived Trust (PT), and Government Regulations (GR). The questionnaire undergoes validation and reliability testing before distribution, employing a Likert scale to measure agreement levels.

3. Phase 3: Data Analysis Using PLS-SEM

The collected data is analyzed using PLS-SEM, chosen for its suitability with small sample sizes and complex models. This technique evaluates both the measurement model (validity and reliability) and the structural model (hypothesis testing). PLS-SEM identifies relationships between the TAM core variables and the additional constructs (PP, PT, GR). These extended variables address concerns specific to blockchain adoption in SMEs, such as security, trust, and regulatory barriers.

Role of Blockchain in Data Collection. The blockchain system itself facilitates secure data entry and verification during prototype testing. SMEs interact with the prototype by uploading fabric information, generating NFTs, and verifying ownership through the blockchain system. This hands-on experience informs their survey responses, ensuring that data reflects real-time interaction with the blockchain-based certification platform.

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Sampling and Research Design. This research employs a descriptive-explanatory design with purposive sampling to select SMEs familiar with copyright challenges. The population focuses on SMEs in Bayan, Sukarara, and Pringgasela. Data collection occurs both online and offline over a one-month period to ensure a sufficient response rate.

This methodological approach ensures that system development, user perception evaluation, and quantitative data analysis are conducted sequentially, offering a comprehensive examination of blockchain adoption for copyright certification in Lombok's woven industry.

The data collection process took place over a one-month period to ensure a sufficient response rate. The collected data is analyzed using PLS-SEM, which is particularly suitable for small sample sizes and allows for the exploration of complex relationships beastween variables [6]. The model is tested for both measurement validity and structural relationships. The analysis in this study uniquely focuses on a comprehensive set of variables that extends beyond the traditional TAM. Unlike most prior research paper that primarily examines the direct effects of PU and PEOU on ATU and BITU, this study integrates additional factors such as Perceived Protection, Perceived Trust, and Government Regulation, including Accessibility of Government Services, Regulatory Complexity, and legal Transparency and Certainty. By including these trust-related and regulatory variables, the research offers a more nuanced understanding of how blockchain technology is accepted for copyright certification among SMEs in Lombok [3]. This unique combination of variables makes the research distinct, as it not only evaluates the ease and usefulness of blockchain technology but also addresses critical concerns about security, privacy, and regulatory support, that are particularly relevant to SMEs and the creative sectors. This multifaceted approach provides deeper insights into the variables influencing the adoption of blockchain technology and contributes both practically and theoretically to the field, offering a novel framework for blockchain acceptance in developing regions [4].

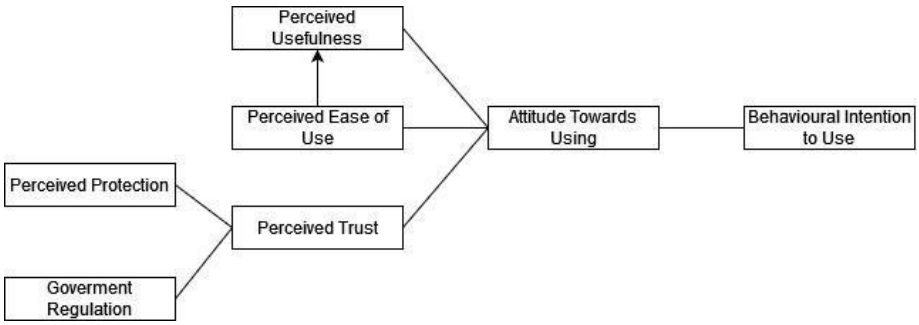

Figure 1. Framework Model

The TAM-based conceptual framework shown in Figure 1 has been expanded to include more factors that affect whether blockchain technology is accepted for copyright certification. The framework demonstrates how different elements interact to influence user's Behavioral Intention to Use (BITU) of the technology. The fundamental TAM characteristics, perceived usefulness (PU) and perceived ease of use (PEOU), are at the center of the paradigm. These constructs have a direct impact on user's attitudes toward using the technology (ATU). PEOU is the degree to which users find the technology easy to use, whereas PU is the degree to which they think utilizing it would improve their performance. These elements eventually affect behavioral intention to use, which forecasts real adoption behavior [7].

