The Infrastructure-Formalization Gap: Electronic Payments and Informal Economy Persistence in Algeria

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Abstract

Algeria's informal economy represented between 27.7 and 32.2 percent of GDP as of 2020—a persistently high share that decades of administrative modernization have failed to reduce. Drawing on longitudinal data from Algeria's GIE and the Bank of Algeria (2016–2025), this study identifies a central paradox: despite substantial electronic payment infrastructure growth since 2016, informal activity remains structurally persistent. The most revealing indicator is POS terminal utilization—with approximately 78,774 terminals deployed yet only 10 million annual transactions recorded by 2025—suggesting that merchants maintain nominal compliance while functionally preserving cash-based operations, a divergence this study terms the infrastructure-formalization gap. To close this gap, the study proposes a two-stage policy strategy combining regulatory enforcement targeting deliberate non-compliance with financial inclusion measures targeting passive cash dependency. Durable formalization requires both stages pursued concurrently as infrastructure expansion alone is insufficient.

Keywords: Algeria; Cash displacement; Electronic payments; Formalization; Informal economy.

JEL Classification Codes: E26, E42, G18, H26, L86, O17, O33.

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Introduction

Algeria's informal economy (IE) is a significant issue for policymakers, where it constitutes a persistent structural feature of the country's economic landscape. Moreover, it encompassing unregistered entrepreneurial activities, an undeclared workforce, and a predominantly cash-based transactional infrastructure. According to Aigner et al. (1986) there are several important reasons why policymakers should be concerned about the growth and size of the IE. Among these reasons, if an increase in the size of the IE is mainly caused by a rise in the tax burden, an increased tax rate may lead to a decrease in tax receipts and thus further increase the budget deficit, or if economic policy measures are based on mistaken 'officially measured' indicators (such as unemployment). In such a situation, it leads to quite unreliable officially measured indicators, that even the direction of intended policy measures may be questionable.

The IE provides livelihoods for a substantial share of the population, however, its continued structural entrenchment constrains Algeria's fiscal capacity and limits access to social protection for a large segment of the working population. Therefore, bringing informal activity within the framework of the regulated economy holds the potential to expand fiscal revenues, extend social guarantees, and support more sustainable and inclusive economic development.

On the other hand, in today's rapidly evolving digital landscape, access to information and communication technologies (ICTs) has become an important indicator of a country's economic development strategies. In this context, Algeria's ICT trajectory provides an important enabling context for this analysis. According to the International Telecommunication Union's ICT Development Index (ITU, 2025), Algeria achieved a total IDI score of 86.1 in 2025, surpassing the global average of 78 points across 164 economies. It reflecting meaningful advances in connectivity infrastructure and digital service accessibility across the country. While a high IDI score does not directly measure digital financial behavior, it establishes the foundational connectivity conditions, such as network coverage, device penetration, and basic digital literacy.

As Algeria increasingly embraces digital technologies, the rise of electronic payment (e-payment) as a modern method of business cash transactions triggers the possibility of formalizing the IE through

secure and easily traced methods. Algeria's strong IDI performance therefore representing that the required constraints on e-payment driven formalization are not primarily infrastructural in the narrow connectivity sense, but these contraints are related to behavioral, institutional, and incentive sense. Thus, the critical policy question is not whether Algerians are connected to digital networks, but whether those networks are being leveraged to shift the transactions from cash into formally auditable electronic channels. As e-payment systems produce transaction records that can be cross-referenced by banks, tax authorities, and other regulators, making it structurally more difficult to sustain informal activity once e-transactions reach critical mass.

This study seeks to address two central research questions: What does Algeria's e-payment infrastructure trajectory reveal about the relationship between digital payment expansion and IE formalization? And what policy architecture is required to leverage existing infrastructure investments into meaningful reductions in informal economic activity? The study's core hypothesis is that formalization through e-payment requires a two-stage policy strategy that combining regulatory enforcement targeting deliberate non-compliance with financial inclusion measures targeting passive cash dependency, and that neither stage is effective without the other.

The study aims to (1) analyze the state and evolution of Algeria's e-payment infrastructure. It distinguishes infrastructure deployment from transaction utilization and formalization effect, where these dimensions are frequently conflated in policy discussions; (2) identify and characterize Algeria's infrastructure-formalization gap, which represents the disconnect between ambitious infrastructure investments and persistent informality; and (3) propose a context-specific, two-stage policy response insights in the comparative cash displacement and IE reduction literature in Algeria.

In an attempt to answer the research questions, a descriptive analytical approach is employed, combining quantitative empirical data from administrative sources with a structured review of the relevant theoretical and comparative literature. The research design is non-experimental and does not establish econometric identification of the causal effect of e-payment expansion on informality in Algeria. The study's contribution is therefore best understood as an evidence-informed policy framework rather than a causal empirical study—a positioning

that reflects both the current state of available data and the genuine complexity of the formalization challenge.

The structure of the paper is as follows: first, reviews the theoretical foundations most directly operative in the analysis on the e-payment–informality nexus; second, presents longitudinal data on Algeria's IE scale and e-payment infrastructure, distinguishing infrastructure deployment from transaction utilization and formalization effect; third, develops the two-stage reduction strategy grounded in those empirical findings; fourth, translates the strategy into sequenced policy pathways with institutional assignments and measurable milestones; and concludes with a summary of contributions, study limitations, and directions for future research.

