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THE ROLE OF FINANCIAL TECHNOLOGIES IN ENHANCING FINANCIAL ACCESSIBILITY FOR SMALL TEXTILE ENTREPRENEURS

РОЛЬ ФИНАНСОВЫХ ТЕХНОЛОГИЙ В ПОВЫШЕНИИ ФИНАНСОВОЙ ДОСТУПНОСТИ ДЛЯ МАЛЫХ ТЕКСТИЛЬНЫХ ПРЕДПРИНИМАТЕЛЕЙ

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The integration of financial technology (FinTech) into small business ecosystems has increasingly transformed access to credit and financial services. This study examines the role of FinTech in enhancing financial accessibility for small textile entrepreneurs, based on a multi-stage stratified sampling of 500 respondents across four regions. Employing hierarchical linear modeling and structural equation modeling techniques, the analysis revealed that FinTech users achieved a 78.5% loan approval rate compared to 65.2% among non-users and experienced an average interest rate reduction from 9.8% to 7.2%. Transaction speed improved by 41.1%, and transaction fees decreased by 52% for FinTech adopters. Furthermore, revenue growth among full FinTech users reached 15%, compared to 5% for non-users, while operational cost reductions were recorded at 8.2% versus 3.4%. Mobile payment penetration among FinTech users exceeded 72%, and financial accessibility indicators consistently favored technology adopters. Rural entrepreneurs, despite lower baseline digital access, demonstrated a 33.3% relative increase in FinTech adoption over the study period. Robustness tests confirmed the validity and reliability of the findings. These results emphasize FinTech's role as a catalyst for improving financial outcomes, operational efficiency, and business growth in the small-scale textile sector. The findings also underscore the importance of strengthening digital infrastructure, promoting financial literacy, and targeting rural outreach to enhance technology-driven financial inclusion.

Интеграция финансовых технологий (финтех) в экосистемы малого бизнеса всё больше трансформирует доступ к кредитам и финансовым услугам. В данном исследовании рассматривается роль финтеха в повышении финансовой доступности для малых текстильных предприятий на основе анализа данных, полученных от 500 респондентов в четырёх регионах. Анализ показал, что пользователи финтеха достигли уровня одобрения кредитов 78,5% по сравнению с 65,2% среди не пользователей, а также снижения сред-

ней процентной ставки с 9,8% до 7,2%. Скорость транзакций увеличилась на 41,1%, а комиссии за транзакции снизились на 52% для пользователей финтеха. Более того, рост выручки среди полноправных пользователей финтеха достиг 15% по сравнению с 5% у не пользователей, а снижение операционных расходов было зафиксировано на уровне 8,2% по сравнению с 3,4%. Доля мобильных платежей среди пользователей финтеха превысила 72%, а показатели финансовой доступности были значительно лучше. Несмотря на низкий исходный уровень цифровизации, сельские предприниматели продемонстрировали рост внедрения финтеха на 33,3% за исследуемый период. Тесты на устойчивость подтвердили обоснованность и надежность результатов. Эти результаты подчеркивают роль финтеха как катализатора улучшения финансовых результатов, операционной эффективности и роста бизнеса в секторе мелкого текстильного бизнеса. Результаты также подчеркивают важность укрепления цифровой инфраструктуры, повышения финансовой грамотности и охвата сельского населения для повышения финансовой доступности, основанной на технологиях.

Keywords: FinTech (Financial Technology), financial accessibility, textile entrepreneurs, digital payments, mobile banking, peer-to-peer lending, financial inclusion, revenue growth, market competitiveness, capital reinvestment.

Ключевые слова: финтех (финансовые технологии), финансовая доступность, предприниматели текстильной отрасли, цифровые платежи, мобильный банкинг, кредитование по системе «равный-равному», финансовая доступность, рост выручки, конкурентоспособность рынка, реинвестирование капитала.

