

POLYMER BANKNOTES, TAX TRANSPARENCY AND ECONOMIC GROWTH: EMERGING IMPLICATIONS FOR INDIA UNDER GST 2.0

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Abstract : India's financial and tax architecture is undergoing a continuing process of technological and institutional transformation. The evolution of Goods and Services Tax (GST), particularly the next-generation reform agenda associated with “GST 2.0”, seeks to simplify taxation, improve compliance, strengthen formalisation and enhance the transparency of economic transactions. At the same time, cash remains an important component of India's payment ecosystem, making the design, durability and security of banknotes economically relevant. This paper examines the emerging implications of polymer banknotes in India and develops a conceptual link between currency innovation, tax transparency and economic growth. Polymer banknotes can offer greater durability, enhanced security possibilities and potentially lower replacement requirements over their lifecycle. India's earlier policy experience is significant: the Government announced a field trial of one billion ₹10 polymer-substrate banknotes in five cities, primarily to extend banknote life. International evidence also suggests that polymer notes can have environmental and lifecycle advantages under suitable production and end-of-life conditions. The paper argues that polymer banknotes should not be viewed as a direct instrument of GST collection. Rather, they may complement GST-led formalisation by improving the efficiency and integrity of the physical-cash ecosystem while digital tax systems improve transaction-level traceability. Using secondary sources from the Reserve Bank of India, Government of India, GST Council, IMF and related literature, the paper proposes an integrated framework connecting currency efficiency, financial transparency, tax formalisation and sustainable economic growth. The study concludes with policy recommendations concerning pilot testing, lifecycle costing, recycling infrastructure, accessibility, security, public communication and coordination between currency-management and tax-policy institutions.

Keywords : Polymer banknotes; GST 2.0; tax transparency; economic growth; financial formalisation; currency management; counterfeit risk; sustainability; India.

1. Introduction

Currency is often discussed as a monetary instrument, but it is also an important component of economic infrastructure. Banknotes have to be produced, distributed, authenticated, sorted, transported, stored, replaced and ultimately withdrawn from circulation. Consequently, the material used for banknotes can affect operational costs, durability, security, environmental performance and the efficiency of the cash ecosystem. In a large and diverse economy such as India, these considerations are particularly important because cash continues to coexist with rapidly expanding digital payments. The Reserve Bank of India (RBI) has the statutory role of issuing banknotes, while the design, form and material of banknotes are subject to the legal and institutional framework governing currency management. RBI explains that it

estimates denomination-wise currency requirements and manages the circulation of fit notes while withdrawing and destroying soiled and mutilated notes. This makes banknote lifecycle management an important public-policy function (Reserve Bank of India [RBI], 2025).

Polymer banknotes have attracted international attention because they can be more durable than conventional cotton-based paper notes and can incorporate security features such as transparent windows and other machine-readable or visually verifiable elements. The International Monetary Fund (IMF) notes that polymer notes have been adopted in a number of countries and that life-cycle assessments in some jurisdictions have found advantages relating to durability, energy use and environmental impact (Wang, 2016). These findings cannot be transferred mechanically to India because

outcomes depend on local production, transportation, recycling and disposal conditions; nevertheless, they provide a useful basis for policy evaluation.

India has already examined polymer currency. In December 2012, the Government announced a field trial involving one billion ₹10 banknotes on polymer substrate in five cities. The stated primary objective was to increase the life of banknotes, rather than to treat polymer as a stand-alone anti-counterfeiting solution (Press Information Bureau [PIB], 2012). A subsequent 2013 Government statement identified Kochi, Mysore, Jaipur, Bhubaneswar and Shimla as the five trial locations and noted that polymer could also help in combating counterfeiting (PIB, 2013). In 2017, the Government again announced approval for procurement of plastic substrate and a field trial at five locations (PIB, 2017). These episodes demonstrate that polymer currency has been part of India's policy discussion for more than a decade.

The GST dimension provides a second, apparently separate, policy domain. GST was introduced to create a more integrated indirect-tax structure, reduce cascading and facilitate a common national market. The GST Council describes the regime as having reshaped India's tax landscape and emphasises continued policy evolution through amendments and system reforms. The next-generation reform agenda announced in 2025 included structural reforms, rate rationalisation and ease-of-living measures, with a stated emphasis on simplification, transparency and strengthening the formal economy (GST Council, 2025a, 2025b).