Firstly. Literature Review

This section reviews the key theoretical frameworks of IE research and e-payment adoption, before examining the scholarly debate surrounding their intersection.

1. Theoretical Foundations of Informal Economy Research

There is controversy among scholars regarding the definition of IE. That’s because it’s not limited to monetary transactions or illicit activities, as legitimate activities and non-monetary transactions fall under the label of IE activities. In the context of this study, the IE reflects mostly the legal economic and productive activities that, if recorded, should contribute to the national GDP (Dell’Anno, 2003; Hassan & Schneider, 2016; Medina & Schneider, 2018). This definition is broad enough to encompass legal unregistered activity as well as intentionally evasive activity while remaining tractable for the cash-displacement argument advanced in this paper.

The persistence of informality in developing economies is structurally determined through an interacting set of economic, institutional, and behavioral drivers. Excess tax and social security fees increase the gap between gross labor costs and net returns, incentivizing off-the-books activity (Tanzi, 1999; Dell'Anno, 2007). Regulatory complexity and weak enforcement inflate compliance costs and increase demand for informal alternatives (Johnson et al., 1997; Friedman et al., 2000). Poor governance and corruption undermine public trust in the state leading to compliance collapse (Feld & Frey, 2007; Torgler & Schneider, 2009). For Algeria in particular, this institutional dimension is important to note: the state capacity erosion post-1990s coupled with the

liberalization legacy of a state-directed economy has shaped informal sector participation in ways that economic models of tax evasion cannot fully capture.

The distinction most directly operative within the policy framework developed is Ulyssea's (2018) informal firm taxonomy. The researcher distinguishes between deliberate informality-seeking firms choosing their status to minimize tax and regulatory obligations and passive informal actors in cash-dependent supply chains whose currency-based status reflects habit, limited access to banking, and low digital literacy rather than noncompliance intent. Deterrence-based enforcement is only actionable against deliberate informality-seekers, passive actors necessitate structural displacement of cash as dominant transaction medium. This distinction organizes the two-stage strategy developed in this study and is operationalized for cash economies.

2. Electronic Payment Adoption: Theoretical Frameworks

The adoption of e-payment systems is well theorized within the information systems and digital finance literatures. The Technology Acceptance Model (TAM), proposed by Davis (1989), identifies perceived usefulness and perceived ease of use as the principal determinants of adoption intention. The researcher predecting that e-payment tools are more likely to be adopted when users genuinely perceive them as simpler and more convenient than cash alternatives. The Unified Theory of Acceptance and Use of Technology (UTAUT), developed by Venkatesh et al. (2003), extends TAM by incorporating social influence, facilitating conditions, and performance expectancy. In developing country contexts, facilitating conditions like encompassing infrastructure availability, institutional support, and technical assistance, are frequently identified as the binding constraint on adoption even when attitudinal prerequisites are met (Kabir et al., 2015; Effah, 2016).

This finding is directly relevant to Algeria, where the data presented in the paper demonstrate that infrastructure investment, while substantial, has not generated the behavioral shift toward electronic transactions that formalization requires—precisely because facilitating conditions in their broadest sense, including financial literacy, consumer trust, and merchant incentives, remain underdeveloped.

3. Electronic payment and Informal Economy Nexus

The empirical relationship between e-payment adoption and IE size is documented most rigorously in the European comparative literature. Schneider & Kearney (2011) identify a strong negative correlation

between electronic transaction frequency per capita and the IE's share of GDP across EU member states, and estimate that a 10 percent increase in e-payment usage per capita is associated with an IE reduction of up to 5 percent. Kowal-Pawul & Lichota (2024) similarly find that non-cash payment penetration significantly predicts reduced informal activity, while Aldaas (2021) confirms a positive relationship between e-payment volumes and formal economic growth using global panel data.

Three critical remarks must be noted for the application of this evidence to Algeria's context: (1) the relationship is correlational as more formal economies generating more electronic transactions cannot be excluded without quasi-experimental identification; (2) the European institutional context differs fundamentally from Algeria's in terms of banking system development, governance quality, and tax administration capacity; and (3) the outlier cases of Estonia—exhibiting high e-payment penetration yet substantial informal activity—and Ireland—exhibiting comparatively limited electronic transactions yet a small informal sector—further establish that e-payment penetration is neither sufficient nor strictly necessary for formalization in the absence of complementary institutional development. Consequently, e-payment adoption is one instrument within a multi-component formalization strategy rather than a standalone solution.

Secondly. The Informal Economy and Electronic Payment in Algeria: Current Status

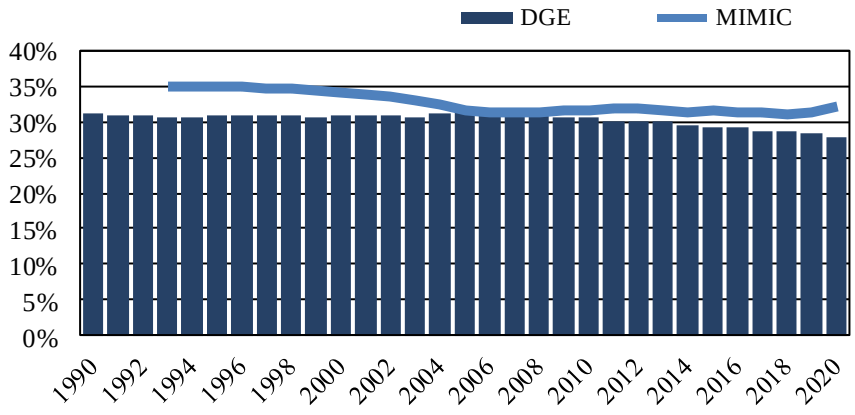
This section examines the scale and persistence of Algeria's IE alongside the current state of its e-payment infrastructure, drawing on available empirical indicators.

