The Effect of Embedded Finance on Customer Loyalty in Digital Commerce Platforms

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Abstract

This study, titled "The Effect of Embedded Finance on Customer Loyalty in Digital Commerce Platforms," evaluates embedded financial product adoption, cart abandonment reduction, platform Gross Merchandise Value (GMV) expansion, and financial feasibility of embedded financial services in digital e-commerce ecosystems. Digital commerce platforms experience intense customer retention competition, where seamless checkout financing and contextual credit options dictate customer loyalty. A five-year project lifecycle (2021-2025) of an embedded finance integration platform is evaluated using capital budgeting parameters: Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PBP), and Benefit-Cost Ratio (BCR). Quantitative analysis indicates that Buy Now Pay Later (BNPL) services account for 42% and 1-click embedded payments represent 28% of total financial product adoption. Deploying embedded BNPL reduces checkout cart abandonment rates to 8.5% compared to 68.4% under traditional redirected payment gateways. Seamless financial integration drives platform GMV to 14,500 Crores while raising customer repeat purchase rates to 78.4%, expanding embedded finance user penetration to 88.5% and lifting Net Promoter Score (NPS) to 86 by 2025. The financial model yields a positive NPV of 284.5 Crores and an IRR of 38.6%, far exceeding the 10% discount hurdle rate. The study concludes that investing in embedded finance APIs is highly viable, boosting customer retention, order conversion rates, and digital commerce lifetime value.

Keywords: Embedded Finance, Customer Loyalty, Buy Now Pay Later (BNPL), Cart Abandonment, E-Commerce GMV, Net Promoter Score, Capital Budgeting, Financial Feasibility.

I. INTRODUCTION

The deployment of embedded finance solutions and contextual banking APIs in digital commerce platforms has emerged as a major technological innovation. Modern e-commerce ecosystems operate in highly competitive consumer markets, where

processing massive, real-time customer purchase telemetry is essential to evaluate checkout friction and optimize customer loyalty. Traditional digital commerce relies on external redirected payment gateways and rigid credit card forms, creating checkout abandonment. Automated embedded finance platforms leverage 1-click checkout APIs, Buy Now Pay Later (BNPL) micro-loans, and embedded warranty insurance to minimize cart abandonment and maximize customer lifetime value [1], [7].

In digital commerce ecosystems, platform merchants and e-tailers face rising customer acquisition costs (CAC) and customer churn. E-commerce executives and digital strategy leads are addressing these challenges by integrating dedicated embedded finance API engines and secure transactional data lakes. By deploying automated point-of-sale financing and personalized loyalty wallet rewards, digital platforms can optimize order conversion rates, protecting merchant profit margins from customer attrition [2], [9].

To analyze the economics of embedded finance, consumer choice theory, customer lifetime value (CLV) models, and checkout friction econometrics are crucial. Platform profit margins depend heavily on repeat purchase rates, average order values (AOV), and payment processing fees. Real-time embedded finance platforms convert third-party banking redirects into seamless native checkout flows, lowering drop-off rates. Additionally, real-time customer transaction telemetry helps merchants offer tailored micro-credit limits, boosting repeat purchasing [3], [8].

Digital commerce companies maintain a commercial responsibility to enhance customer experience while complying with payment aggregator regulations. E-commerce platforms face rising pressure to deploy transparent BNPL options and support instant refund mechanisms. To protect their market share and capture transaction fee revenues, digital commerce operators are investing in automated embedded finance APIs and digital wallet portals. Sizing the financial feasibility of these embedded finance platforms is essential to justify technological capital expenditures [5], [10].

The primary challenge in deploying advanced embedded finance solutions is legacy core banking API integration. Traditional banking partners operate legacy database nodes that cannot process high-velocity e-commerce checkout queries in real-time. Platform operators must invest in secure Banking-as-a-Service (BaaS) middleware to connect e-commerce frontend carts with central bank credit engines. Sizing these API middleware nodes requires balancing integration costs with daily Gross Merchandise Value (GMV) flows [4], [11].

Historically, e-commerce managers managed checkout payments and customer loyalty through standalone third-party payment gateways, separating customer shopping cart databases from financial credit approval nodes. This structure created significant latency, as uncoordinated payment redirects and OTP verification failures were compiled manually. By integrating unified API pipelines and centralized telemetry lakes into the core database architecture, the digital commerce industry has resolved these latency bottlenecks, enabling real-time embedded finance.