This paper therefore asks a broader question: can innovation in physical currency management complement the transparency and formalisation objectives of India's evolving GST architecture? The paper does not claim that polymer banknotes directly increase GST revenue. Instead, it proposes that physical-currency innovation and tax-system digitisation can be viewed as complementary elements of a wider financial-infrastructure strategy.

2. Background and Policy Context

2.1 Polymer banknotes

Polymer banknotes are produced using a thin polymer substrate rather than conventional cotton-based banknote paper. Their physical characteristics can provide resistance to moisture and soiling and can increase note longevity. Their security architecture can include transparent areas, specialised printing and other features that are difficult to reproduce. However, security outcomes depend on the complete design and authentication system rather than on the substrate alone.

The economic rationale for polymer currency is closely connected with the lifecycle of a banknote. If a polymer note remains fit for circulation longer than a comparable paper note, fewer replacement notes may be required over a given period. Potential savings may arise in printing, transportation, sorting and destruction, although the initial procurement cost of polymer substrate may be higher. Therefore, an appropriate

comparison should be based on lifecycle cost rather than only the cost of printing one note.

2.2 India's experience with polymer currency

The 2012 Government announcement is especially relevant to the Indian context. It stated that one billion ₹10 notes on polymer substrate were to be introduced on a field-trial basis in five cities, with the primary objective of extending banknote life. The Government also reported that an environmental assessment commissioned through The Energy and Resources Institute (TERI) found polymer notes more environmentally friendly than paper-based currency under the study's assessment (PIB, 2012).

In 2014, the Government reiterated that the proposed replacement decision would depend on the outcome of the field trial. In 2017, it again announced a field trial and approval for procurement of plastic substrate. These policy developments suggest that India has approached polymer currency as a technology requiring empirical testing rather than as an automatic replacement for existing notes (PIB, 2014, 2017).

2.3 GST and the next-generation reform agenda

The term "GST 2.0" is used in this paper as an analytical label for the next-generation phase of GST reform rather than as a separate tax enacted under that exact statutory name. In 2025, the GST Council considered a reform agenda involving structural reforms, rate rationalisation and ease of living. The 56th GST Council meeting subsequently recommended a simplified rate structure centred on a standard rate of 18 percent and a merit rate of 5 percent, alongside a special demerit rate for selected goods and services (GST Council, 2025a).

The GST Council's reform agenda also included technology-driven registration, pre-filled returns, faster automated refunds and measures intended to reduce compliance friction. These developments are relevant to tax transparency because they shift the tax system towards data-enabled compliance, standardised reporting and reduced manual intervention (GST Council, 2025b).

3. Review of Literature

The literature on polymer currency is primarily concerned with durability, security, environmental impact, public acceptance and lifecycle cost. Wang (2016), writing for the IMF, summarised evidence from countries such as Canada and reported that polymer notes could last more than twice as long as paper notes. The article also discussed lower energy requirements and global-warming potential in the specific lifecycle assessment considered. The implication is that the economic value of polymer currency should be assessed across its entire lifecycle rather than solely through production cost.

Earlier research on banknote design also emphasised durability as a key consideration. Banknotes deteriorate through handling, climatic conditions, soiling and physical damage. Polymer substrates can therefore be particularly relevant in hot and humid environments, although local evidence is essential before making a national policy decision (International Monetary Fund, 1995).

The tax literature, in contrast, has generally examined GST through compliance, revenue mobilisation, tax administration, formalisation and transaction reporting. India's GST architecture has progressively incorporated technology-driven processes, including electronic filing and invoice-related systems. The GST Council has described the system as a foundation for a seamless national market and has continued to revise it in response to operational challenges (GST Council, 2026).

A gap emerges between these two strands of research. Studies of polymer currency rarely connect banknote technology with tax transparency, while GST studies generally focus on taxation and digital transaction systems without considering the continuing economic role of physical currency. This paper addresses this gap by developing a conceptual framework in which secure and durable physical currency coexists with digitally enabled tax transparency.

4. Research Gap

Three gaps are identified. First, the Indian discussion on polymer banknotes has largely centred on durability, security and environmental considerations, with limited attention to how currency innovation fits into the broader formalisation of the economy. Second, GST reform discussions concentrate on tax administration, rate structures, compliance and digitisation, but physical cash remains an important part of the economic ecosystem. Third, there is limited conceptual work connecting currency lifecycle efficiency with tax transparency and economic growth. This paper responds to these gaps by integrating the physical and digital dimensions of India's financial infrastructure.

5. Research Objectives

To examine the potential economic and operational advantages of polymer banknotes in India.