1. The Scale and Persistence of Algeria's Informal Economy

Drawing on the cross-national database compiled by Elgin et al. (2021)—which provides IE estimates for 196 countries over the period 1990–2020 using both the Multiple Indicators Multiple Causes (MIMIC) and Dynamic General Equilibrium (DGE) approaches—Algeria's IE emerges as large, persistent, and structurally embedded. At its peak in 1993, MIMIC-based estimates placed Algeria's IE at 34.9 percent of GDP; the DGE model yielded a more conservative estimate of 30.7 percent for the same year, a divergence attributable to structural assumptions about formal-informal sector interactions rather than substantive disagreement about scale (Figure 1). By 2020, both models converge on an estimate of 27.7–32.2 percent of GDP—a reduction

from peak levels, but one that indicates persistent structural informality rather than meaningful formalization progress.

Figure 1. Algeria's Informal Economy as a Share of GDP: DGE and MIMIC Estimates (1990–2020)



Source: Authors' own elaboration based on Elgin et al., 2021.

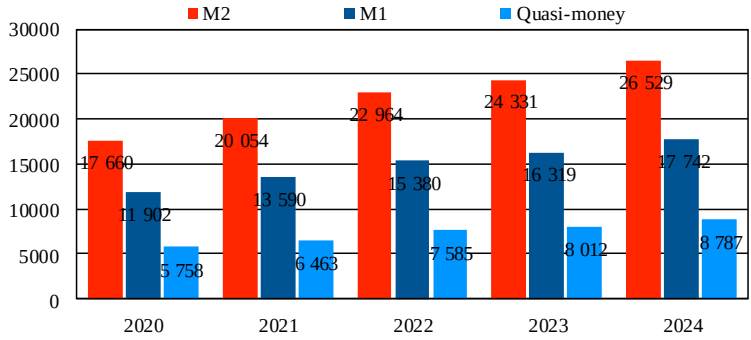
The elevated informality estimates recorded through the early 2000s reflect a convergence of structural conditions. The economic dislocations of the post-1986 oil price shock, including sharp GDP contraction, rising unemployment, and fiscal austerity, pushed a substantial share of economic activity toward informal survival strategies. Simultaneously, the institutional fragility of the 1990s, characterized by weakened state capacity and weaken public trust in regulatory institutions, reduced both the perceived risk of detection and the intrinsic motivation for tax compliance. The weight of the agricultural sector and limited formal entry points for private entrepreneurs in Algeria's largely state-directed economy further entrenched informality as a structural rather than cyclical phenomenon.

The post-2014 decline recorded by both models is consistent with Algeria's administrative modernization efforts during this period, including the digitalization of tax declaration procedures, the streamlining of business registration, and the early expansion of banking infrastructure. The fiscal pressure generated by the 2014 oil price collapse likely strengthened government incentives through enhanced enforcement. This declining trend also coincides with the early stages of Algeria's e-payment expansion, initiated with the launch of the CIB interbank card system in 2016. Whether this co-movement

reflects a causal relationship between e-payment infrastructure and formalization outcomes, or simply a common response to the fiscal shock, cannot be determined from these data alone—a limitation that underscores the need for the causal identification research agenda.

Complementary evidence from monetary aggregate data published by the Bank of Algeria (2025) provides a revealing perspective on the structural cash dependency that sustains informality. Algeria's broad money supply (M2) grew from 17,660 million DA in 2020 to 26,529 billion DA in 2024—a cumulative increase of approximately 50 percent (figure 2).

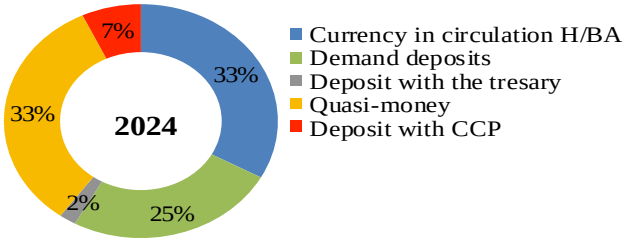
Figure 2. Evolution of Algeria's Money Supply (2020–2024)



Source: Authors' own elaboration based on Bank of Algeria, 2025.

Within this aggregate, currency in circulation outside the banking system alone accounted for 33 percent of total M2 at end-2024 (figure 3)—a share that the Bank of Algeria itself characterizes as a major challenge for financial inclusion. Critically, this component grew suggesting that cash outside the banking system is not merely persistent but actively expanding in absolute terms despite a decade of e-payment infrastructure investment.

Figure 3. Structure of Algeria's Monetary Aggregate M2 (2024)



Source: Authors' own elaboration based on Bank of Algeria, 2025.

Two interpretive cautions apply to these monetary data. First, currency outside the banking system is not synonymous with informal economic activity: remittance flows, precautionary household savings, and transaction costs associated with rural banking access all contribute to elevated cash-to-M2 ratios independently of informality. Second, M2 dynamics also reflect oil revenue cycles, public expenditure patterns, and demographic growth. These monetary figures should therefore be read as indicators consistent with structural cash dependency rather than as direct measures of informal activity—a distinction the paper maintains throughout. They nonetheless establish a monetary fingerprint consistent with the MIMIC/DGE based estimates, and one that the e-payment formalization strategy proposed in the study must confront directly.

