Public Attention and Digital Financial Inclusion in Indonesia: Google Trends Evidence on QRIS and Digital Public Service Infrastructure

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Abstract
The rapid expansion of digital payment systems has become a central element of monetary and financial sector reforms in emerging economies. In Indonesia, the implementation of the Quick Response Code Indonesian Standard (QRIS) aims to enhance payment system efficiency, interoperability, and financial inclusion. However, the effectiveness of such reforms depends not only on infrastructure availability but also on public awareness and information-seeking behaviour, which typically precede actual adoption and sustained usage.

This study examines whether online search intensity can serve as a high-frequency indicator of public attention toward digital payment infrastructure in Indonesia. Using monthly Google Trends data from January 2023 to December 2025, the analysis focuses on search interest in "QRIS" as the primary variable, with "Services Online" and "Smart City" included as contextual benchmarks representing broader digitalisation narratives. A time-series–oriented approach is employed, incorporating stationarity testing, first differencing, and correlation as well as lead–lag analysis to examine the dynamics of public attention.

The findings indicate that changes in public attention to QRIS display distinct temporal patterns and exhibit meaningful dynamic relationships with attention to online services, suggesting that shifts in attention to digital payments may precede broader engagement with digital public services. These results support the interpretation of search-based indicators as early signals of behavioural readiness for digital payment adoption. From a policy perspective, the study highlights the usefulness of high-frequency attention data for monitoring payment system reforms and informing communication strategies to support digital financial inclusion

Keywords: Digital payments; QRIS; Financial inclusion; Google Trends; Public attention

1. Introduction

The acceleration of digital payment development has become a fundamental component of financial system transformation across emerging markets. The rapid evolution of financial technology (FinTech) has significantly reshaped payment ecosystems, particularly in developing economies where digital solutions are leveraged to expand financial access (Suryono et al., 2021; Wibowo & Haryanto, 2021). In Indonesia, the introduction of the Quick Response Code Indonesian Standard (QRIS) by Bank Indonesia represents a strategic policy initiative designed to improve transaction efficiency, strengthen interoperability among payment service providers, and expand financial inclusion. Empirical studies indicate that QR-based payment systems contribute to accelerating digital transaction adoption, particularly among micro and small enterprises (Nugroho et al., 2023; Pramono et al., 2022).

However, the effectiveness of digital payment reforms depends not only on infrastructure readiness but also on public awareness and digital engagement behaviour. Prior literature suggests that information-seeking behaviour often precedes technology adoption and reflects early stages of behavioural intention formation (Arifin &

Kurniawati, 2024). Within Indonesia's broader digital transformation and smart city agenda, digital payment systems form an essential component of integrated public service modernization (Rachmawati et al., 2022). Consequently, QRIS should be understood not merely as a technological innovation, but as a policy-relevant instrument embedded within a larger framework of financial system modernization and inclusive finance reform.

This study investigates whether online search intensity can serve as a high-frequency proxy for measuring public attention toward digital payment infrastructure in Indonesia. Previous research demonstrates that search engine data can function as a real-time indicator of economic behaviour and technology adoption dynamics (Arifin & Kurniawati, 2024). Using monthly Google Trends data from January 2023 to December 2025, this study focuses on search interest in "QRIS" as the primary variable, while "Services Online" and "Smart City" are included as contextual benchmarks representing broader digitalization narratives. A time-series analytical framework is employed, incorporating stationarity testing, first differencing, correlation analysis, and lead–lag examination to capture dynamic relationships among public attention indicators.

The findings reveal distinct temporal fluctuations in public attention toward QRIS and demonstrate meaningful dynamic associations with search interest in online services. These results align with prior evidence indicating that digital payment awareness is closely linked to broader financial inclusion and digital ecosystem development (Nugroho et al., 2023; Wibowo & Haryanto, 2021). The study further supports the interpretation of search-based indicators as early behavioural signals reflecting readiness for digital payment adoption. From a policy perspective, high-frequency digital attention data provide valuable insights for monitoring payment system reforms and designing effective communication strategies to strengthen digital financial inclusion and smart governance initiatives (Rachmawati et al., 2022; Pramono et al., 2022).

