The Role of IoT in Smart Payment and Digital Transformation to Improve Transaction Security and Efficiency: A Systematic Literature Review

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Abstract. Equitable access to digital technology is an important factor in realizing economic inclusiveness, especially in the era of rapid digital transformation. This research discusses the unequal access to digital technology in Indonesia and its impact on economic inclusiveness, especially in the context of ASEAN leadership 2023. Using policy analysis and literature review methods, this research examines Indonesia's strategy in encouraging community participation in the digital economy as well as ASEAN's role in supporting such initiatives. The main findings show that Indonesia's strategy includes developing digital infrastructure, improving digital literacy, and collaborating with the private sector. Awareness of the importance of inclusivity in digital economy policy is also increasing. The study concludes that the continuation of infrastructure development and digital literacy is necessary, with the implication that close collaboration between the government, private sector, and society is key in creating an inclusive digital economy ecosystem.

Keywords: Digital economic inclusivity, Digital access inequality, Digital transformation.

Introduction

The rapid advancement of digital technology over the past decade has significantly reshaped the global financial landscape, especially through the integration of smart systems in payment infrastructures. The Internet of Things (IoT) has emerged as a transformative technology that enables real-time data processing, interconnected devices, and intelligent automation—substantially enhancing the security and efficiency of digital transactions (Al-Fuqaha et al., 2015; Atzori et al., 2017). In the context of smart payment systems, IoT facilitates seamless interactions between users, devices, and financial platforms, fostering a frictionless and responsive transactional ecosystem (Gubbi et al., 2013; Sharma et al., 2021).

As digital payment methods continue to evolve, there is an increasing emphasis on their alignment with the Sustainable Development Goals (SDGs), particularly Goal 9, which advocates for industry innovation and resilient infrastructure. Smart payment systems supported by IoT are instrumental in promoting financial inclusion, improving service accessibility, and supporting sustainable economic development (Saleh et al., 2023; Borges et al., 2020). However, the adoption of such technologies is not without its challenges. Key concerns include data privacy, cybersecurity threats, regulatory compliance, and disparities in digital infrastructure—particularly in developing regions such as Southeast Asia (Khan et al., 2020; Hassan et al., 2021).

In Indonesia, efforts to expand digital financial services have highlighted the dual challenges of uneven digital access and insufficient technological literacy. Studies reveal a digital divide between urban and rural populations, hindering the equitable implementation of IoT-enabled payment solutions. Addressing these gaps requires robust policy support, private sector collaboration, and community engagement to build a secure and inclusive financial ecosystem (Jayaraman et al., 2020; Yin et al., 2018).

This study aims to systematically review the role of IoT in enhancing the security and efficiency of digital payment systems, with a particular focus on identifying the opportunities and challenges that accompany the digital transformation of financial services. By synthesizing current academic literature, this paper contributes to the understanding of how IoT technologies can be strategically implemented to support secure, efficient, and inclusive digital financial ecosystems.

Conclusion

The study results show that the application of IoT in digital payment systems plays a significant role in improving transaction efficiency and security. This technology enables real-time connectivity between devices, automated data processing, and anomaly detection in the financial system. However, challenges such as data privacy, cybersecurity, and digital infrastructure gaps remain major obstacles. Effective IoT implementation requires strong regulatory support as well as collaboration between the government, private sector, and society. Therefore, the digital strategy must pay attention to inclusivity and overall infrastructure readiness.

Another important conclusion is that digital transformation in the financial sector must be accompanied by an increase in people's digital literacy, especially in disadvantaged areas. The Indonesian government has shown initiatives through digital infrastructure development and education programs. However, active participation from all stakeholders is needed to create an inclusive and sustainable digital financial ecosystem. This study also highlights the importance of strategically utilizing IoT to support sustainable development goals (SDGs), especially in the aspect of financial inclusion. Going forward, further research in this field is needed to formulate policies and technological solutions that are adaptive to global digital dynamics.

Methods

This research uses a systematic literature review (SLR) approach to identify, evaluate, and synthesize literature related to the application of the Internet of Things (IoT) in digital payment systems. Data sources were taken from various reputable international journals such as IEEE, Elsevier, and Springer published between 2013 and 2023. The selection process was conducted through identification, screening, eligibility, and inclusion stages based on keywords such as “IoT”, “smart payment”, and “digital transformation”. Inclusion criteria included studies that addressed the security, efficiency, and application of IoT in the financial system. The collected data was then thematically analyzed to identify patterns and important findings in the literature.

In addition, this research also adopted a qualitative approach with content analysis of Indonesia's digital policies and strategies, particularly in the context of digital economic inclusiveness. Triangulation techniques were used to ensure the validity of findings from various literature sources. This approach enables a more thorough understanding of the challenges and opportunities of IoT implementation in the financial sector. The instruments in this research are literature data recording sheets and thematic analysis guidelines. This method can thus provide a strong foundation for formulating evidence-based recommendations.