Additionally, the model introduces other important variables: Accessibility of Government Services, Regulatory Complexity, and Legal Transparency and Certainty, which collectively define the Government Regulation construct. These regulatory factors impact Perceived Protection, and ultimately Perceived Trust. Perceived Trust, in turn, affects both PEOU and ATU [12]. By incorporating these trust-related and regulatory variables, the structure offers a comprehensive perspective on the adoption

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of blockchain technology, recognizing that government regulation, security, and privacy considerations are crucial in influencing user's attitudes, confidence, and plans to embrace new technologies.

3. RESULT

The evaluation of the PLS model involves two stages: outer model evaluation and inner model evaluation. Reflective measurement models can be assessed through tests for convergent validity, discriminant validity, and composite reliability. The results of the measurement model are outlined in Figure 2.

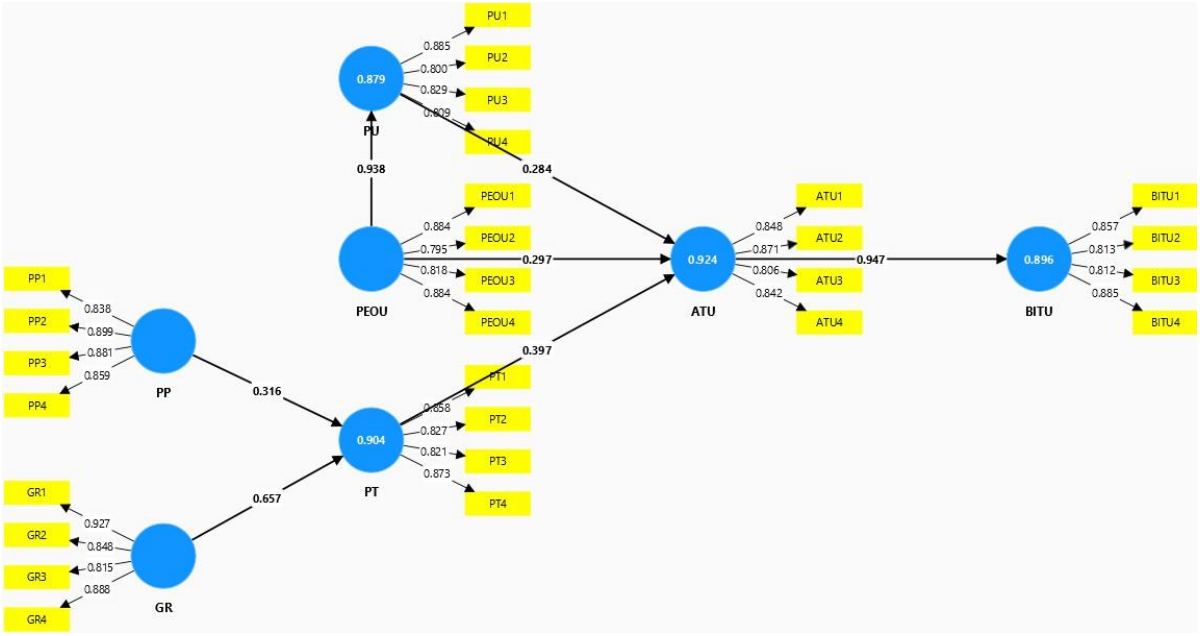

Figure 2. Path Diagram Value of Outer Loading and Path Coefficient

From table 2 the diagram represents an extended TAM designed to evaluate the acceptance of blockchain-based copyright certification technology. The foundational TAM consists of core constructs such as PU, PEOU, ATU, and BITU. PU indicates user's perceptions of the technology's ability to enhance performance, while PEOU measures how effortless the technology is perceived to be. These constructs influence ATU, which subsequently determines BITU, forming the basis for understanding user acceptance [11]. However, given the distinct challenges faced by the Lombok weaving industry in protecting their intellectual property, this basic TAM framework has been expanded to address additional contextual factors.