2. The Growth of Algeria's Electronic Payment Infrastructure: Status and Analytical Assessment

Algeria's legal framework for e-payment is well established. Article 6 of Law N° 18-05 of May 10, 2018 relating to e-commerce defines e-payment as any legally permitted payment instrument enabling proximity or remote transactions through an electronic system. Article 27 of the same law mandates that consideration in remote commercial transactions be paid electronically. Article 111 of Finance Law N° 17-11 of December 27, 2017 further requires all economic agents offering goods or services to consumers to provide e-payment terminals, enabling card-based payment upon consumer request. This legislative framework establishes mandatory minimum conditions for e-payment acceptance. However, as the data presented demonstrate, legal mandates have proved insufficient to drive behavioral adoption at scale.

The operational governance of Algeria's e-payment ecosystem is coordinated through the Economic Interest Group for Monetary Transactions (GIE), established in June 2014. The GIE's functions encompass standards coordination, electronic banking product guidelines, technical routing platform management, certification, and security overnight. Its 19 member institutions include 18 banks and Algeria Post, with the Bank of Algeria participating in a non-member supervisory role (Table 1). This institutional architecture provides the coordination platform fot the multi-stakeholder alignment that the policy strategy proposed requires.

Table 1. List of banks affiliated with the GIE

Type	Institutions
Public banks	CNEP, CPA, BADR, BDL, BEA, BNA
Private banks	BNP Paribas, Société Générale, Fransabank, Trust, AGB, Albaraka, Essalam, Arab Bank, Natixis, ABC Bank, Housing Bank, HSBC
Post	Algeria Post
Non-member	Bank of Algeria

Source: Authors' own elaboration based on GIE (2025).

Since the official launch of CIB card operations in October 2016, Algeria's e-payment ecosystem has undergone substantial expansion across all infrastructure dimensions. A rigorous assessment requires distinguishing among three analytically distinct dimensions that are frequently conflated in policy discussions: infrastructure deployment, transaction utilization, and formalization effect.

2.1. Payment Cards

Card issuance data reveal a structurally bifurcated expansion. CIB interbank cards grew from 4,022,203 in 2023 to 4,244,542 in 2025, a cumulative increase of just 5.5 percent over two years. This near-stagnation suggests that commercial bank card penetration has approached a ceiling within the currently banked population; further expansion requires reaching the unbanked—precisely the population most associated with informal economic activity. Eddahabia postal cards, by contrast, grew from 12,487,304 in 2023 to 17,655,039 in 2025, a 41.4 percent increase, reflecting the postal network's comparative advantage in reaching peri-urban and rural populations with limited commercial banking access (Table 2).

Table 2. Distribution of CIB and Eddahabia Payment Cards in Algeria (2023–2025)

Year	CIB	Eddahabia
2023	4 022 203	12 487 304
2024	4 239 021	15 605 882
2025	4 244 542	17 655 039

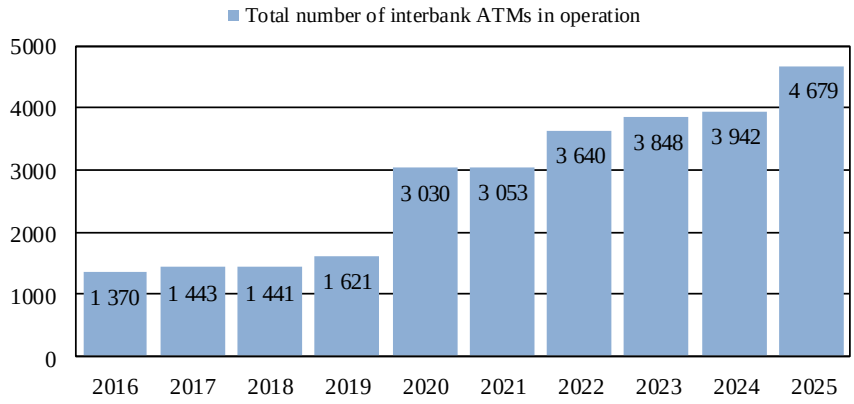
Source: Authors' own elaboration based on GIE (2025).

This divergence reveals a two-speed financial inclusion dynamic. Postal card penetration is advancing where banking penetration has stalled—yet postal cardholders, many of whom use Aleria Post as their primary or sole financial institution, are not necessarily integrated into the formal banking and tax compliance systems that e-payment-driven formalization requires. Inclusion through postal channels is a necessary but insufficient step toward formalization.

2.2. ATM Infrastructure and Withdrawal Activity

The interbank ATM network expanded from 1,370 units in 2016 to 4,679 by 2025, a 241 percent increase reflecting sustained public investment in physical financial access (figure 4). ATM withdrawal activity has grown correspondingly, reaching approximately 235 million transactions annually by 2025.