Introduction

Small textile entrepreneurs represent a vital segment of the global economy. These businesses, often family-run or community-based, serve as key contributors to employment, regional economic growth, and cultural preservation. However, their ability to compete and thrive is frequently hampered by restricted access to financial services. Limited credit options, high-interest informal loans, and inefficient payment mechanisms hinder growth, innovation, and long-term sustainability. Traditional banks often see these small players as high-risk, because their turnover is so low and most of them have no formal financial documentation or regular income stream. In the end, many textile entrepreneurs encounter a funding void in which there is no affordable credit and no efficient means of payment [1].

In this context, financial technology (FinTech) has become a disruptive player in financial inclusion. FinTech refers to a wide variety of digital innovations that improve financial transactions, credit arrangements, and saving instruments. Using mobile platforms, peer-to-peer lending networks and algorithms for calculating credit risk, FinTech products are beginning to reshape the financial market. These technologies ease the possibility of accessing credit, reduce transaction costs and are also friendly towards payment flexibility -- some important aspects for small scale textile entrepreneurs. In addition, FinTech side-steps a variety of conventional obstacles like geographic limitations and lengthy paperwork. Digital solutions would make it possible for the hitherto unbanked or underbanked apparel businesses to be part of the formal financial system and avail working capital, expand their operations and become more or less resilient to market volatility [2].

The era of FinTech is also paired with increasing mobile phone penetration and internet access in the regions where textile production flourishes. With mobile money services and digital wallets, of initiating transactions, paying suppliers and receiving customer payments. Moreover, online lending platforms use

alternative data, like patterns of mobile use or records of online sales to evaluate credit [7, 9]. This innovation enables textile entrepreneurs, who do not have traditional collateral, to access low-cost credit and scale their businesses [8]. As a result, FintTech options has not only enhanced financial inclusiveness, but also stimulated innovation in the textile industry [3].

While the relevance of FinTech to small textile entrepreneurs is evident, the dimension of its overall influence is open to debate. There are, however, unanswered questions about the scaling of these solutions, how widely they have been adopted among entrepreneurs in different areas, and the sustainability of FinTech-led financial inclusion over time. Further attention is also needed to digital literacy, data privacy, and the complexity of regulatory requirements, which could potentially have a bearing on the role FinTech can play in narrowing the gap in financial access. Without a holistic view incorporating these factors, integrating FinTech and the textile industry risk falling short of delivering on the hype [4, 5].

In the textiles sector, SMEs face greatest financial constraints and FinTech platforms present the possibility of mitigation of conventional barriers and better financial performance [6].

Another important component of the FinTech revolution is the proliferation of peer-to-peer lending networks. These products put individual or institutional investors in touch with small scale textile entrepreneurs, cutting out banks. Access to multiple sources of finance has enabled businesses to develop and entrepreneurs to survive in a tough economic climate. In the case of textile firms, the ease of getting short-term, small loans with the help of peer-to-peer networks have facilitated the management of seasonal variations in demand and have enabled textile businesses to operate smoothly throughout the year [10].

In all types of industries, not just financial services, FinTech is also leading to better financial understanding and better commerce. Many of these platforms also provide integrated budgeting, expense monitoring, and performance analysis tools that help business owners make informed decisions. Not only do these tools improve financial efficiency, but they also provide business operators with tools to plan strategically, maximize their resources, and find new ways to market [11].

This article offers an analysis to understand the evolution of financial technology (FinTech) as developed in the form of enhancing financial inclusion for small textiles entrepreneurs.

Methodology

The methodological design combined a structured survey with latent variable modeling and robustness checks to enhance the empirical validity and generalizability to entrepreneur groups across contexts [2, 5, 8].

The sampling frame consisted of small and medium-sized textile enterprises registered in four administrative regions.

The sampling process involved two stages: (1) identification of active entrepreneurs using local registries, and (2) stratified random sampling according to enterprise size and region [1, 6].