To tailor the model for the Lombok weaving industry, additional constructs such as Government Regulations (GR), Perceived Trust (PT), and Perceived Privacy (PP) were introduced. GR accounts for the impact of bureaucratic and often cumbersome regulatory processes on the adoption of blockchain technology as an alternative for copyright certification. PT emphasizes the importance of trust in adopting decentralized technologies like blockchain, especially for ensuring data and intellectual property security. PP, meanwhile, reflects concerns over safeguarding sensitive personal or business-related data. These additional constructs influence PEOU, PU, and ATU, making the model more comprehensive and capable of capturing the unique factors affecting technology adoption in this context. By addressing these specific challenges, the extended model provides deeper insights into the adoption of blockchain-based copyright certification, offering a transformative solution for the Lombok weaving industry.

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The structural model diagram illustrates the hypothesized relationships among several constructs in a PLS-SEM analysis. Key findings highlight that PEOU strongly influences both PU and ATU, suggesting that ease of using the system positively shapes user's perceptions of its usefulness and their overall attitude. The model shows that ATU is a crucial predictor of BITU, with a substantial path coefficient, indicating that a positive attitude increases the desire to utilize the system. PT, driven by factors like GR and PP, also significantly impacts user's attitudes, reinforcing the importance of trust in shaping user perceptions. The high R-squared (R2) values for ATU (0.824) and BITU (0.896) show that a significant amount of the variance in these constructs can be explained by the model, suggesting strong predictive power. Additionally, the observed indicators demonstrate high loadings, confirming reliable measurement of the underlying latent variables. Overall, the model supports the theoretical framework, emphasizing that ease of use, perceived usefulness, and trust are key factors influencing user attitudes and behavioral intentions [13].

3.1. Results of Outer Model

The statistical method known as outer loading analysis within the TAM evaluates how effectively each question or statement reflects constructs such as perceived usefulness and ease of use. This process involves analyzing the strength of the relationship between individual items and the constructs they are intended to measure. The evaluation includes key steps such as testing for convergent validity, discriminant validity, and reliability [25]. Outer loading is performed by calculating the statistical value for each measurement item, where loading factor values exceeding 0.7 are generally deemed acceptable, and values below 0.4 suggest that the item may not adequately represent the construct. Additionally, the Average Variance Extracted (AVE) should meet or exceed a threshold of 0.5. By conducting outer loading analysis, researchers can assess the reliability and relevance of each item in accurately measuring TAM constructs [26].

Table 1. Loading Factor

	ATU	BITU	GR	PEOU	PP	PT	PU
ATU1	0.848						
ATU2	0.871						
ATU3	0.806						
ATU4	0.842						
BITU1		0.857					
BITU2		0.813					
BITU3		0.812					
BITU4		0.885					
GR1			0.927				
GR2			0.848				
GR3			0.815				
GR4			0.888				
PEOU1				0.884			
PEOU2				0.795			
PEOU3				0.818			
PEOU4				0.884			
PP1					0.838		
PP2					0.899		
PP3					0.881		
PP4					0.859		
PT1						0.858	

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PT2	0.827	
PT3	0.821	
PT4	0.873	
PU1		0.885
PU2		0.800
PU3		0.829
PU4		0.809

Table 1 presents the loading coefficient values for various measurement items within the TAM framework. All the values exceed the 0.7 threshold, signifying strong correlations between the measurement items and their respective constructs. Each item effectively represents its intended construct, ensuring high levels of reliability and validity in evaluating perceived usefulness and ease of use. These results confirm the strong alignment between the questionnaire items and their associated constructs, demonstrating a high degree of accuracy in capturing user perceptions of technology acceptance [27].