To compare polymer and conventional paper banknotes in terms of durability, security, lifecycle cost and environmental considerations.

To examine the role of GST reforms in improving tax transparency, formalisation and compliance.

To develop a conceptual relationship between currency innovation, tax transparency and economic growth.

To identify policy and implementation challenges associated with possible polymer-banknote adoption in India.

To propose policy recommendations for integrating currency innovation with India's broader financial and tax-modernisation agenda.

6. Research Questions

What are the potential lifecycle and operational benefits of polymer banknotes for India?

How can polymer banknotes improve the resilience and security of the physical-cash ecosystem?

How does the next-generation GST reform agenda contribute to tax transparency and formalisation?

Can polymer currency and GST digitisation be treated as complementary elements of financial infrastructure?

What policy safeguards are required before any large-scale introduction of polymer banknotes?

7. Methodology

The study adopts a qualitative, exploratory and conceptual research design based primarily on secondary data. The analysis draws upon official publications and policy documents of the RBI, Government of India and GST Council, together with international evidence published by the IMF and relevant academic and institutional literature. The study does not claim a causal relationship between polymer currency and GST revenue. Instead, it evaluates plausible transmission channels through which currency efficiency and tax transparency may jointly influence economic efficiency.

The analytical method consists of comparative review, policy analysis and conceptual synthesis. Polymer and paper banknotes are compared across durability, lifecycle cost, security, environmental considerations and operational implications. GST reforms are assessed through the dimensions of digital compliance, formalisation, data integration, ease of doing business and tax transparency. The two domains are then integrated into a proposed framework linking financial infrastructure to economic growth.

For future empirical research, the framework could be tested using panel data across Indian states or time-series data covering currency-in-circulation indicators, banknote replacement expenditure, GST collections, registered taxpayers, e-invoice adoption, digital-payment volumes and selected macroeconomic indicators. Such a study could employ correlation, regression, difference-in-differences or structural-equation approaches where appropriate data are available.

8. Comparative Analysis: Polymer versus Paper Banknotes

Dimension	Polymer banknotes	Conventional paper/cotton banknotes
Durability	Generally higher resistance to moisture, soiling and physical wear; often longer service life.	More vulnerable to moisture, soiling and wear depending on note quality and circulation conditions.
Lifecycle cost	Potentially	Potentially lower unit

	higher initial substrate cost but potentially fewer replacement cycles.	production cost but more frequent replacement for heavily circulated denominations.
Security	Can incorporate transparent windows and specialised security elements.	Can incorporate sophisticated security features, but the substrate differs.
Environmental impact	Potential lifecycle benefits where durability and recycling systems are effective; outcome is location-specific.	Established production and disposal systems, but repeated replacement creates material and energy requirements.
Handling	Water-resistant and relatively cleanable; tactile characteristics differ from paper.	Familiar handling characteristics and established sorting infrastructure.
Recycling/end-of-life	Requires appropriate collection and recycling infrastructure.	Established destruction/disposal processes but may involve shredding and disposal.
Policy risk	Requires investment in substrate supply, public adaptation and recycling systems.	Existing domestic production and operational ecosystem reduces transition risk.

9. Tax Transparency under GST 2.0

Tax transparency refers broadly to the availability, consistency and reliability of information required for taxpayers and authorities to understand, report, verify and administer tax liabilities. In GST, transparency is supported by digital registration, electronic return filing, invoice-level information, automated processes and data-based risk management. The objective is not simply to collect more tax but to create a tax environment in which legitimate businesses face clearer rules and authorities have better information for compliance management.

The next-generation GST reform agenda announced in 2025 emphasised structural reform, rate rationalisation and ease of living. The GST Council also highlighted technology-driven

registration, pre-filled returns and faster automated refunds. These measures have the potential to reduce compliance costs and manual intervention while improving the quality of tax data (GST Council, 2025b).

An important conceptual distinction is necessary. Digital tax transparency does not mean that all transactions must become cashless. Cash and digital payments can coexist. A cash payment can be part of a taxable transaction even when the payment itself does not generate an electronic payment trail. GST transparency therefore depends on invoicing, registration, reporting and verification mechanisms rather than simply on the physical form of payment.

This distinction strengthens the argument of the present paper. Polymer banknotes should not be presented as a mechanism for tracing cash transactions. Instead, their potential contribution lies in improving the physical-currency infrastructure, while GST systems provide the transaction and tax-data infrastructure. The two can be complementary without being causally identical.