Figure 4. Growth of the Interbank ATM Network in Algeria (2016–2025)



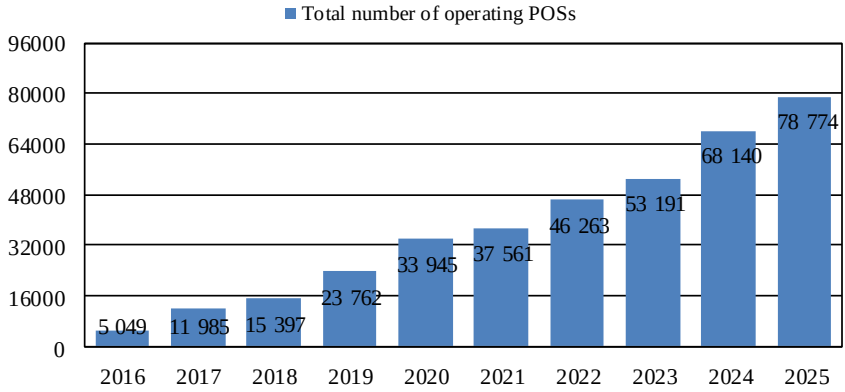
Source: Authors' own elaboration based on GIE (2025).

A critical analytical distinction must be drawn, ATM activity primarily measures cash withdrawal from the banking system rather than e-payment. Rising ATM usage indicates that more Algerians are accessing their bank deposits—but in cash form, which then re-enters the informal cash economy. ATM expansion therefore does not reduce cash circulation, it may facilitate more efficient cash distribution. This interpretation is consistent with the monetary data presented, which shows that currency outside the banking system grew to 33 percent in 2024 despite a decade of ATM network expansion. ATM infrastructure serves financial inclusion but should not be interpreted as a formalization instrument.

2.3. POS Terminal Deployment and Utilization

The POS terminal deployment represents the most impressive infrastructure achievement in Algeria's e-payment story. Operating terminals expanded from 5,049 in 2016 to 78,774 by 2025 (figure 5)—a nearly fifteen-fold increase—reflecting both regulatory pressure under Article 111 of Finance Law 17-11 and growing consumer demand for cashless payment options. POS payment activity reached approximately 10 million transactions annually by 2025.

Figure 5. Expansion of Point-of-Sale Terminals in Algeria (2016–2025)



Source: Authors' own elaboration based on GIE (2025).

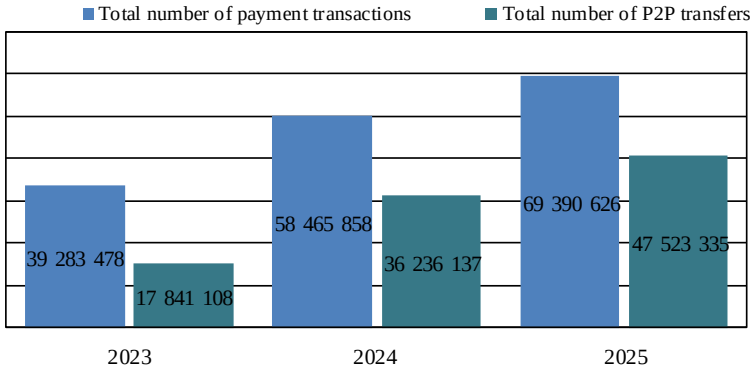
This aggregate figure, however, conceals a utilization paradox that is analytically central to the formalization argument. With approximately 78,774 terminals deployed and roughly 10 million annual transactions, the implied average utilization rate is approximately 127 transactions per terminal per year—the equivalent of roughly one transaction every three days. This extremely low utilization rate strongly suggests that a significant proportion of deployed terminals remain largely inactive, merchants maintain card acceptance capability to satisfy regulatory requirements while continuing to conduct business in cash in practice.

This behavioral pattern is precisely what Ulyssea's (2018) taxonomy identifies as committed informality—nominal compliance masking functional maintenance of cash-based operations to preserve fiscal opacity. The gap between terminal deployment and actual utilization is therefore not merely an operational inefficiency, it is a behavioral signal about the depth of cash preference embedded in Algeria's informal commercial ecosystem.

2.4. Mobile Payment Adoption

Mobile payment activity has exhibited the strongest growth trajectory across all e-payment dimensions. Total payment transactions grew from 39,283,478 in 2023 to 69,390,626 in 2025—a 77 percent increase—while person-to-person (P2P) transfers expanded even more rapidly, from 17,841,108 to 47,523,335 over the same period, a 166 percent increase (figure 6). By 2025, P2P transfers represented approximately 68.5 percent of total mobile payment activity.

Figure 6. Mobile Payment Transactions and P2P Transfers in Algeria (2023–2025)



Source: Authors' own elaboration based on GIE (2025).

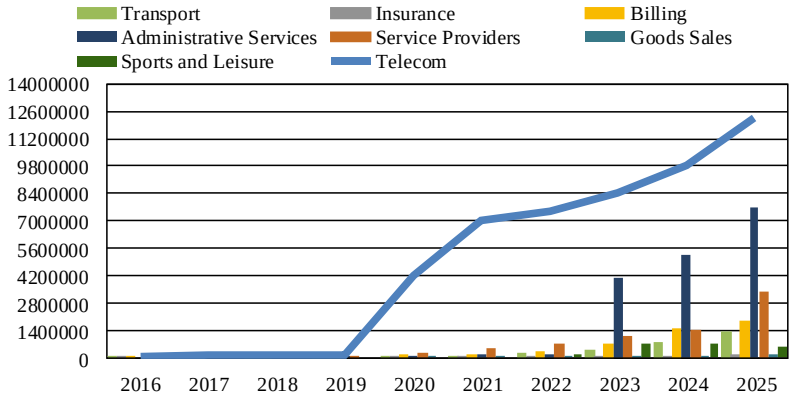
The dominance of P2P transfers within mobile payment activity warrants careful analytical attention. P2P transfers, while electronically traceable in principle, do not necessarily bring informal commercial transactions into formally auditable channels. The financial relationships between individuals are digetize without formalizing the underlying economic activities that generate those flows. The rapid growth of P2P transfers may therefore reflect the digitization of informal financial networks rather than their formalization. This insight—that the most dynamic segment of Algeria's e-payment growth is also the segment least directly connected to formalization—is one of the paper's most analytically significant findings. It suggests that current mobile payment growth metrics substantially overstate formalization progress, and that policy should focus on incentivizing commercial rather than personal mobile payment use.