The convergent validity assessment of the measurement model in this study was conducted through outer loadings analysis, which evaluates the correlation between each indicator and its associated latent construct. The results indicate that all constructs ATU, BITU, GR, PEOU, PP, PT, and PU are well-represented by their respective indicators, with outer loadings predominantly exceeding the recommended threshold of 0.7 [17]. Specifically, the indicators for each construct exhibit strong loadings, with most values above 0.8, signaling a high level of construct reliability. For example, the loadings for "Attitude Towards Using" range from 0.806 to 0.871, while "Behavioral Intention to Use" ranges from 0.812 to 0.885, reflecting robust alignment between these indicators and their constructs. Although a few indicators, such as PEOU2 at 0.795, fall slightly below 0.8, these values are close enough to be considered acceptable, maintaining the overall integrity of the measurement model. This level of high outer loading signifies strong convergent validity, indicating that the indicators for each construct consistently measure the intended latent variable. As a result, the reliability of the constructs in the model is supported, forming a solid foundation for subsequent analysis of the structural relationships among the constructs in the TAM framework using PLS-SEM [28]. This reliability in measurement enables a more accurate evaluation of how factors like perceived usefulness, ease of use, trust, and protection influence the adoption of blockchain-based copyright certification technology among SMEs in Lombok's traditional weaving industry.

Table 2. AVE Values

	Average Variance Extracted (AVE)
ATU	0.709
BITU	0.709
GR	0.758
PEOU	0.716
PP	0.756
PT	0.714
PU	0.691

Table 2 displays the Average Variance Extracted (AVE) values for the latent variables within the TAM framework. All values surpass the 0.5 threshold, demonstrating that the latent variables capture a significant portion of the variance. These AVE values confirm a strong level of convergent validity, indicating that each latent variable accounts for more than 50% of the variance shared with its corresponding indicators [15]. This highlights the reliability and consistency of the measurement in

assessing constructs like perceived usefulness, perceived ease of use, and other latent variables within the TAM, ensuring robustness in evaluating user perceptions and technology acceptance.

The table presents the AVE values for several constructs used in the study, including ATU, BITU, GR, PEOU, PP, PT, and PU. AVE is a metric employed in SEM and confirmatory factor analysis (CFA) to assess the convergent validity of constructs. The degree of a construct's strong correlation with its indicators, which indicates that the items accurately reflect the idea they are meant to measure, is known as convergent validity. A concept is considered to have enough convergent validity if it explains more than half of the variance of its indicators, as indicated by an AVE of 0.50 or above, which is the generally acknowledged benchmark.

In this study, all constructs surpass the 0.50 threshold, with AVE values ranging from 0.691 (PU) to 0.758 (GR). This range implies that each construct has appropriate convergent validity, since it catches a reasonable part of the variability from its indicators. The construct GR, with an AVE of 0.758, demonstrates the highest convergent validity, while PU, with an AVE of 0.691, has the lowest. Nonetheless, both values are well above the minimum threshold, showing that all constructs are valid representations of their respective concepts. The consistency of AVE values across constructs reinforces the measurement's reliability, suggesting that the constructs used in this study accurately reflect the underlying theoretical concepts they are designed to measure. Consequently, these AVE values provide confidence in the study's measurement model, supporting the use of these constructs in further analysis [29].

Table 3. Cross Loading Values

	ATU	BITU	GR	PEOU	PP	PT	PU
ATU1	0.848	0.798	0.770	0.786	0.802	0.802	0.819
ATU2	0.871	0.829	0.831	0.822	0.785	0.841	0.823
ATU3	0.806	0.800	0.793	0.787	0.728	0.761	0.749
ATU4	0.842	0.760	0.744	0.781	0.798	0.798	0.772
BITU1	0.778	0.857	0.825	0.806	0.750	0.833	0.844
BITU2	0.814	0.813	0.744	0.796	0.811	0.755	0.736
BITU3	0.781	0.812	0.792	0.813	0.717	0.810	0.810
BITU4	0.812	0.885	0.824	0.794	0.811	0.795	0.855
GR1	0.815	0.834	0.927	0.832	0.787	0.824	0.844
GR2	0.806	0.853	0.848	0.836	0.776	0.822	0.842
GR3	0.803	0.808	0.815	0.811	0.808	0.806	0.796
GR4	0.819	0.795	0.888	0.795	0.746	0.821	0.827
PEOU1	0.828	0.821	0.800	0.884	0.804	0.839	0.789
PEOU2	0.782	0.807	0.776	0.795	0.770	0.799	0.815
PEOU3	0.787	0.770	0.745	0.818	0.772	0.769	0.739
PEOU4	0.792	0.821	0.859	0.884	0.775	0.830	0.826
PP1	0.769	0.783	0.768	0.783	0.838	0.758	0.828
PP2	0.840	0.806	0.791	0.820	0.899	0.794	0.809
PP3	0.818	0.801	0.795	0.811	0.881	0.789	0.772
PP4	0.785	0.803	0.761	0.796	0.859	0.805	0.791
PT1	0.775	0.757	0.773	0.789	0.731	0.858	0.776
PT2	0.850	0.835	0.863	0.849	0.812	0.827	0.837
PT3	0.768	0.772	0.745	0.769	0.766	0.821	0.780
PT4	0.84	0.833	0.788	0.821	0.743	0.873	0.817
PU1	0.814	0.835	0.794	0.797	0.761	0.807	0.885
PU2	0.747	0.768	0.783	0.776	0.738	0.798	0.800
PU3	0.796	0.804	0.781	0.820	0.816	0.796	0.829
PU4	0.765	0.796	0.806	0.721	0.740	0.763	0.809