2. Literature Review and Hypotheses Development
2.1 Digital Payments and Financial Inclusion
Digital payment systems have become a critical driver of financial inclusion and payment system modernization in emerging economies. The expansion of fintech-based services reduces transaction costs, improves efficiency, and broadens access to financial services, particularly for unbanked and underbanked populations (Suryono et al., 2021; Wibowo & Haryanto, 2021). In the Indonesian context, the introduction of QR-based payment infrastructure represents an institutional effort to standardize digital transactions and enhance interoperability across payment providers.

Recent empirical evidence suggests that digital payment adoption contributes positively to financial inclusion outcomes, particularly among micro and small enterprises (Nugroho et al., 2023). Beyond transactional efficiency, digital payment systems support transparency, traceability, and integration within broader digital ecosystems. From a monetary policy perspective, payment system digitalization also enhances data availability and transaction monitoring, strengthening financial system resilience.

However, financial inclusion is not achieved solely through infrastructure deployment. Behavioural readiness, awareness, and trust are equally important determinants of adoption. Consistent with the Unified Theory of Acceptance and Use of Technology (UTAUT), behavioural intention and facilitating conditions significantly influence technology usage decisions (Venkatesh et al., 2012). Thus, public attention may represent an early cognitive stage preceding actual adoption of digital payment systems.

2.2 Public Attention and Online Search Behaviour
The concept of public attention has gained increasing importance in economic and financial research. Online search data, particularly from Google Trends, have been widely used as high-frequency proxies for information demand and behavioural interest (Choi & Varian, 2012; Mavragani & Ochoa, 2020). Search intensity reflects active information-seeking behaviour, which often precedes decision-making and adoption processes.

In financial markets, search-based indicators have been shown to predict trading behaviour and economic activity (Preis et al., 2013). More recent studies extend this approach to digital finance adoption, arguing that online search activity can capture early-stage awareness and readiness before observable changes appear in transaction data (Arifin & Kurniawati, 2024).

Within the digitalisation ecosystem, attention to digital payments may not evolve in isolation. Instead, it interacts dynamically with broader digital narratives such as online service usage and smart city initiatives (Rachmawati et al., 2022). Understanding these dynamic relationships is essential for interpreting whether attention to QRIS functions as a standalone phenomenon or as part of a broader digital transformation process.

2.3   Dynamic Attention and Lead–Lag Relationships

Attention-based theories suggest that changes in public focus can precede observable behavioural outcomes. In time-series settings, lead–lag analysis allows researchers to identify whether shifts in one variable systematically occur before shifts in another. If increases in QRIS-related search intensity consistently precede increases in searches for online services, this pattern may indicate that digital payment awareness functions as an early behavioural signal. From a policy perspective, identifying such lead–lag dynamics is particularly relevant for central banks and payment system authorities, including Bank Indonesia. High-frequency attention indicators may complement traditional financial statistics, which are typically published with reporting lags.

Given the exploratory nature of this study, the focus is placed on dynamic association rather than strict causality. The objective is to assess whether QRIS-related attention exhibits systematic co-movement and temporal precedence relative to broader digital service engagement.

2.4   Hypotheses Development

Based on the theoretical framework and prior empirical findings, the following hypotheses are proposed:

H1: Changes in public attention to QRIS are positively associated with changes in attention to online services.

This hypothesis is grounded in the argument that digital payment infrastructure forms part of a broader digital ecosystem. Increased awareness of digital payments may coincide with or stimulate interest in other digital services (Nugroho et al., 2023; Rachmawati et al., 2022).

H2: Changes in public attention to QRIS precede changes in attention to online services (lead–lag effect).

If digital payment awareness represents an early stage of digital behavioural readiness, then increases in QRIS-related search intensity should systematically lead increases in online service attention (Arifin & Kurniawati, 2024).