2.5. Internet Payment Activity and Sectoral Concentration

Internet payment transactions have grown substantially since 2016, with telecommunications remaining the dominant sector through 2025. Administrative services have emerged as a significant secondary

category, consistent with the government's push toward digital public service delivery (figure 7).

Figure 7. Internet Payment Activity by Sector in Algeria (2016–2025)



Source: Authors' own elaboration based on GIE (2025).

However, the sectoral distribution of internet payments reveals a critical structural gap. The sectors most associated with informal economic activity in Algeria such as small-scale retail, agriculture, construction, informal services, and street commerce, remain almost entirely absent from the internet payment transaction data. E-payment adoption has been most successful in sectors that were already substantially formal prior to digitalization, it has made minimal inroads into the informal sectors that constitute this paper's primary policy concern.

2.6. Synthesis: The Infrastructure-Formalization Gap

The dimensions above point toward a common conclusion: (1) the growth in card issuance has plateaued within the commercially banked population; (2) ATM expansion is facilitating more efficient cash distribution rather than displacing cash use; (3) POS terminal usage is still far below deployment levels; (4) the growth in mobile payments is concentrated in P2P transfers rather than commercial transactions; and (5) internet payments are still almost entirely confined to already-formal sectors. Together, these particular patterns can be understood as an infrastructure form but also constitute what this paper terms Algeria’s infrastructure formalization gap. It is a substantial e-payment infrastructure that has not produced proportional reductions in informal economic activity.

However, the gap should not be interpreted as a failure of investment. Algeria's infrastructure trajectory since 2016 compares favorably to regional peers. The CIB-Eddahabia interoperability introduced in 2020, for example, is a meaningful structural advance. The gap instead reflects behavioral, institutional, and incentive-related constraints and barriers, which no amount of deployed terminals or issued cards can solve as a standalone investment. Infrastructure is a necessary but insufficient condition for formalization. The policy strategy developed in the next section is designed to address complementary dimensions like the need for behavioral change, regulatory enforcement, and financial literacy, specifically, and that the infrastructure data reveal to be missing.

Thirdly. A Two-Stage Strategy for Reducing Algeria's Informal Economy

This section proposes a sequenced policy framework that distinguishes between deliberate informal actors and those passively dependent on cash, prescribing targeted interventions for each. The strategy combines regulatory enforcement with e-payment promotion as complementary tools for advancing IE formalization in Algeria.

1. From Empirical Gaps to Policy Design

The infrastructure-formalization gap discussed has direct implications for policy design. Three previous findings are instructive. To begin with, the extremely low POS utilization rate suggests the presence of acute deliberate evaders; these actors respond only to credible regulatory pressure, not financial incentives or awareness campaigns. Second, the dominance of P2P transfers within mobile payment growth, and the near-complete absence of high-informality sectors from internet payment data, suggest that passive informal actors are not all evaders; many are merely cash-dependent due to limited access and low digital literacy, two constraints requiring structural displacement of cash as the default transaction medium. Third, the monetary data, with currency outside the banking system representing 33 percent of M2, indicate that together it constitute a large and currently expanding target for formalization policy.

These findings map motivate a two-stage policy strategy. While stage one targets deliberate evaders through regulatory enforcement and institutional reform, stage two targets passive informal actors through e-payment promotion, financial inclusion, and digital literacy development. Critically, both stages must be pursued concurrently: enforcement without financial inclusion risks driving informal actors

toward deeper concealment rather than formalization, while financial modernization without regulatory credibility risks creating an additional unmonitored digital channel in an already fragmented transactional landscape.

2. The Cash-Informality Nexus

Cash transactions constitute the operational backbone of the IE because they are anonymous, untraceable, and generate no auditable record (Schneider & Kearney, 2011). E-payment systems, by contrast, produce transaction data accessible to financial institutions, tax authorities, and regulators—making it structurally more difficult to sustain informal activity once electronic transactions become the transactional norm. The formalization effect of e-payment therefore operates not primarily through enforcement but through the architectural displacement of cash as the default medium of exchange. This displacement logic provides the theoretical foundation for both stages of the strategy that follows.

3. Stage One: Regulatory Enforcement Targeting Deliberate Non-Compliance

The first stage targets actors who consciously maintain cash-based operations to evade fiscal and regulatory obligations. The behavioral evidence for this population's existence is clear: a POS utilization rate of approximately one transaction per terminal every three days is consistent with nominal compliance masking functionally cash-based commercial practice.