Table 3 evaluates the cross-loading values of each construct, ensuring that the correlation between constructs and their corresponding measurement items is stronger than their correlations with other constructs. A cross-loading value exceeding 0.7 is expected [30]. Cross-loading analysis is a method for assessing discriminant validity by comparing these values. Discriminant validity is established when each item's loading value on its own construct exceeds its cross-loading values with other constructs. The data, exported to Excel, demonstrate that all indicators load more heavily on their respective constructs compared to others, with values exceeding the threshold of 0.7 [6]. This confirms the discriminant validity of the research instrument, ensuring that each construct is uniquely measured by its indicators.

For instance, the ATU indicators ATU1, ATU2, ATU3, and ATU4 have loadings of 0.848, 0.871, 0.806, and 0.842 on ATU, all higher than their loadings on any other constructs. Similarly, BITU indicators BITU1, BITU2, BITU3, and BITU4 show loadings of 0.857, 0.813, 0.812, and 0.885 on BITU, again confirming discriminant validity. The GR indicators GR1 through GR5 also reflect this pattern, with loadings of 0.905, 0.851, 0.829, 0.860, and 0.862 on GR. For PEOU, the indicators PEOU1 to PEOU4 load most strongly on PEOU with values of 0.884, 0.795, 0.818, and 0.884. Similarly, PP indicators PP1, PP2, PP3, and PP4 show strong loadings of 0.838, 0.899, 0.881, and 0.859 on PP. Furthermore, Perceived Trust (PT) indicators PT1 to PT4 demonstrate high loadings on PT, with values of 0.856, 0.829, 0.820, and 0.874. Lastly, PU indicators PU1, PU2, PU3, and PU4 have loadings of 0.885, 0.800, 0.829, and 0.809 on PU.

These findings demonstrate that each construct in the model is well-differentiated, with each indicator's highest loading falling on its own construct. This strong discriminant validity supports the model’s capability to accurately measure distinct constructs, which is critical for understanding the structural relationships and factors influencing the adoption of blockchain-based copyright certification among SMEs in Lombok.

Table 4. Reliability Test Result

	Composite Reliability (rho_a)	Composite Reliability (rho_c)
ATU	0.864	0.907
BITU	0.863	0.907
GR	0.893	0.926
PEOU	0.868	0.910
PP	0.893	0.925
PT	0.867	0.909
PU	0.852	0.899

The evaluation of composite reliability in Table 4 involves analyzing the composite reliability values, Cronbach's alpha, and Average Variance Extracted (AVE) for the constructs being measured. A construct is considered reliable if its composite reliability value exceeds 0.700, AVE exceeds 0.500, and Cronbach's alpha is greater than 0.600 [12]. These metrics provide a standard for assessing the reliability of a construct within the measurement model. Composite reliability exposes the construct's consistency and stability, whereas AVE assesses the proportion of variance captured by the construct's indicators versus measurement error. Cronbach's alpha measures internal consistency, which reflects how strongly the indications correlate. These criteria give a detailed examination of a construct's reliability in determining the validity of measuring instruments [30].