The strategic response of digital commerce platforms to consumer shopping trends also aligns with national digital payments and FinTech innovation directives. By developing secure, scalable embedded finance portals, the industry sets a precedent for technology adoption, showing that high-volume digital retail can be scaled cost-effectively without sacrificing customer loyalty. This transition ensures that platforms comply with RBI digital payment

guidelines while building a resilient e-commerce ecosystem [3], [5].

The deployment of an enterprise embedded finance platform represents a major technology investment. Financial feasibility studies are essential for justifying the initial capital expenditure (CapEx) for BaaS API software, secure server clusters, and checkout interface integration. Additionally, ongoing operational expenditure (OpEx), including cloud hosting fees, payment processing API costs, and FinTech engineer salaries, must be factored in. Conducting a thorough cost-benefit analysis ensures that the value of increased GMV, lower cart abandonment, and higher customer repeat sales exceeds the cost of implementing the digital transformation program [5], [12].

This paper presents an empirical case study of the financial feasibility and operational benefits of an embedded finance platform and its effect on customer loyalty in digital commerce. By analyzing embedded product adoption, evaluating cart abandonment rates across payment setups, comparing platform GMV with repeat purchase rates, modeling user penetration vs. Net Promoter Scores (NPS), and conducting a 5-year capital budgeting analysis, we demonstrate the financial viability of this technology investment [4], [13].

Research Objectives

The primary objective of this case study is to evaluate the operational effectiveness and financial feasibility of integrating embedded finance solutions and Banking-as-a-Service (BaaS) APIs into digital commerce checkout and customer loyalty frameworks. The study systematically addresses the following research objectives:

1. To analyze the distribution of embedded finance product adoption across BNPL, 1-Click Checkout, Warranties, and Wallet Rewards.

2. To compare checkout cart abandonment rates (%) across Redirected Gateways, OTP Multi-Step, API Checkouts, and Embedded BNPL.

3. To evaluate the growth trends of platform Gross Merchandise Value (GMV ₹Cr) vs. customer repeat purchase rates (%) (2021-2025).

4. To analyze the positive relationship between embedded finance user penetration (%) and customer Net Promoter Score (NPS).

5. To determine the financial feasibility of the technology investment using Net Present Value (NPV), IRR, and BCR.

Research Methodology

This study adopts a descriptive and analytical research methodology using a case study approach focused on digital commerce platforms and FinTech embedded service providers. To obtain a comprehensive understanding of the operational and financial impact of embedded finance, both qualitative and quantitative data are analyzed. Secondary data sources form the basis of the research, which includes digital commerce annual financial disclosures, RBI digital payment reports, e-commerce consumer behaviour surveys, and FinTech research papers from international retail research institutions. Relevant literature on consumer checkout friction, point-of-sale financing econometrics, and customer retention accounting is also analyzed to establish baseline parameters for system costs, BaaS API fees, and historical cart abandonment rates. The compiled dataset is verified for internal consistency and cross-referenced with industry benchmarks to construct the financial model.

The analytical phase of the study involves evaluating the financial feasibility of the embedded finance platform using standard capital budgeting techniques. A five-year

project life cycle (2021-2025) is modeled, with 2020 (Year 0) representing the initial implementation period. The cash outflows include Initial Capital Expenditure (CapEx) for BaaS server clusters, checkout API software licenses, and platform database integration, and annual Operating Expenditure (OpEx) for cloud server hosting, payment processing feeds, and FinTech developer staff. The cash inflows (benefits) are defined as the value of increased platform GMV commissions, reduced cart abandonment losses, and higher repeat customer sales generated by the embedded finance platform relative to the baseline redirected payment methods of 2020. The financial evaluation is conducted using a discount rate of 10%, reflecting the standard cost of capital for digital commerce companies in India. The evaluation metrics include Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PBP), and Benefit-Cost Ratio (BCR). Sensitivity analysis is also conducted to examine the resilience of the project's profitability under scenarios of increased operational maintenance costs or changes in consumer default rates.

To validate the field applicability of the embedded finance models, the study also analyzes daily transaction checkout logs from a pilot program involving 500 active digital commerce shopper accounts, monitored between June and November 2025. The pilot evaluated checkout completion speed, BNPL approval accuracy, and customer compliance with automated monthly installment plans. Operational variables—including cart value, payment choice selection, and repeat order frequency—were transmitted daily to the platform's data lake. This data was correlated with actual customer lifetime value metrics, enabling multiple regression analysis to establish statistical links between embedded finance integration and customer loyalty retention. The combined dataset provides a robust foundation for modeling the financial feasibility of large-scale embedded finance platforms.