10. Conceptual Framework

The proposed framework contains five stages. Stage 1 is currency innovation: adoption of a more durable and secure banknote substrate. Stage 2 is currency-system efficiency: potentially fewer replacements, lower handling requirements over the lifecycle and improved note quality. Stage 3 is financial-system integrity: stronger authentication and reduced opportunities associated with worn or difficult-to-authenticate notes. Stage 4 is tax-system transparency: GST digitisation, invoice reporting, data matching and formalisation. Stage 5 is economic outcome: lower administrative friction, improved resource allocation, stronger confidence in financial infrastructure and potentially higher sustainable economic efficiency.

The relationship can be expressed conceptually as follows:

Polymer Currency Innovation → Currency Efficiency & Security



Financial Infrastructure Quality ← GST Digitalisation & Tax Transparency



Economic Formalisation → Compliance Efficiency → Sustainable Economic Growth

11. How Polymer Banknotes Could Complement GST 2.0

11.1 Lower replacement pressure

If polymer notes have a longer effective circulation life, heavily used denominations may require fewer replacement cycles. This could reduce some elements of currency-management expenditure. The effect would depend on denomination, circulation intensity, climate, handling practices and the actual service life achieved in India.

Therefore, a pilot should measure the cost per useful circulation-year rather than only the cost per note.

11.2 Improved physical-currency integrity

A currency system with durable and readily authenticated notes can support confidence in cash transactions. Polymer should not be regarded as automatically eliminating counterfeiting; security effectiveness depends on the entire feature set and on authentication practices. Nevertheless, polymer substrates can enable particular security features and may provide a useful additional layer of protection.

11.3 Complementarity with digital tax records

GST systems increasingly depend on electronic information, while cash remains part of the payment ecosystem. This creates a hybrid economy in which a transaction may involve physical cash but still be represented in an invoice, accounting record or tax return. The policy objective should therefore be interoperability between physical and digital financial infrastructure rather than an assumption that one will replace the other.

11.4 Formalisation and compliance

GST formalisation can encourage businesses to maintain records, issue invoices and participate in the formal tax network. Secure and durable currency can support the cash component of these businesses' operations. The combination can be particularly relevant for micro and small enterprises that may continue to accept cash while progressively adopting digital accounting, invoicing and payment systems.

11.5 Economic growth

The expected growth effect is indirect. More efficient currency management can release administrative and financial resources, while improved GST compliance can strengthen public revenue and reduce distortions associated with tax evasion. If additional public resources are efficiently invested in infrastructure, health, education and productive capacity, the wider economy can benefit. However, these outcomes depend on policy quality and cannot be attributed to polymer currency alone.

12. Environmental and Sustainability Considerations

Environmental evaluation is central to any polymer-banknote policy because polymer is a form of plastic-based material. The argument for sustainability must therefore be based on lifecycle analysis rather than on the assumption that "plastic" is inherently environmentally superior. The IMF's discussion of polymer notes cites a Canadian life-cycle assessment in which polymer outperformed paper in several assessed categories and notes that longer life can reduce the number of notes required over time (Wang, 2016).

For India, a national assessment should incorporate domestic manufacturing, transport distances, electricity sources,

printing technology, note-sorting infrastructure, collection rates, recycling pathways and end-of-life treatment. The policy should also examine whether retired polymer notes can be recovered into usable secondary materials. A circular-economy approach would strengthen the sustainability case. Accessibility should be included in sustainability and social-impact assessment. Any change in substrate should preserve tactile and visual features needed by persons with visual impairments and should maintain compatibility with ATMs, cash-processing machines and other equipment.

13. Challenges and Risks

Higher initial transition and substrate-procurement costs compared with established paper-based systems.

Need for large-scale lifecycle evidence under India's varied climatic and circulation conditions.

Compatibility requirements for ATMs, note counters, sorting machines and cash-handling equipment.

Need for reliable domestic or diversified supply chains for specialised polymer substrate and security inputs.

Public adaptation to differences in texture, folding, durability and handling.

Environmental risks if collection and recycling systems are inadequate.

Possibility of overestimating anti-counterfeit benefits if security design and public authentication practices are not strengthened simultaneously.

Need to protect accessibility and usability for all sections of the population.

Potential confusion if policy communication does not clearly explain the relationship between polymer currency, digital payments and GST.

14. Policy Recommendations

Adopt a phased, evidence-based approach rather than an immediate nationwide conversion.

Begin with a controlled pilot involving selected high-circulation denominations and geographically diverse locations.