H3: Changes in public attention to QRIS exhibit weaker dynamic association with smart city narratives compared to online services.

Smart city discourse is often policy-driven and macro-oriented, whereas digital payment adoption is more closely related to daily transactional behaviour. Therefore, the dynamic linkage between QRIS and smart city attention is expected to be weaker.

3.   Research Methodology
3.1   Research Design

This study employs a quantitative time-series research design to analyse the dynamics of public attention toward digital payment infrastructure. Consistent with prior research that utilises online search data as proxies for economic attention and behavioural interest (Choi & Varian, 2012; Preis et al., 2013), the analysis emphasises temporal patterns, co-movement, and lead–lag relationships rather than causal estimation.

3.2   Data Source and Variables

Monthly Google Trends data are collected for Indonesia covering the period January 2023 to December 2025. Google Trends provides a relative index of search interest scaled from 0 to 100, reflecting changes in attention over time rather than absolute search volumes. The primary variable of interest is search intensity for "QRIS," representing public attention to digital payment infrastructure. Searches for "Services Online" and "Smart City" are included as comparative indicators capturing broader digital service usage and digitalisation narratives.

3.3 Time-Series Treatment and Analytical Strategy

Time-series data derived from online search indices may exhibit trending behaviour, which can result in spurious correlations if not appropriately addressed. Following standard practice in applied financial time-series analysis, stationarity is assessed using the Augmented Dickey–Fuller (ADF) test. When non-stationarity is detected, the series are transformed using first differencing, allowing the analysis to focus on changes in attention rather than levels.

All correlation analyses are conducted on the first-differenced series to ensure stationarity and statistical validity. Pearson correlation is used to examine contemporaneous relationships between changes in public attention across keywords. To capture dynamic interactions, lead–lag correlation analysis is applied to assess whether changes in attention to QRIS precede changes in attention to online services or smart city narratives. This approach is consistent with the interpretation of attention as a potential early behavioural signal rather than a contemporaneous outcome.

While more advanced econometric techniques such as vector autoregression (VAR) or autoregressive distributed lag (ARDL) models could be employed to explore dynamic relationships in greater depth, the analytical strategy adopted in this study is appropriate for its exploratory objective. Given the use of Google Trends as a high-frequency proxy for public attention rather than direct measures of adoption or transaction values, the focus on stationarity adjustment, differencing, and correlation dynamics allows for a parsimonious yet informative assessment without imposing strong structural assumptions.

3.4 Validity and Limitations

Google Trends data capture relative public attention rather than actual usage or transaction volumes (Mavragani & Ochoa, 2020). Accordingly, the findings are interpreted as indicators of behavioural interest and information demand, not direct measures of digital payment adoption or financial inclusion outcomes. In addition, search intensity may be influenced by short-term external events, such as policy announcements or media coverage, potentially generating temporary spikes in attention. These limitations are acknowledged, and the results are positioned as complementary to conventional payment system indicators rather than substitutes.

4. Results

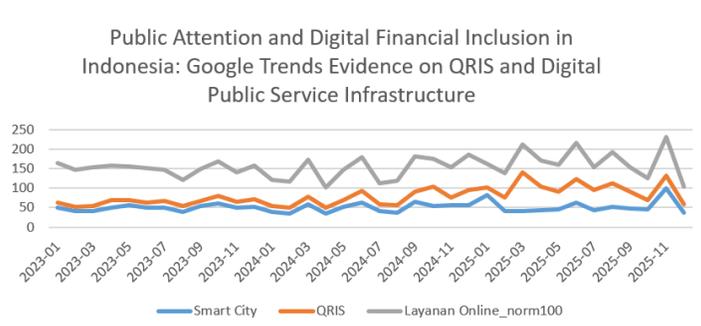### 4.1 Descriptive Trends of Public Attention

Figure 1. Monthly Google Trends Index for QRIS, Services Online, and Smart City (Indonesia, January 2023 – December 2025)
Source: Google Trends, processed by authors.