In Table 4, all constructs ATU, BITU, GR, PEOU, PP, PT, and PU exceed the 0.70 threshold for both rho_a and rho_c, indicating high internal consistency across constructs. The rho_a values range from 0.852 (PU) to 0.893 (GR and PP), while rho_c values range from 0.899 (PU) to 0.926 (GR). This consistency in high reliability values suggests that each construct has strong internal consistency, with

GR and PP exhibiting the highest composite reliability, indicating these constructs are particularly stable in their measurement.

The slight difference between rho_a and rho_c for each construct is expected, as rho_a adjusts for the construct's average indicator correlation, while rho_c provides an overall reliability estimate without this adjustment. Both reliability metrics are above the minimum threshold, strengthening confidence in the constructs' measurement reliability. These findings reinforce the robustness of the measurement model, as all constructs exhibit strong reliability, making them suitable for further structural analysis in the study.

3.2. Results of Inner Model

The inner model in TAM represents the structural connections between constructs through causal relationships, such as the impact of perceived usefulness on the intention to use. This model depicts the interconnections among latent variables and how these relationships influence user behavior toward technology. Additionally, the inner model illustrates how latent variables, measured by their respective indicators, align with the theoretical framework and assumptions of the TAM [15].

Table 5. Path Coefficient Value

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistika (|O/STDEV|)	P Values
ATU-> BITU	0.947	0.943	0.024	39.194	0.000
GR -> PT	0.697	0.696	0.097	7.152	0.000
PEOU->ATU	0.295	0.291	0.144	2.046	0.041
PEOU -> PU	0.938	0.933	0.029	32.872	0.000
PP -> PT	0.270	0.269	0.102	2.633	0.008
PT -> ATU	0.401	0.402	0.175	2.288	0.022
PU -> ATU	0.282	0.282	0.167	1.685	0.092

The provided Table 5 displays the path coefficients derived from a structural equation modeling (SEM) analysis, showcasing the relationships between several constructs. The values under "Original sample" (O) indicate the estimated path coefficients, while the "Sample mean" (M) provides their mean values based on bootstrapping. The standard deviations (STDEV) illustrate the variability in these estimates.

The path coefficients and significance levels in Table 5 reveal the strength and direction of the relationships between the constructs:

- PEOU → PU (0.938, p = 0.000): Ease of use significantly influences SMEs' perception of blockchain's usefulness. SMEs who find the system easy to understand and operate are more likely to view it as beneficial for copyright protection.
- PU → ATU (0.282, p = 0.092): Although positive, the effect is not statistically significant. This suggests that while usefulness is important, other factors (e.g., trust and regulatory support) may be more influential in shaping attitudes toward blockchain adoption in this industry.
- PEOU → ATU (0.295, p = 0.041): Ease of use positively affects attitudes toward blockchain adoption, indicating that SMEs are more inclined to adopt blockchain if they perceive it as easy to integrate into their existing processes.
- PT → ATU (0.401, p = 0.022): Perceived trust significantly impacts attitudes, highlighting that SMEs are more likely to develop a favorable attitude toward blockchain when they trust its security and reliability.

- PP → PT (0.270, p = 0.008): Perceived protection positively influences trust. SMEs place greater trust in blockchain when they believe it safeguards their products and copyright information.
- GR → PT (0.697, p = 0.000): Government regulations strongly influence perceived trust, emphasizing that SMEs are more likely to trust blockchain when the regulatory framework supports and facilitates its implementation.
- ATU → BITU (0.947, p = 0.000): Attitude toward using blockchain is the most powerful predictor of behavioral intention. SMEs with positive attitudes are highly likely to adopt blockchain for copyright certification.

Table 6. R2 Values

	R-square	R-square adjusted
ATU	0.924	0.919
BITU	0.896	0.894
PT	0.904	0.900
PU	0.879	0.877

Table 6 shows the R2 and modified R2 values for a variety of structural equation model components. The coefficient of determination (R2) is the proportion of the dependent variable's variance that can be explained by the model's independent variables. Higher R2 values imply that the model explains a large amount of variance in the dependent constructs. When comparing models with various numbers of predictors, the adjusted R2 value is a more accurate measure because it penalizes the inclusion of non-significant factors [6].