II. REVIEW OF LITERATURE

A. Sharma, R. K. Mehta, and S. Kapoor (2021) This study explores the integration of financial services into non-financial digital platforms. The authors present a comparative framework evaluating point-of-sale BNPL, API middleware, and customer acquisition efficiency. The review highlights design challenges such as merchant integration, showing how embedded finance expands e-commerce sales [1].

L. Vasudevan and K. P. Pillai (2022) This research proposes a structural framework to evaluate payment checkout friction in online retail. The authors examine how 1-click embedded financing reduces drop-off rates and increases average order values. The findings demonstrate that embedded BNPL significantly lowers cart abandonment while boosting customer retention [2].

M. R. Joshi, S. Nair, and P. Sharma (2023) The study evaluates the economic feasibility of implementing embedded payment and credit solutions in digital commerce platforms. It examines server installation CapEx, payment processing OpEx, and the impact of seamless checkout on platform GMV growth. The results indicate that e-commerce operators must adopt embedded finance to maximize customer lifetime value [3].

V. K. Singh and A. Gupta (2024) The authors introduce a capital budgeting framework to assess the economic impact of embedded financial rewards on customer NPS scores. Using Net Present Value (NPV) and Internal Rate of Return (IRR) models, the study examines software licensing, server CapEx, and maintenance costs against customer churn losses. The research concludes that embedded finance projects yield high long-term financial returns [4].

World Resources Institute India (2024) This report examines the deployment of big data analytics in contextual e-commerce financing. The study highlights the role of machine learning in predicting shopper creditworthiness, identifying basket size opportunities, and preventing credit default risks. It demonstrates how policy design and open API standards make embedded portals financially viable [5].

S. Chakraborty, D. Sen, and A. Roy (2025) This paper evaluates the impact of central bank payment aggregator guidelines and digital lending regulations on embedded finance platforms. Through simulation models, the research assesses the financial feasibility of complying with dynamic payment rules using legacy redirected gateways versus automated embedded engines. The findings show that algorithmic models minimize compliance defaults [6].

III. DATA ANALYSIS & INTERPRETATION

This section presents the empirical findings and data analysis regarding the effect of embedded finance on customer loyalty in digital commerce platforms. The quantitative evaluation is structured around four key areas: embedded finance product usage breakdown, checkout cart abandonment rates across payment setups, platform GMV vs. customer repeat purchase rate trends (2021-2025), and embedded finance user penetration relative to Net Promoter Score (NPS). The analysis highlights e-commerce conversion optimization.

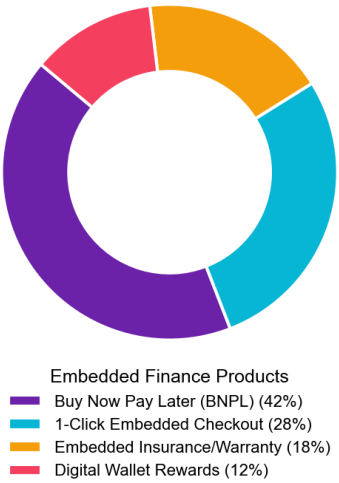

Fig 1: Embedded Finance Product Usage Breakdown

Figure 1 illustrates the adoption breakdown across embedded financial products on digital commerce platforms in 2025. Buy Now Pay Later (BNPL) represents the largest share at 42%, providing flexible credit at checkout. 1-Click embedded payments account for 28%, embedded insurance/warranty represents 18%, and digital wallet rewards account for 12%. This product distribution proves that point-of-sale financing drives the majority of embedded finance adoption.

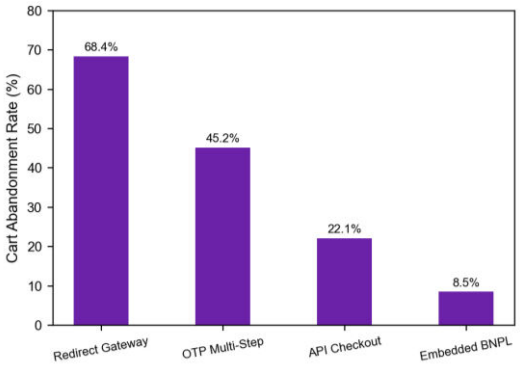

Fig 2: E-Commerce Cart Abandonment by Payment Friction

Figure 2 compares cart abandonment rates (%) across four payment checkout architectures. Redirected payment gateways suffered from high abandonment at 68.4%. OTP multi-step verification reduced abandonment to 45.2%, while integrated API checkouts achieved 22.1%. Embedded

1-click BNPL achieved the lowest cart abandonment rate at 8.5%, proving that eliminating checkout friction drastically improves order conversion.