Figure 1 presents the monthly Google Trends indices for QRIS, Services Online, and Smart City in Indonesia from January 2023 to December 2025. The figure highlights distinct temporal patterns across the three search terms, reflecting differences in the dynamics of public attention toward digital payments, digital services, and smart city narratives.

Overall, public attention to Services Online remains relatively high and stable throughout the observation period, reflecting the routine and continuous use of digital services by the population. In contrast, QRIS exhibits substantially higher volatility, characterised by sharp increases and sudden declines in search intensity. This pattern

suggests that attention toward digital payment infrastructure is more sensitive to specific events, such as policy announcements, regulatory changes, or major promotional campaigns.

Meanwhile, searches related to Smart City display episodic spikes rather than sustained trends. Peaks in smart city attention appear to coincide with policy discourse or large-scale urban initiatives, supporting the interpretation that smart city narratives are primarily policy-driven rather than usage-driven. These contrasting patterns indicate that public attention toward digital payments, digital services, and policy narratives follows distinct temporal dynamics.

4.2   Descriptive Statistics

Table 1 reports the summary statistics of monthly search intensity for the three keywords.

Keyword	Mean	Median	SD	Min	Max	Peak Month
Smart City	51	50	13	34	100	2025-11
QRIS	28	20	19	11	100	2025-03
Services Online	76	77	15	44	100	2023-01 and 2023-03

The results reveal clear differences in the distribution of public attention. Services Online records the highest average search intensity (mean ≈ 76) with relatively low dispersion, indicating stable and sustained interest over time. QRIS, by contrast, has a lower mean search index (≈ 28) but the highest standard deviation (≈ 19), highlighting the volatile nature of attention toward digital payment infrastructure. This volatility is consistent with the interpretation that public interest in QRIS is strongly event-driven.

The Smart City keyword occupies an intermediate position, with moderate average attention and dispersion. Notably, the peak month for QRIS occurs in March 2025, whereas smart city attention peaks in November 2025. These non-coinciding peak periods suggest that attention toward payment systems and urban digitalisation narratives is not synchronised, reinforcing the need to analyse these dimensions separately within the digitalisation ecosystem.

4.3   Correlation Analysis: Levels versus First Differences

Initial correlation analysis based on level data indicates weak relationships between QRIS and the other keywords, raising concerns regarding spurious correlation due to trending behaviour. To address this issue, the analysis proceeds using first-differenced series, which capture changes in attention rather than absolute levels.

Table 2
Correlation Analysis of First-Differenced Search Indices

Keyword Pair	Pearson r
Smart City - QRIS	0.15
Smart City - Services Online	0.76
QRIS - Services Online	0.36

Table 2 presents Pearson correlation coefficients computed on the differenced series. The results show a moderate positive correlation between QRIS and Services Online (r ≈ 0.36), suggesting that increases in attention to digital payments tend to be associated with subsequent changes in attention toward online services. This finding supports the interpretation of QRIS-related attention as an early behavioural signal linked to broader digital service engagement.

In contrast, the correlation between Smart City and QRIS remains weak (r ≈ 0.15), indicating limited direct interaction between payment system attention and smart city narratives. However, the relationship between Smart City and Services Online is relatively strong (r ≈ 0.76), implying that public discourse on urban digitalisation is more closely connected to general digital service usage than to payment infrastructure specifically.

These results should be interpreted as descriptive dynamic associations rather than causal relationships, consistent with the exploratory objective and the nature of search-based attention data.

4.4 Lead–Lag Correlation Analysis

Table 3

Lead–Lag Correlation between QRIS and Online Service Searches

Lag (Months)	Correlation Coefficient (QRIS – Services Online)
-2	0.18
-1	0.27
0	0.36
+1	0.41
+2	0.29

Correlations are computed using first-differenced Google Trends indices. Positive lag values indicate that changes in QRIS search intensity precede changes in online service searches.