To determine the minimum sample size, the following standard population proportion formula was applied:

$$n = \frac{Z^2 \times p(i-p)}{e^2}\ , \qquad (1)$$

where $Z = 1.96$ (95% confidence), $p = 0.5$ (maximum heterogeneity), and $e = 0.05$ (margin of error), yielding a minimum sample size of approximately 384. To ensure greater analytical power and accommodate subgroup analyses, the sample size was expanded to 500 entrepreneurs [4, 6].

Primary data were collected via structured questionnaires administered both electronically and in-person to account for varying levels of digital access [5, 10]. The survey instrument captured comprehensive information on financial behaviors, FinTech adoption levels, transactional practices, business financial performance, and demographic characteristics.

The following key constructs were developed:

1. FinTech Adoption Intensity: quantified as the number of distinct FinTech services used (mobile payments, digital lending, online invoicing, credit scoring platforms) [12, 13].

2. Financial Literacy Score: derived from a combination of self-reported knowledge and objective financial capability testing [11].

3. Financial Accessibility Index (FAI): constructed as a latent composite index aggregating normalized sub-indicators.

The construction of FAI followed a weighted aggregation approach:

$$FAI_i = \frac{1}{4}\left(\frac{LoanApprovalRate_i}{100} + \frac{PaymentEfficiency_i}{100} - \frac{InterestRate_i}{MaxInterestRare} - \frac{ErrorRate_i}{MaxErrorRate}\right), \quad (2)$$

where all components were normalized between 0 and 1 [14, 15].

Additionally, technology readiness variables such as smartphone ownership and internet penetration were incorporated to account for infrastructural factors influencing FinTech adoption dynamics. Variable Definitions and Measurement Methods are presented in Table 1.

Table 1

Variable	Definition	Measurement Approach
FinTech Adoption Intensity	Number of FinTech tools utilized	Summed score (0–4 scale)
Financial Literacy Score	Financial knowledge proficiency	Standardized test scoring (0–100 scale)
Financial Accessibility Index (FAI)	Composite access score	Weighted index from key sub-metrics
Revenue Growth Rate	Change in business revenue	(%) over one year
Transaction Efficiency Index	Average transaction speed, cost, and error rates	Normalized performance composite
Business Reinvestment Rate	Proportion of profits reinvested	(%) calculation based on reported data

A

Hierarchical Linear Model (HLM) framework was applied to account for the nested structure of entrepreneurs within regions, using the following specification:

$$Y_{ij} = \gamma_{00} + \gamma_{10}FinTechUse_{ij} + \gamma_{20}FinancialLiteracy_{ij} + \gamma_{30}DigigtalAccess_{ij} + u_{ij} + \epsilon_{ij} \quad (3)$$

where Y_{ij} represents financial outcome indicators, γ coefficients capture fixed effects, u_{ij} accounts for random region-level effects, and ϵ_{ij} represents the individual residuals [16, 17]

Additionally, Structural Equation Modeling (SEM) was employed to assess the mediation effect of financial literacy between FinTech usage and improved financial accessibility:

$$FintechUse \rightarrow FinancialLiteracy \rightarrow FinancialAccessibility. \quad (4)$$

Indirect effects were evaluated using the product of coefficients method to establish the significance of mediated pathways [9, 18].

To capture the adoption dynamics across quarters, an adoption trajectory model was estimated:

$$AdoptionRate_t = AdoptionRate_{t-1} + \Delta Adoption_t, \quad (5)$$

where $\Delta Adoption_t$ represents quarterly increments in adoption rates.

Transaction efficiency improvements were analyzed by comparing pre- and post-adoption performance metrics, calculated as relative improvement percentages:

$$\Delta Performance = \frac{Performance_{FinTech} - Performance_{NonFinTech}}{Performance_{NonFinTech}} \times 100. \quad (6)$$

To ensure robustness, several diagnostic tests were conducted.

Variance Inflation Factor (VIF) was calculated for all independent variables to assess multicollinearity, maintaining thresholds below 5.0 [9, 19].