Policy instruments likely to be effective against this segment include enhanced tax audit capacity targeting small and medium enterprises with high cash turnover; mandatory real-time transaction reporting for merchants above defined turnover thresholds; simplified and transparent tax regimes that reduce compliance costs; and sanctioning mechanisms calibrated to perceived detection probability rather than sanction severity alone. The fiscal compliance literature consistently finds that audit probability is a more powerful behavioral deterrent than sanction magnitude, making investment in cross-referencing and information systems a higher-return intervention than simply increasing penalties (Andreoni et al., 1998).

Two implementation cautions apply specifically to the Algerian context. First, enforcement credibility is conditional on institutional quality: tax administration capacity, judicial reliability, and anti-corruption measures are prerequisites for effective enforcement, not its

products. Introducing enforcement pressure before these preconditions are met risks arbitrary rather than rule-based compliance—an outcome likely to deepen distrust of the regulatory apparatus rather than reduce it (Johnson et al., 1998; Dreher & Schneider, 2010). Second, enforcement should not precede the financial inclusion investments of stage two in any given sector or region: penalizing cash use before electronic alternatives are genuinely accessible is both inequitable and counterproductive. A practical threshold for expanding stage one enforcement coverage would be evidence that POS utilization rates in a given sector have reached a minimum level of active use, indicating that the behavioral infrastructure for enforcement-based pressure is sufficiently in place.

4. Stage Two: E-Payment Promotion Targeting Passive Cash Dependency

The second stage addresses actors whose cash dependence reflects habit, limited banking access, or low digital literacy rather than deliberate evasion. Reaching this population requires structural displacement of cash as the default transaction medium through a combination of infrastructure expansion, financial incentives, and awareness development—not enforcement.

The European comparative evidence offers directional guidance on potential formalization effects, though it must be applied with care. Schneider and Kearney (2011) estimate that a 10 percent increase in e-payment usage per capita is associated with an IE reduction of up to 5 percent across EU member states. This relationship is correlational, not causal, and the European institutional context with developed banking systems, strong tax administration, high governance quality, differs substantially from Algeria's context. The estimated elasticities are therefore best understood as an upper-bound illustration of the formalization potential of sustained e-payment promotion, rather than as a transferable projection. The outlier cases of Estonia and Ireland further establish that e-payment penetration is neither sufficient nor strictly necessary for formalization in the absence of complementary institutional development.

Stage Two for Algeria requires targeted action on four fronts. First, expanding mobile banking access in underserved peri-urban and rural areas through the Algeria Post network—leveraging its demonstrated reach, as evidenced by 41.4 percent growth in Eddahabia postal card issuance between 2023 and 2025 compared to just 5.5 percent growth in CIB commercial bank cards over the same period. Second, designing

time-limited financial incentive mechanisms—including tax rebates for merchants reporting a minimum proportion of cashless transactions and cashback mechanisms for e-payment users—with sunset clauses and pre-registered outcome evaluations to generate the causal evidence base currently absent from the literature. Third, developing targeted financial literacy programs that build practical digital payment competence and trust among merchants and consumers in informal economic environments. Fourth, creating regulatory incentives that direct mobile payment growth toward commercial rather than personal transactions, addressing the P2P dominance. The effectiveness of each instrument should be understood as conditional on Algeria's institutional trajectory rather than assumed from cross-country evidence alone.

Fourthly. Policy Pathways: Sequencing, Institutional Responsibilities, and Measurable Milestones

This section translates the analytical framework into five interconnected action areas, specifying the responsible institutions, implementation sequence, and measurable milestones against which progress can be assessed.

1. Regulatory and Enforcement Environment

Responsibility: Ministry of Finance, Tax Authority, and Bank of Algeria. Cross-referencing capacity between merchant transaction data and declared turnover must be operational before audit-based enforcement is deployed. Anti-corruption measures and judicial reliability improvements must accompany—not follow—regulatory reform; without these, enforcement credibility cannot be established regardless of the formal framework (Johnson et al., 1998; Dreher & Schneider, 2010).

Milestone: POS utilization rate of at least one transaction per terminal per day in a target sector, indicating sufficient behavioral embedding of e-payment to make enforcement-based pressure on cash holdouts effective rather than arbitrary.

2. E-Payment Infrastructure Reorientation

Responsibility: GIE, Bank of Algeria, Algeria Post, and Ministry of Finance. The priority reorientation is from coverage metrics toward formalization-relevant deployment. POS terminal subsidization should target small and micro enterprises in high-informality sectors rather than sectors already substantially formal. The Algérie Poste network should serve as the primary distribution channel for mobile banking expansion

in rural and peri-urban areas. Fintech providers should be actively encouraged, through regulatory sandboxes and licensing reform, to develop low-cost QR-code payment solutions accessible to merchants without dedicated POS hardware.

Milestone: Reduction in the proportion of POS terminals recording zero transactions in a rolling 30-day window, tracked quarterly by GIE.

3. Financial Incentive Design

Responsibility: Ministry of Finance, in coordination with the Bank of Algeria and GIE. Incentives should be time-limited, tied to measurable formalization milestones, and designed to avoid permanent fiscal distortions (Bennihi et al., 2021). A pilot portfolio could include tax rebates for merchants who adopt POS terminals and report a minimum proportion of cashless transactions; cashback mechanisms for consumers using e-payment at participating merchants; and simplified compliance regimes as transitional incentives for informal businesses formalizing voluntarily. All incentive programs should be subject to pre-registered impact evaluations to generate the causal evidence base that the current literature on Algeria's IE lacks.