Table 3 presents the lead–lag correlation results between QRIS and online service search attention. The correlation coefficient increases when QRIS search intensity leads online service searches by one month ($r \approx 0.41$), suggesting that increases in public attention toward QRIS tend to precede increases in attention toward online services. Although the analysis does not imply causality, the temporal ordering supports the interpretation of search-based attention as an early behavioural signal within the broader digital service ecosystem.

4.5 Dynamic Interpretation and Policy Implications

Taken together, the results suggest that public attention to digital payments follows a distinct dynamic pattern compared to broader digital service usage and policy narratives. Attention toward QRIS appears to function as a high-frequency, event-sensitive indicator, whereas attention toward online services reflects more stable, habitual behaviour.

From a monetary and financial policy perspective, these findings carry important implications. Payment system reforms aimed at promoting financial inclusion may benefit from monitoring public attention indicators as early signals of behavioural readiness. In particular, spikes in QRIS-related searches may provide policymakers with timely information regarding public responsiveness to payment system initiatives before changes materialise in transaction data.

Moreover, the weak linkage between QRIS and smart city attention suggests that payment system communication strategies should not rely solely on broader digitalisation narratives. Instead, targeted messaging focused on usability, security, and everyday transaction benefits may be more effective in sustaining public engagement with digital payment infrastructure.

4.6 Discussion within the Financial Inclusion Literature

The findings align with prior studies emphasizing the role of information acquisition and awareness in the adoption of financial technologies. Consistent with behavioural and financial inclusion frameworks, attention and information-seeking behaviour emerge as precursors to adoption rather than outcomes themselves. By providing empirical evidence from Indonesia, this study extends the digital payments literature by demonstrating the usefulness of search-based indicators in capturing early-stage patterns of public attention related to digital payment policies.

Importantly, the results underscore that public attention should be viewed as a complementary indicator rather than a substitute for conventional measures such as transaction volumes or account ownership. When combined with traditional financial indicators, high-frequency attention data may enhance policymakers' ability to evaluate and refine payment system reforms in a more timely manner.

5. Discussions and Conclusion

This study investigates whether online search intensity can function as a high-frequency proxy for public attention toward digital payment infrastructure in Indonesia, focusing on QRIS within the broader digitalisation ecosystem.

Using monthly Google Trends data from January 2023 to December 2025, the findings provide several important insights for the literature on digital finance, financial inclusion, and attention-based economic indicators.

The empirical results reveal that public attention to QRIS exhibits substantially higher volatility compared to attention toward online services. This pattern indicates that digital payment infrastructure is more sensitive to policy announcements, regulatory changes, promotional campaigns, and media exposure. In contrast, attention to online services remains relatively stable, reflecting habitual and routine digital engagement. These contrasting dynamics suggest that digital payment attention is more event-driven, whereas online service engagement represents a more embedded behavioural pattern within the digital economy.

Correlation analysis conducted on the first-differenced series demonstrates a moderate positive association between changes in QRIS search intensity and changes in online service searches. This finding supports the interpretation that digital payment awareness is interconnected with broader digital service engagement. While prior research highlights the potential role of digital payments in advancing financial inclusion (Nugroho et al., 2023; Wibowo & Haryanto, 2021), the present analysis focuses on patterns of public attention rather than direct financial inclusion outcomes.

Moreover, the observed lead–lag pattern suggests that increases in QRIS-related search intensity may precede increases in attention toward online services. Although the study does not establish causality, this temporal ordering aligns with attention-based frameworks in which information-seeking behaviour precedes adoption decisions (Choi & Varian, 2012; Venkatesh et al., 2012). In this sense, search-based indicators may capture early-stage behavioural readiness before observable changes appear in transaction data.

In contrast, the dynamic linkage between QRIS and smart city narratives appears relatively weak. While smart city discourse reflects broader policy-level digitalisation agendas (Rachmawati et al., 2022), digital payment attention is more closely associated with everyday transactional behaviour. This distinction implies that payment system development may operate partly independently from broader digitalisation narratives. For policymakers, particularly Bank Indonesia, this suggests that communication strategies promoting QRIS adoption should emphasize usability, security, and everyday transactional benefits rather than relying solely on broader smart city or digital transformation rhetoric.