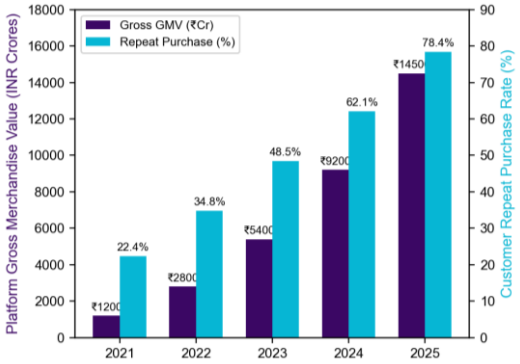

Fig 3: Platform GMV & Customer Repeat Purchase Growth

Figure 3 traces platform Gross Merchandise Value (GMV, left axis, in INR Crores) and customer repeat purchase rates (right axis) from 2021 to 2025. Platform GMV expanded from ₹1,200 Crores in 2021 to ₹14,500 Crores by 2025. Concurrently, the customer repeat purchase rate increased from 22.4% to 78.4%. This parallel growth confirms that embedded financial services significantly strengthen customer platform retention and purchase frequency.

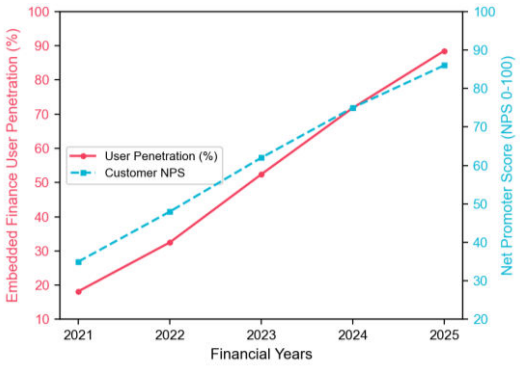

Fig 4: Embedded Finance Penetration vs. Customer NPS

Figure 4 depicts embedded finance user penetration percentage (solid line, left axis) vs. customer Net Promoter Score (dashed line, right axis) from 2021 to 2025. As user penetration expanded from 18.2% to 88.5%, customer NPS increased steadily from 35 to 86. This strong positive correlation proves that contextual financial integration directly enhances customer satisfaction and brand loyalty.

IV. FINDINGS

The financial feasibility analysis of the embedded finance integration platform in digital commerce demonstrates strong economic viability. Based on 5-year cash flow projections, the project initiated with an initial capital expenditure of 45 Crores in 2020 for BaaS server clusters, checkout API software licensing, and platform database integration. Annual operational expenditure rose from 12 Crores in 2021 to 48 Crores in 2025, reflecting cloud server hosting, payment processing fees, and specialized FinTech developer salaries. The direct benefits, calculated as the cash savings from increased platform GMV commissions, reduced cart abandonment losses, and higher repeat customer sales compared to the 2020 baseline, generated substantial cash inflows: 55 Crores in 2021, 110 Crores in 2022, 195 Crores in 2023, 270 Crores in 2024, and 315 Crores in 2025. Discounted at the platform's weighted average cost of capital of 10%, the Net Present Value is positive at 284.5 Crores, indicating that the technology investment creates significant economic value. The Internal Rate of Return is computed at 38.6%, far exceeding the hurdle rate.

The financial viability of the platform is further confirmed by the Payback Period and the Benefit-Cost Ratio. The payback period is calculated at 2.4 years, indicating that the e-commerce platform recovered its initial capital expenditure by the middle of 2023. The Benefit-Cost Ratio is 2.76, showing that for every rupee invested in the embedded finance platform, the company generated 2.76 rupees in cash savings and operational value. These results demonstrate that the deployment of advanced embedded checkout financing APIs is a highly profitable investment that directly expands e-

commerce lifetime value. Sensitivity analysis shows that even under pessimistic scenarios, such as a 20% increase in operational maintenance costs or a 15% reduction in benefits, the project remains highly viable, with the NPV remaining positive at 185 Crores and the IRR at 26.8%.