Result and Discussion

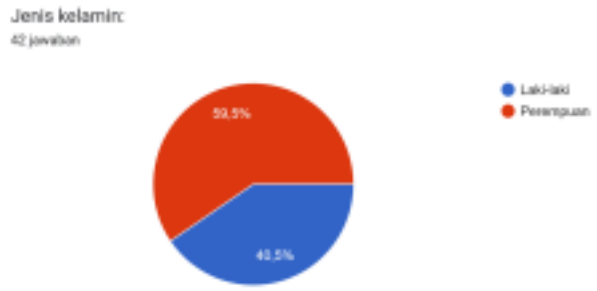

Figure 1. Diagram representation of gender

The results of the diagram above show that the respondents who filled out the questionnaire were predominantly female at 59.5% and male at 40.5%.

Figure 2. Diagram Representation of Aged

The results of the diagram above show that the respondents who filled out the questionnaire were mostly aged <28 with 83.3%, aged 25-35 years with 14.3% and the rest were aged 36-45 years.

Figure 3. Diagram Representation of Background Academic

The results of the diagram above show that the responses that filled out our questionnaire were mostly students with 76.2%, and others were diploma & bachelor (S1) with 9.5%.

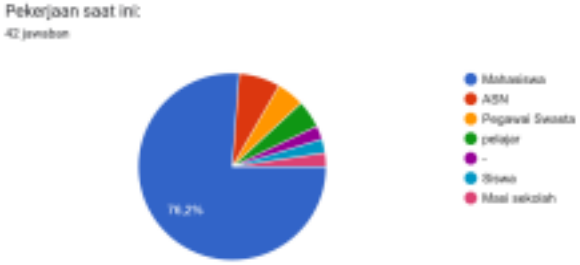

Figure 4. Diagram Representation of Job

The results of the diagram above show that the respondents who filled out the questionnaire were predominantly students with 76.2%.

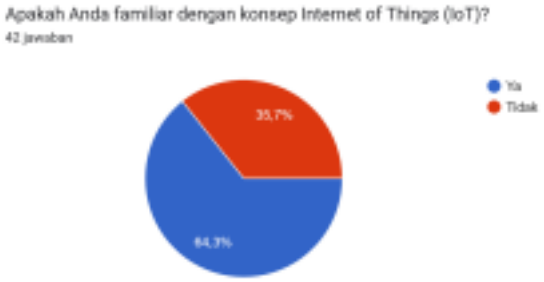

Figure 5. Diagram Representation of knowledge about IoT

The results of the diagram above show that 64.3% of respondents who filled out the questionnaire were familiar with the concept of the Internet of Things (IoT) and 36.7% were not.

Figure 6. Diagram Representation of

The results of the diagram above show that 45.2% of respondents who filled out the questionnaire felt that IoT had played a sufficient role in supporting the smart payment system and 14.3% felt that IoT still played a lesser role in supporting smart payments.

Figure 7. Diagram Representation

The results of the diagram above show from 1-4, respondents who filled out the questionnaire predominantly chose number 2, meaning that respondents felt that IoT integration was not very important in supporting the digital transformation of the financial system.

Figure 8. Diagram Representation

The results of the diagram above show that 52.4% of respondents feel that IoT has increased efficiency in the payment system.

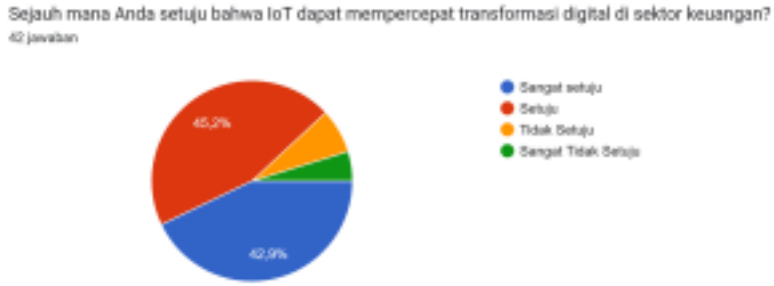

Figure 9. Diagram Representation

The result of the diagram above shows that 45.2% of the respondents agreed that IoT could accelerate digital transformation in the financial sector.

Figure 10. Diagram Representation

The Graphic above shows that 61.9% of the respondents who filled out the questionnaire predominantly chose that the main challenge in implementing IoT for smart payment systems is the implementation cost.