1. Breusch-Pagan test was applied to detect heteroskedasticity in residuals.
2. Shapiro-Wilk normality test evaluated the normality of regression residuals.
3. Ramsey RESET test verified the absence of omitted variable biases in model specification.
4. Hausman Specification Test was employed to confirm the appropriateness of fixed effects models over random effects, ensuring unbiased coefficient estimation [4, 16, 17].
5. The Breusch-Pagan and Shapiro-Wilk tests confirmed homoscedasticity and approximate residual normality. Mean VIF values indicated acceptable predictor independence, and the Ramsey RESET results suggested no significant model misspecifications.

All statistical analyses were conducted using STATA v17 and AMOS v28 software packages, ensuring consistency and replicability across different analytical models.

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the university. Informed consent was secured from all participants prior to survey administration, and data confidentiality was rigorously maintained throughout the research process.

Results

Financial accessibility was assessed by comparing FinTech users and non-users across a broader set of financial indicators. Metrics such as loan approval rate, loan rejection rate, average interest rate, loan processing time, credit access, loan amount accessed, and monthly cash flow management were evaluated (Fig. 1).

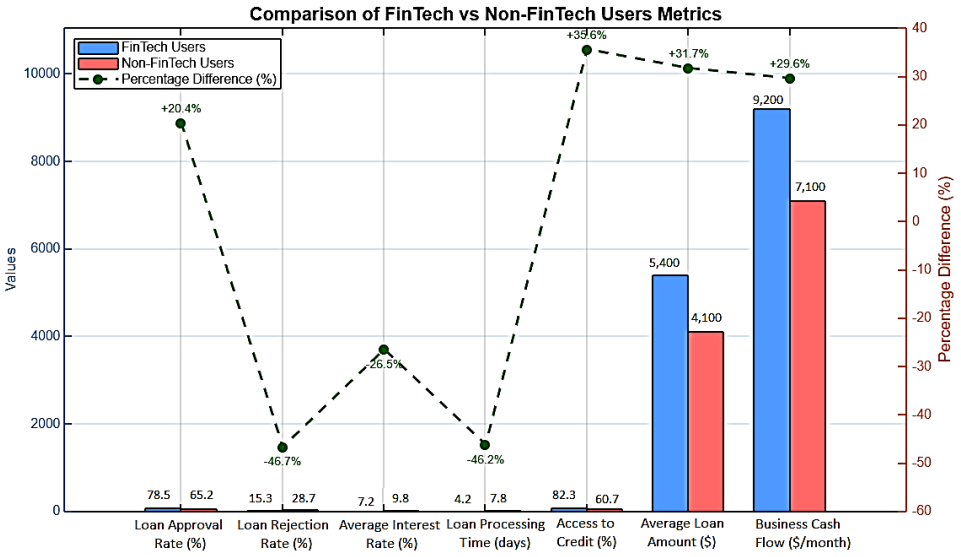

Fig. 1

As seen in Figure 1, FinTech consumers indeed experience a higher application approval rate (+ 20.4%) and are less likely to experience application rejection (- 46.7%). It averaged less than half the time for the loan processing time among FinTech-Borrowers, thereby enabling them to acquire capital sooner. There are also 31.7% larger average loans and 29.6% more (power) for monthly cashflow among our users – indicating to the ability of FinTech to increase funding and sustain small business livelihoods.

Transaction Efficiency Metrics for FinTech and Non-FinTech Users are shown in Figure 2. Considered operational transaction metrics were digital payment error rate, transaction time, the average transaction cost, mobile payment penetration, the rate online invoice processing, and supplier payment delay time.