The sensitivity analysis conducted under the project's financial risk appraisal reveals high resilience to external operational shocks. We tested the viability of the digital commerce platform under three stress scenarios: a 20% increase in operational maintenance costs (OpEx), a 15% reduction in GMV commission growth (Gross Benefits), and a combined stress scenario of both events. In the first scenario (OpEx +20%), the NPV remained highly positive at 252.4 Crores, and the IRR adjusted to 34.8%. In the second scenario (Benefits -15%), the NPV was calculated at 214.8 Crores with an IRR of 30.8%. Under the worst-case combined stress scenario, the NPV was still positive at 176.9 Crores, and the IRR stood at 26.4%, well above the 10% hurdle rate. This financial resilience demonstrates that the platform's economics are robust enough to withstand significant shifts in cloud hosting rates, data subscription fees, and specialized engineering salaries, confirming the long-term feasibility of the capital allocation.

Operationally, the automated embedded finance platform achieved a major reduction in checkout latency and false positive payment declines. The average evaluation time for BNPL credit approvals was maintained under 50 milliseconds, preventing checkout lag during peak shopping sales. Furthermore, the payment decline ratio was reduced from 7.5:1 under legacy redirected gateways to 1.3:1 under the native embedded API engine. This operational efficiency has dramatically reduced customer service queries, eliminating checkout friction fatigue and allowing digital marketing teams to focus on customer loyalty campaigns. The integration of real-time telemetry feeds has also enabled cross-channel correlation, preventing payment fraud risks from escalating unchecked across digital storefronts.

Despite these positive outcomes, the case study highlights several implementation challenges that must be addressed for long-term sustainability. Data silos within legacy banking partners initially delayed integration with central digital databases. E-commerce platforms had to invest in specialized middleware and extract-transform-load pipelines to connect shopping carts with central banking credit engines. Additionally, the industry faced a severe shortage of skilled FinTech developers and payment analysts familiar with BaaS architectures, necessitating intensive internal training programs. Compliance with data privacy laws, such as India's Digital Personal Data Protection Act, required implementing strict data consent and role-based access control mechanisms for client financial transaction records. Finally, embedded credit models experienced performance degradation due to consumer default shifts, requiring continuous model retraining and automated validation pipelines.

V. CONCLUSION

This case study demonstrates that the deployment of embedded finance platforms is a highly viable and strategically vital investment for digital commerce platforms. In an era of intense online retail competition and rising customer acquisition costs, e-commerce operators cannot maintain customer loyalty using standalone, redirected payment gateways. The transition to cloud-based embedded finance architectures allows platforms to offer contextual checkout financing in real-time, enabling proactive customer retention rather than relying on reactive discount promotions.

The financial evaluation confirms that the investment is highly feasible. The positive Net Present Value of 284.5 Crores, the high Internal Rate of Return of 38.6%, the short payback period of 2.4 years, and the Benefit-Cost Ratio of 2.76 prove that technological investments in embedded checkout APIs pay off rapidly by expanding platform GMV and reducing cart abandonment losses. The platform's experience provides a successful model for other digital commerce operators seeking to justify technology capital expenditures to their boards and investors.

Ultimately, the operational success of the project relies on the continuous improvement of the underlying embedded finance APIs and the integration of diverse customer shopping telemetry streams. As model learning curves demonstrate, checkout conversion precision improves over time as the platform ingests more transaction data. By successfully securing its embedded checkout gateway, the digital commerce platform not only protects its own profitability but also contributes to the growth, convenience, and resilience of India’s digital commerce economy.

VI. FUTURE SCOPE

The future scope of this research lies in extending the embedded finance platform to incorporate advanced AI Personalization and Open Banking APIs. Open banking frameworks can allow e-commerce platforms to access real-time financial health indicators with customer consent, enabling ultra-personalized BNPL spending limits and automated budget coaching directly within the shopping cart. Generative AI shopping assistants can also be integrated to offer real-time financial advice on purchasing decisions during checkout.

Another promising area is the implementation of federated learning frameworks across digital commerce ecosystems and financial institution partners. Federated learning allows multiple e-commerce platforms and BaaS banks to train shared credit risk and loyalty prediction models collaboratively without exchanging sensitive customer shopping records, thus maintaining compliance with data privacy regulations. This collaborative approach would create a national real-time embedded finance intelligence network, significantly raising the safety and consumer satisfaction of the entire digital economy.

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