Table 6 displays the R^2 values, reflecting the explanatory power of the blockchain adoption analysis model:

- ATU (R^2 = 0.924): Attitudes toward blockchain adoption are strongly explained by ease of use, usefulness, and trust.
- BITU (R^2 = 0.896): Behavioral intention to use blockchain is largely driven by attitudes, underscoring the importance of fostering positive perceptions among SMEs.
- PT (R^2 = 0.904): Perceived trust is primarily influenced by government regulations and perceived protection, indicating that SMEs' trust in blockchain hinges on regulatory clarity and data security.
- PU (R^2 = 0.879): Perceived usefulness is significantly determined by perceived ease of use, demonstrating that SMEs' belief in blockchain's performance-enhancing potential stems from its perceived usability.

Table 7. Key Table Summary

Table No.	Key Values	Interpretation in Blockchain Adoption Context
Table 1 (Outer Loadings)	All > 0.7	Measurement items strongly reflect SME perceptions of ease of use, usefulness, trust, protection, and regulation.
Table 2 (AVE)	All > 0.5	Constructs are valid; SMEs' views on blockchain adoption are accurately measured.
Table 3 (Cross Loading Values)	All indicators load highest on their respective constructs	Discriminant validity is established, ensuring that constructs like Trust (PT) and Regulation (GR) are distinct and uniquely measured, which is critical when assessing blockchain adoption.
Table 4 (Composite Reliability)	All > 0.7	High internal consistency, indicating reliable measurement of SME attitudes and intentions.

Table 5 (Path Coefficients)	Significant paths: PEOU → PU, PEOU → ATU, PT → ATU, PP → PT, GR → PT, ATU → BITU	Ease of use, trust, and regulatory support are pivotal for blockchain adoption among SMEs.
Table 6 (R^2 Values)	ATU: 0.924, BITU: 0.896, PT: 0.904, PU: 0.879	The extended TAM effectively explains SMEs' blockchain adoption behavior

4. DISCUSSIONS

4.1. Overview of the Three-Phase Approach

The research followed a structured three-phase approach:

- Phase 1: Development of an Extended TAM framework tailored to SMEs in Lombok's creative industry.
- Phase 2: Quantitative data collection and analysis using PLS-SEM.
- Phase 3: Comparative validation with existing blockchain adoption research and contextual evaluation.

The results provided empirical support for the Extended TAM while uncovering context-specific drivers of blockchain adoption.

4.2. Phase 1: Preliminary Model Development Outcomes

In the preliminary phase, Perceived Trust (PT), Government Regulations (GR), and Perceived Protection (PP) were integrated into the classic TAM model. This extension was necessary because SMEs in Lombok expressed concerns about counterfeiting risks and legal uncertainties, aligning with observations from SMEs in other developing economies (Antsipava et al., 2024; Chen, 2023) [5].

4.3. Phase 2: Statistical Results of Path Coefficients & Hypothesis Testing

Using PLS-SEM, the path coefficients were estimated, revealing the following key relationships:

Table 8. Path Coefficients and Hypothesis Testing Results using PLS-SEM

Hypothesis	Path Coefficient	p-Value	Result
PEOU → PU	0.938	<0.001	Supported
PU → ATU	0.282	0.092	Not Supported
PT → ATU	0.401	0.022	Supported
PP → PT	0.270	0.008	Supported
GR → PT	0.697	<0.001	Supported
ATU → BITU	0.947	<0.001	Supported
PEOU → ATU	0.295	0.041	Supported

These results confirmed the pivotal role of trust (PT), regulatory clarity (GR), and perceived protection (PP), alongside ease of use (PEOU), as determinants of blockchain adoption intention.