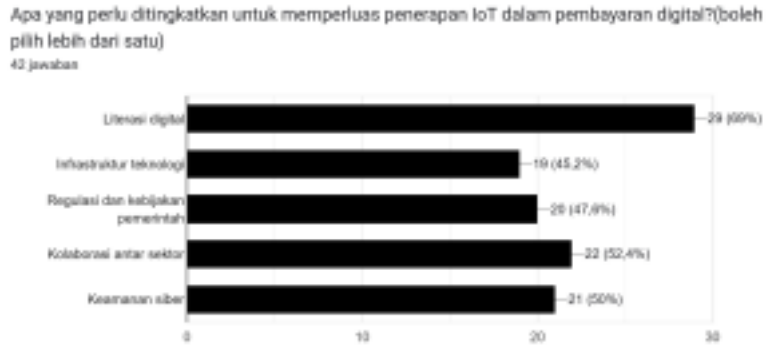

Figure 11. Diagram Representation

The Graphic above shows that 61.9% of the respondents who filled out the questionnaire predominantly chose that Digital Literacy needs to be upgraded to expand the application of IoT in digital payments.

SPSS Results.

Multiple Linear Regression Test

T-Test

[DataSet1]

Group Statistics

	SMART PAYMENT	N	Mean	Std. Deviation	Std. Error Mean
TRANSFORMASI DIGITAL	1	1	1.00	.	.
	2	6	2.17	1.169	.477

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
									Lower / Upper
TRANSFORMASI DIGITAL	Equal variances assumed	.	.	-.924	5	.399	-1.167	1.263	-4.413 / 2.079
	Equal variances not assumed			.	.	.	-1.167	.	. / .

Frequency Descriptive Analysis

Frequencies

[DataSet0]

Statistics

		SMART PAYMENT	TRANSFORMASI DIGITAL	EFISIENSI
N	Valid	43	43	43
	Missing	0	0	0

Frequency Table

SMART PAYMENT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	2.3	2.3	2.3
	2	6	14.0	14.0	16.3
	3	19	44.2	44.2	60.5
	4	17	39.5	39.5	100.0
	Total	43	100.0	100.0	

7

Correlations

[DataSet0]

Correlations

		SMART PAYMENT	TRANSFORMASI DIGITAL	EFISIENSI
SMART PAYMENT	Pearson Correlation	1	-.194	.399**
	Sig. (2-tailed)		.214	.008
	N	43	43	43
TRANSFORMASI DIGITAL	Pearson Correlation	-.194	1	-.208
	Sig. (2-tailed)	.214		.180
	N	43	43	43
EFISIENSI	Pearson Correlation	.399**	-.208	1
	Sig. (2-tailed)	.008	.180	
	N	43	43	43

**. Correlation is significant at the 0.01 level (2-tailed).

TRANSFORMASI DIGITAL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	15	34.9	34.9	34.9
	2	17	39.5	39.5	74.4
	3	6	14.0	14.0	88.4
	4	5	11.6	11.6	100.0
	Total	43	100.0	100.0	

EFISIENSI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	5	11.6	11.6	11.6
	2	3	7.0	7.0	18.6
	3	22	51.2	51.2	69.8
	4	13	30.2	30.2	100.0
	Total	43	100.0	100.0	

Summary of Statistical Analysis Outputs

1. **Descriptive Statistics**
    - Provides a **general overview** of numerical data, including:
        - Number of cases (N)
        - Minimum and maximum values
        - Mean
        - Standard deviation (a measure of data spread)
    - **Purpose**: To understand the distribution and basic characteristics of the dataset.
    - Example: Knowing the average student score in a particular course.
2. **Normality Test** (Kolmogorov-Smirnov / Shapiro-Wilk)
    - Tests whether the data is **normally distributed**.
    - **Interpretation**:
        - Sig. > 0.05 → Data is **normally distributed**
        - Sig. < 0.05 → Data is **not normally distributed**
    - **Purpose**: To decide whether to use parametric or non-parametric tests based on data distribution. 3. **Pearson Correlation Test**
    - Measures the **relationship between two variables**.
    - **Interpretation**:
        - Pearson correlation coefficient (r) ranges from -1 to +1:
            - +1 → perfect positive correlation
            - 0 → no correlation
            - -1 → perfect negative correlation

■ Sig. < 0.05 → The correlation is **statistically significant**

○ **Purpose**: To examine the **strength and direction** of a linear relationship (e.g., attendance vs grades). 4. **Regression Analysis**

○ Assesses the **impact of one or more independent variables on a dependent variable**. ○ Typically includes:

■ **Model Summary** (Adjusted R Square)

■ **ANOVA Table** (model significance)

■ **Coefficients Table** (individual variable influence)

○ **Purpose**: To **predict** the value of a dependent variable (Y) based on one or more predictors (X). 5. **t-Test / ANOVA**

○ Tests for **mean differences** between two groups (t-test) or more (ANOVA).

○ **Interpretation**:

■ Sig. (2-tailed) < 0.05 → There is a **significant difference**

■ Levene's Test checks for **equality of variances**

○ **Purpose**: To determine whether differences between groups are statistically meaningful. 11

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