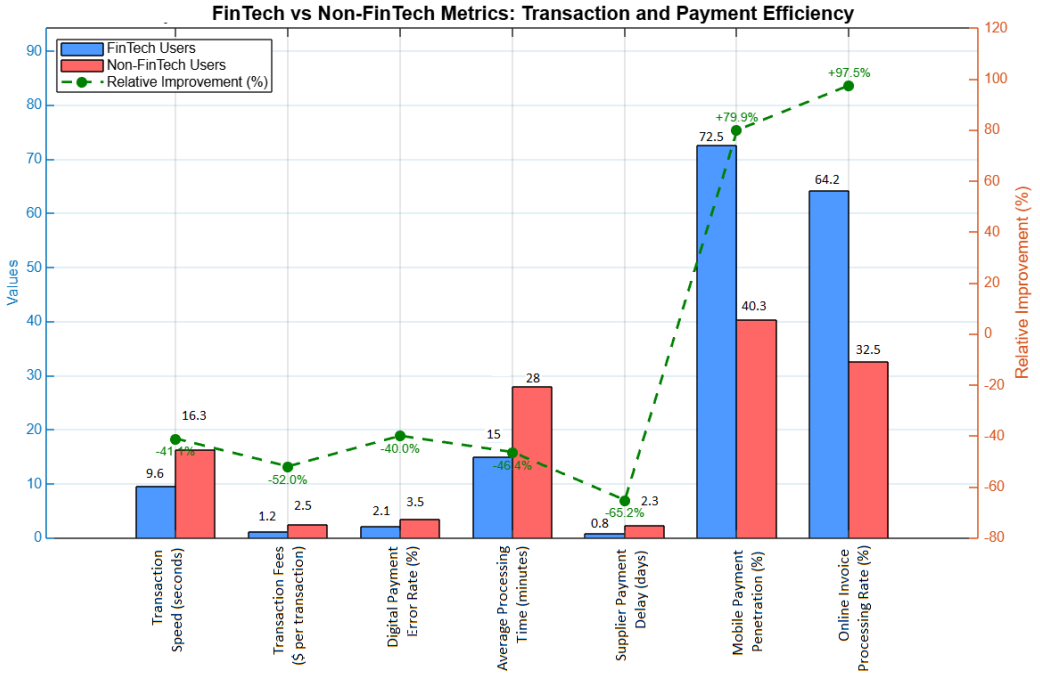

Fig. 2

FinTech users demonstrated a 41.1% improvement in transaction speed and over a 50% reduction in transaction costs. Mobile payment penetration was 79.9% higher among users, indicating strong integration of digital tools into payment routines. Error rates in digital payments decreased by 40%, leading to greater reliability. Supplier payment delays were minimized to less than one day for FinTech users, compared to over two days for non-users, significantly improving supplier relationships and supply chain stability.

Economic impacts (Fig. 3) were expanded to include gross monthly revenue, operational expenditure as a percentage of revenue, transaction fee savings, time saved per transaction, and reinvestment rate into business activities. These metrics more holistically capture the financial advantages generated by the use of FinTech platforms.