From a theoretical standpoint, this study contributes to the digital financial inclusion literature by integrating public attention theory with payment system economics. By conceptualising online search intensity as a proxy for behavioural readiness, the research extends prior work on Google Trends as an economic indicator and situates it within the context of digital payment reform. The findings reinforce the view that attention and information demand represent precursors to adoption rather than outcomes themselves.

From a policy perspective, high-frequency search-based data offer a complementary monitoring tool alongside traditional financial statistics. Unlike transaction volumes or account ownership indicators, which are typically published with reporting lags, Google Trends provides near real-time insights into shifts in public interest. Monitoring spikes and trends in QRIS-related searches may therefore assist authorities in evaluating the immediate public response to policy initiatives and communication campaigns.

Nevertheless, several limitations must be acknowledged. Google Trends data reflect relative search intensity rather than actual usage or transaction values, and search behaviour may be influenced by short-term external events such as media coverage or regulatory announcements. Consequently, the results should be interpreted as indicators of public attention rather than direct measures of financial inclusion outcomes. Future research could integrate search-based indicators with official transaction data, macroeconomic variables, or employ econometric frameworks such as vector autoregression (VAR) to examine dynamic interactions more formally and test causality.

Overall, this study demonstrates that public attention metrics derived from online search data can provide meaningful insights into the evolving dynamics of digital payment systems in emerging economies. By positioning QRIS within Indonesia's broader digital transformation and financial inclusion agenda, the findings highlight the potential importance of behavioural readiness in supporting payment system reforms. Integrating attention-based

indicators into policy monitoring frameworks may enhance the responsiveness and effectiveness of digital financial inclusion strategies in the future.

6. Limitations of Research

This study acknowledges several limitations that should be considered when interpreting the findings.

First, the analysis relies on Google Trends data as a proxy for public attention. While search intensity provides high-frequency insights into information-seeking behaviour, it reflects relative search interest rather than actual usage, transaction volume, or financial inclusion outcomes. Consequently, increases in QRIS-related searches cannot be directly equated with higher levels of digital payment adoption. Public attention represents an early cognitive or behavioural signal, not confirmed behavioural execution.

Second, Google Trends data are scaled from 0 to 100 based on relative popularity within a specified period and region. This normalization prevents direct comparison with absolute search volumes and may limit cross-country or long-term structural comparisons. Additionally, search behaviour may be influenced by short-term external factors such as media coverage, policy announcements, promotional campaigns, or temporary public controversies, potentially generating attention spikes that do not correspond to sustained behavioural change.

Third, the study adopts an exploratory time-series approach using stationarity adjustment, correlation, and lead–lag analysis. While this framework allows identification of dynamic associations, it does not establish causal relationships. The observed temporal ordering between QRIS attention and online service searches should therefore be interpreted as indicative rather than causal. More advanced econometric techniques, such as vector autoregression (VAR), Granger causality testing, or autoregressive distributed lag (ARDL) models, could provide deeper insight into structural dynamics.

Fourth, the observation period (January 2023 to December 2025) may not fully capture longer-term structural shifts in digital payment adoption. Digital financial ecosystems evolve over extended horizons, and behavioural adaptation may exhibit nonlinear patterns beyond the timeframe analysed.

Finally, the study focuses exclusively on Indonesia. While this provides valuable country-specific insights within the context of QRIS and the digital payment reform agenda led by Bank Indonesia, the findings may not be directly generalisable to other emerging economies with different institutional frameworks, regulatory environments, or levels of digital maturity.

Future research could address these limitations by integrating search-based indicators with official transaction data, financial inclusion metrics, or survey-based behavioural measures. Expanding the analysis across multiple countries and employing more advanced econometric modelling would further strengthen the robustness and generalisability of attention-based approaches in digital finance research.

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