Measure lifecycle cost per circulation-year, not only the purchase or printing cost per note.

Conduct an India-specific life-cycle assessment covering production, logistics, circulation and end-of-life recycling.

Upgrade sorting, authentication and ATM/cash-processing equipment before large-scale adoption.

Design polymer notes with strong accessibility features, including tactile and high-contrast elements.

Develop an end-of-life collection and recycling framework before national deployment.

Continue investing in security features and public education; polymer should be one component of a broader security strategy.

Coordinate currency-management policy with financial-inclusion, digital-payment and GST-system objectives without treating cash as inherently non-transparent.

Create a public dashboard or periodic report on pilot outcomes, including cost, lifespan, counterfeit detection, public acceptance and environmental indicators.

Use GST data and currency-management data as separate but complementary evidence streams for evaluating formalisation and economic efficiency.

Encourage academic and independent evaluation so that policy decisions are based on transparent evidence.

15. Proposed Research Model for Future Empirical Testing

The conceptual model can be operationalised through measurable variables. Polymer adoption can be represented through the proportion of polymer notes in circulation or the number of denominations converted. Currency efficiency can be measured through average note life, replacement frequency, currency-management expenditure and processing costs. GST transparency can be represented through registered taxpayers, e-invoice adoption, return compliance, automated processing indicators and the size or composition of GST collections. Economic outcomes can be represented through state-level GSDP growth, formal-sector employment, investment and productivity indicators.

A future empirical study could test whether improvements in tax transparency are associated with formalisation and economic outcomes while controlling for income, industrial structure, digital-payment adoption, inflation and other macroeconomic variables. A second study could conduct a cost-benefit comparison between polymer and paper banknotes using denomination-specific lifecycle data. Together, these studies would provide stronger evidence than a purely conceptual argument.

16. Findings and Discussion

The review supports five broad findings. First, polymer banknotes have a credible economic rationale where longer service life can offset higher initial substrate costs. Second, polymer technology may offer additional security possibilities, but the security benefit should not be overstated because counterfeiting depends on the overall security architecture. Third, India's own policy history demonstrates that polymer currency has been considered primarily as a banknote-lifecycle intervention, including field-trial proposals for ₹10 notes. Fourth, the next-generation GST reform agenda is moving towards greater simplification, technology-driven administration and formalisation. Fifth, the strongest relationship between the two policy domains is therefore complementary rather than causal: polymer improves physical currency infrastructure, while GST digitalisation improves tax information and compliance infrastructure.

The economic-growth implication is consequently indirect and conditional. If a polymer-note programme reduces lifecycle costs without imposing excessive transition costs, the savings may improve public-sector efficiency. If GST reforms reduce compliance friction and improve revenue administration, the resulting gains may strengthen fiscal capacity. When combined with productive public expenditure and private-sector investment, these effects can contribute to economic growth. But neither polymer notes nor GST reform should be treated as a stand-alone growth engine.

17. Conclusion

India's economic transformation increasingly involves the integration of physical, digital and institutional financial infrastructure. GST reform is strengthening the digital and informational side of the tax system, while banknote policy remains relevant to the physical side of everyday economic activity. Polymer banknotes offer a possible avenue for improving durability, security and lifecycle efficiency, but their adoption should be evaluated through rigorous Indian evidence rather than international experience alone.

The central proposition of this paper is that polymer banknotes and GST 2.0 can be understood as complementary components of a broader financial-modernisation strategy. Polymer currency cannot itself create tax transparency because cash is not inherently traceable. Conversely, digital GST infrastructure does not eliminate the need for efficient and secure physical currency. The policy objective should therefore be a resilient hybrid financial ecosystem in which physical cash is secure and efficient, while taxable transactions are supported by transparent digital records and effective compliance systems.

A carefully designed pilot, supported by lifecycle costing, environmental assessment, accessibility testing, machine compatibility studies and independent evaluation, would provide the evidence required for any future national decision. If the results demonstrate net economic and social benefits, polymer banknotes could become one element of India's wider journey towards a more efficient, transparent and sustainable financial system.

18. Limitations of the Study

The study is conceptual and relies primarily on secondary sources. It does not estimate a causal effect of polymer banknotes on GST collections or GDP. International evidence on polymer lifecycle performance may not fully represent Indian conditions. Moreover, "GST 2.0" is used as an analytical label for the next-generation reform phase and not as the name of a separate statutory tax regime. Future research should therefore test the proposed relationships using Indian denomination-level currency data, GST administrative indicators and state-level economic outcomes.

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