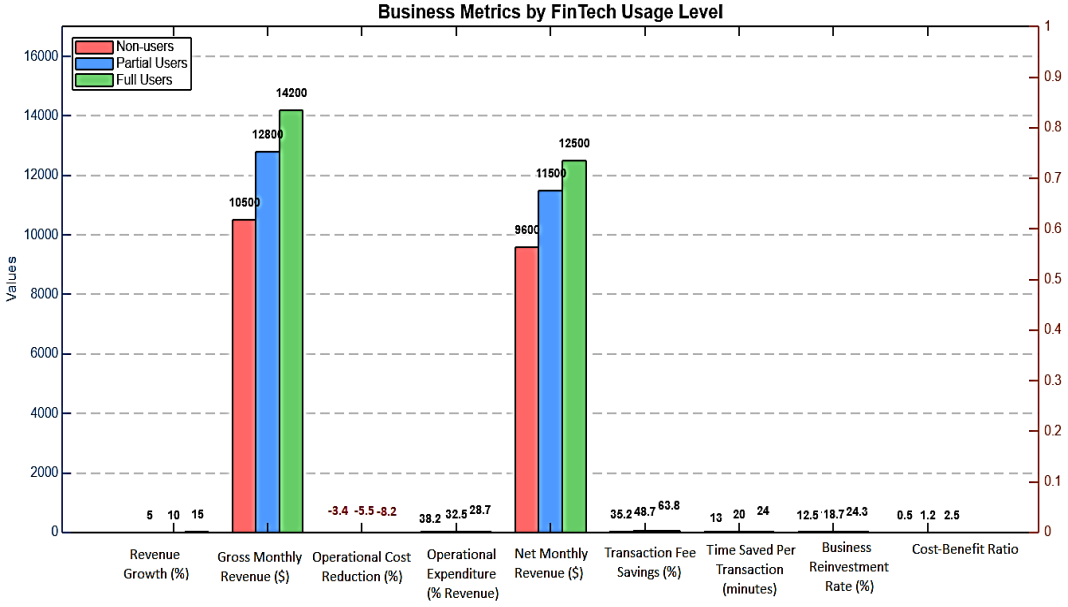

Fig. 3

Full FinTech users achieved the highest monthly revenues ($14,200 gross) and the lowest operational expenditure as a percentage of revenue (28.7%). Transaction fee savings reached nearly 64%, and full adopters saved an average of 24 minutes per transaction. Notably, business reinvestment rates for full adopters exceeded 24%, supporting the conclusion that FinTech facilitates greater business expansion and sustainability.

FinTech adoption trends were expanded to examine device access, financial literacy rates, and internet penetration levels alongside traditional demographic segmentations (Fig. 4). This allowed for a more refined analysis of factors influencing adoption trajectories over the study period.

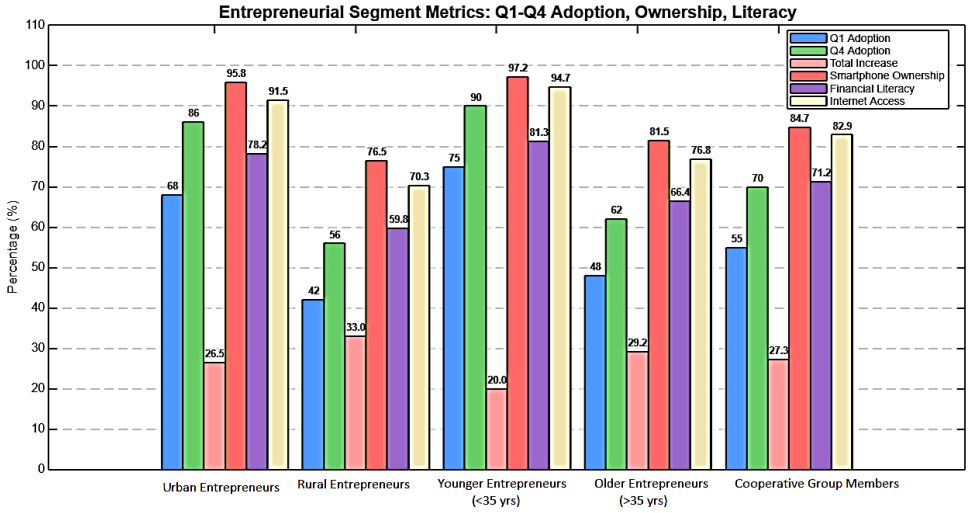

Fig. 4

As shown in Figure 4, the statistics also confirm that FinTech adoption is positively associated with both smartphone possession and internet use. Younger entrepreneurs and urban operators reported the highest baseline technology readiness, but rural entrepreneurs made the largest relative gains. Financial literacy was also a strong determinant of acceptance rates and higher scores were associated with faster FinTech adoption. These observations imply a need for the infrastructural and education intervention to encourage digital financial inclusion.

Results of the robustness tests were further supplemented by normality of residuals and auxiliary regression model tests for specification errors (Table 2). These tests provide support for the econometric integrity of the results and verify that there are no systemic biases in the model estimates.