4.4. Phase 3: Comparison with Existing Studies

Comparison with blockchain adoption studies in SMEs are Sohaib et al. (2020) and Lee (2023) emphasized the critical role of PEOU and PU in technology adoption, especially in SMEs, consistent with the strong PEOU → PU relationship observed in this study (Path Coefficient: 0.938). However, PU → ATU's insignificance (Path Coefficient: 0.282, p = 0.092) contrasts with classic TAM findings

(Davis, 1989) [2][18]. This divergence aligns with research by Antsipava et al. (2024) and Chen (2023), who highlighted that SMEs in traditional sectors often prioritize trust and regulatory support over usefulness. Trust (PT) emerged as a key determinant of attitude (ATU), supporting Legesse et al. (2024) and Obidallah et al. (2024), who found that blockchain adoption in agriculture and small-scale manufacturing heavily depends on trust in digital systems [14][17]. Government Regulations (GR) significantly shaped trust (PT) (Path Coefficient: 0.697, $p < 0.001$), in line with Sciarelli et al. (2022) and Chang et al. (2022), who found that regulatory certainty drives blockchain adoption in supply chains and finance [4][1].

Comparison with cultural and creative industry research are studies focusing on blockchain for copyright protection in creative industries are relatively scarce. However, Pan et al. (2023) emphasized that creative SMEs require both technological literacy and legal security to embrace blockchain [31]. This echoes the finding that PT and GR are more influential than PU in Lombok's SMEs. In cultural sectors like handicrafts in India (Rao et al., 2022), SMEs often perceive blockchain as complex and trust-building initiatives by governments were found to accelerate adoption, aligning with the importance of GR and PT in this study.

4.5. Impact and Importance for Informatics and Computer Science

This study holds significant implications for the field of informatics and computer science, particularly by expanding the understanding of blockchain adoption through the validation of an Extended Technology Acceptance Model (TAM) in the SME context. The findings provide empirical evidence that trust, regulatory factors, and protection concerns are equally, if not more, influential than the traditional usability and usefulness constructs in shaping blockchain adoption among SMEs. This suggests that future blockchain adoption frameworks within informatics research must integrate socio-regulatory dimensions alongside technological acceptance factors. Furthermore, the results emphasize that in digitally constrained environments, such as traditional SMEs with limited digital literacy, perceived ease of use (PEOU) alone is insufficient. Trust and government support emerge as primary enablers, challenging existing assumptions in Human-Computer Interaction (HCI) and opening new research avenues into trust-building mechanisms within blockchain systems. Another notable contribution lies in demonstrating blockchain's potential for Digital Rights Management (DRM) systems. The study's focus on copyright certification for cultural SMEs highlights blockchain's computational utility beyond cryptocurrencies, emphasizing its applicability in safeguarding intellectual property within informatics and information systems research. Finally, the study advances SME-specific technology adoption research, underlining that micro-enterprises in the creative sector require integrated digital-legal platforms that are not only user-friendly but also legally compliant. For blockchain developers and informatics scholars, this calls for the design of low-barrier systems tailored to the unique needs of SMEs, ensuring that blockchain technologies can be effectively deployed in sectors where intellectual property protection is crucial.

5. CONCLUSION

This study enhances the Technology Acceptance Model (TAM) by integrating Perceived Trust (PT), Perceived Protection (PP), and Government Regulation (GR) as critical determinants of blockchain adoption for digital copyright certification among Lombok's woven fabric SMEs. The findings emphasize that, beyond perceptions of ease of use and usefulness, trust and regulatory clarity are fundamental to fostering a positive attitude and behavioral intention toward blockchain adoption. This is particularly important for SMEs in traditional and creative industries, where intellectual property concerns and regulatory uncertainties often impede technology adoption. The results highlight that blockchain adoption in these sectors is not purely a technological matter but is deeply intertwined with

legal confidence and perceptions of protection, requiring tailored strategies to simplify both system usability and compliance processes.

The study's implications are significant for Informatics and Computer Science, particularly in advancing blockchain system design, Human-Computer Interaction (HCI), and digital rights management technologies. It demonstrates that effective blockchain adoption models must integrate socio-legal factors alongside technical usability, especially for low-digital-literacy users. This research underscores the urgency of developing blockchain platforms that are not only user-friendly but also embedded with trust-enhancing mechanisms and regulatory safeguards, enabling SMEs in creative and cultural sectors to safeguard their intellectual property rights. By addressing these adoption barriers, this study offers a foundation for future informatics solutions that bridge technology, law, and culture, empowering traditional industries to thrive in the digital economy.

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