Milestone: Share of participating merchants maintaining active POS utilization above the one transaction per day threshold after incentive withdrawal—a test of behavioral persistence rather than incentive-driven compliance.

4. Financial Literacy and Consumer Trust

Responsibility: Bank of Algeria, GIE, Ministry of Education, and community organizations. Currency outside the banking system representing 33.53 percent of M2 (Bank of Algeria, 2025) provides a quantitative indicator of the behavioral inertia that awareness campaigns must overcome. Campaigns—informed by successful precedents in comparable economies, including the Albanian experience documented by EY (2019)—should prioritize three objectives: explaining e-payment mechanisms and their security properties; demonstrating concrete cost and convenience advantages over cash for both merchants and consumers; and building practical digital payment competence in non-urban and low-literacy populations. Campaigns should be co-designed with local community organizations and adapted to regional contexts, drawing on comparable initiatives in Algeria. Consumer protection frameworks and accessible dispute resolution mechanisms are prerequisites for sustained adoption: trust-building must address

legitimate fraud and data security concerns, not merely assert their absence.

Milestone: Consumer survey-based trust index for e-payment platforms, administered biannually in urban, peri-urban, and rural areas.

5. Multi-Stakeholder Coordination

Responsibility: GIE (coordination lead), with mandatory participation of Bank of Algeria, Ministry of Finance, Ministry of Commerce, Algeria Post, commercial banks, and fintech sector representatives. The GIE's existing coordination mandate provides a natural platform for multi-stakeholder alignment, but its remit should be formally extended to include formalization outcome monitoring alongside its current infrastructure and standards functions. Sector specific formalization strategies, particularly for agriculture and small-scale retail, which consistently identify as the largest contributors to Algeria's structural informality, should be developed through sectoral consultations ensuring that incentives are calibrated to the real operating conditions of informal actors rather than formal sector behavioral norms.

Milestone: Annual formalization progress report published jointly by GIE and the Bank of Algeria, disaggregated by sector and region, with standardized indicators enabling longitudinal comparison.

Conclusion

This paper has examined the role that e-payment systems can play in formalizing Algeria's IE, which MIMIC/DGE based estimates place at between 27.7 and 32.2 percent of GDP as of 2020, down from a peak of 34.9 percent in 1993 (Elgin et al., 2021). Drawing on longitudinal administrative data from the GIE Monétique and the Bank of Algeria through 2025, and situating Algeria within the comparative literature on the e-payment–informality nexus, the analysis establishes three principal findings.

First, Algeria's e-payment infrastructure has expanded substantially since 2016 across all dimensions—ATM networks, POS terminals, mobile payments, and card issuance—with acceleration following the CIB-Eddahabia interoperability introduced in 2020. This expansion is a necessary precondition for the formalization pathway proposed in this study. Yet the data reveal a significant infrastructure-formalization gap: deployment metrics have not translated proportionally into transaction utilization, and transaction growth is concentrated in segments—P2P

mobile transfers and already formal sectors—with limited direct formalization effect.

Second, the comparative literature robustly supports a negative relationship between e-payment penetration and IE size. This relationship is, however, conditional on complementary institutional quality, governance capacity, and behavioral change. E-payment expansion operates most effectively as one component of a multi-instrument policy architecture rather than as a standalone formalization mechanism.

Third, formalization through e-payment requires a two-stage policy strategy in which both stages must be pursued concurrently. Stage one targets deliberate evaders through regulatory enforcement, enhanced audit capacity, and institutional reform, while stage two targets passive informal actors whose cash dependence reflects habit, limited banking access, and low digital literacy. Simultaneously, neither stage is sufficient alone: enforcement without complementary financial inclusion risks driving informal actors toward deeper concealment, and financial modernization without regulatory credibility risks creating an additional unmonitored digital channel. The institutional preconditions for stage one credibility must develop in parallel with the financial inclusion investments of stage two. Therefore, both stages require monitoring through pre-registered outcome metrics to build the causal evidence base that the literature on Algeria's IE currently lacks.

In sum, achieving the IE's formalization potential that e-payment infrastructure makes structurally possible requires more than continued investment in terminals, cards, and connectivity. It requires sustained regulatory reform, coherent inter-institutional coordination, and behavioral policy instruments calibrated to the distinct motivations of deliberate and passive informal actors pursued with the commitment and institutional continuity that durable structural change demands.

This study carries limitations that qualify its findings (1) the analysis is descriptive and comparative and does not establish econometric identification of the e-payment effect on Algerian informality; (2) the MIMIC and DGE estimates vary in methodology and cannot distinguish passive from deliberate informal actors with the precision that sector-specific policy design requires; and (3) the comparative evidence reflects institutional contexts that differ substantially from Algeria's, limiting the direct transferability of estimated elasticities.

For future research, three directions follow from these limitations (1) rigorous country-level analysis using panel or quasi-experimental methods—exploiting the growing longitudinal variation in GIE sectoral transaction data—to estimate the causal effect of e-payment expansion on formal economic activity; (2) qualitative and survey-based research into the adoption barriers and motivations of informal operators in agriculture, small-scale retail, and construction, to generate the granular understanding required for effective sector-specific intervention design; and (3) comparative research situating Algeria alongside other MENA economies at similar stages of e-payment development, to identify which institutional complementarities are most consequential for formalization in the region.

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