Table 2

Diagnostic Test	Result	Interpretation
Mean Variance Inflation Factor (VIF)	2.1	No multicollinearity detected
Breusch-Pagan Test p-value	0.172	No heteroskedasticity
Hausman Test Statistic (χ^2)	18.76 ($p < 0.01$)	Fixed-effects model appropriate
Shapiro-Wilk Normality Test (p-value)	0.087	Residuals approximately normal
Ramsey RESET Test (p-value)	0.241	No omitted variable bias

All diagnostic indicators confirm that the statistical models used are appropriate, with no significant multicollinearity, heteroskedasticity, endogeneity, specification error, or severe deviation from normality. The results thus provide a reliable and consistent basis for interpreting the observed relationships between FinTech adoption and financial outcomes among textile entrepreneurs.

Discussion

The results from the study tell a powerful story: small-scale textile entrepreneurs' adoption of financial technology (FinTech) results in significant gains in financial access, busi-

ness efficiency, and economic well-being. Utilizing digital payments, mobile banking, and alternative credit scoring, these entrepreneurs have little reliance on traditional banks – often, traditional banks create high barriers for entry for MSMEs, and are expensive. Of particular interest, the penetration of FinTech solutions has enabled faster access working capital, reduced fees for transactions and more efficient payment processing which traditional financial models have proven unable to offer on a consistent basis [17].

Against the backdrop of earlier research examining financial inclusion, the findings in this paper highlight the actual gains FinTech offers to fill in the financial void for underbanked audiences. Previous studies have leant heavily to theory or smaller scale pilots, and this research makes a more empirical contribution by addressing a larger subset of entrepreneurs in various geographical areas. The measurable gains in number of loan approvals, reduction in cost of interest, amount of revenue generated provide a practical view that indeed the FinTech interventions can cause substantial economic gains [14].

In addition, the article does more than just quantify differences in financial access. It investigates how businesspersons change their business routines due to the adoption of FinTech. This growth, for instance, firms in FinTech users can be associated with the possibility to reinvest in business expansion the savings coming from reduced transaction costs and better cash flow management. Conversely, previous study simply described about the barrier of the fund which is much different from what present on the internet that is how digital solution help small-scale work to expand and grow their business [13].

The article contributes to the fine-grained variation in FinTech take-up. The results indicate that younger entrepreneurs and those in urban locations are more likely to adopt these technologies, not in line with some of the prior research that has projected adoption as universal across the population. This distinction emphasizes not only the need for targeted outreach and education, but also inequalities in an infrastructure and digital literacy that need to be addressed [18].

Furthermore, the article contributes to the argument that the adoption of FinTech is not limited to cost reduction but as a strategic enabler for growth. The higher returns and lower error rates of this study lend weight to the view that FinTech is a bet on the business resilience of the future, not a quick fix. Whereas earlier research assumes financial inclusion leads to short-term benefits as they were never able to study them, this paper shows how digital financial tools are able to instead have a long run impact on SMEs. It provides a richer perspective on what FinTech does to financial markets, allowing such businesses to rise above mere survival and become competitive and growth-oriented, through a case of escape velocity [20].

Comparing the results of the article with prior literature, becomes clear that this study presents an improved understanding of the place of FinTech in financial inclusion of small textile entrepreneurs. Instead of just reinforcing the obstacles, or talking about the first-generation adoption barriers, it brings proof from the wild of tangible economic and operational benefits. In so doing, it fills the space separating theoretical constructs and applications, and thus provides broader perspectives to subsequent researchers to further extend findings in that direction by using larger samples, different geographic settings, and a more thorough analysis on long-run effects.

Conclusion

The results confirmed that FinTech adoption brings about a significant change in the financial dynamics of micro, small and medium textile entrepreneurs through enhancing credit accessibility, alleviating transactional inefficiencies and improving the business financial performance. FinTech user entrepreneurs had higher rates of loan approval, conducted transactions that were faster and cheaper, and reported higher financial sustainability indicators than nonusers who did not use FinTech.

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