



# The FinTech Maturity Divide: Benchmarking AI Services, Open Banking, and Embedded Finance Across Financial Service Sectors

Davletov I. Rakhimberganovich<sup>1,\*</sup>      Dusmuratov R. Davlatbayevich<sup>2</sup>

<sup>1</sup> Department of Accounting, Tashkent State University of Economics, Tashkent, Uzbekistan

<sup>2</sup> Department of Economic analyses and audit, Tashkent State University of Economics, Tashkent, Uzbekistan

Emails: [i.davletov@tsue.uz](mailto:i.davletov@tsue.uz) . [r.dusmuratov@tsue.uz](mailto:r.dusmuratov@tsue.uz)

Received: January 19, 2024    Revised: March 14, 2024    Accepted: June 26, 2024    \* Corresponding author

## ABSTRACT

The global financial services industry is undergoing a structural transformation driven by the convergence of artificial intelligence, open application programming interfaces, digital payment infrastructure, and embedded financial services. Despite sustained investment activity, the empirical evidence base for comparing technology adoption maturity across institutional types and capability domains remains fragmented, leaving executives and policymakers without the benchmarking evidence needed for informed strategic investment decisions. This paper addresses that gap through a systematic multi-dimensional maturity study drawing on primary survey data from financial industry professionals across multiple countries and a consumer adoption survey of retail banking customers, covering five technology dimensions: artificial intelligence services, open banking and application programming interface ecosystems, digital payment infrastructure, embedded finance, and regulatory technology. Challenger banks and FinTech startups substantially outperform traditional incumbent institutions on open banking and embedded finance, while traditional institutions retain a relative advantage in regulatory technology compliance. Payment processors dominate on digital payment maturity but show the widest capability gap in artificial intelligence and embedded finance. Consumer adoption analysis reveals pronounced age-related disparities in buy-now-pay-later, cryptocurrency, and robo-advisory services with direct implications for financial inclusion strategy. Regression analysis identifies application programming interface readiness as the single strongest predictor of overall maturity, confirming that foundational data architecture investment has compounding returns across all five technology domains. The paper contributes a validated five-dimension maturity framework, a regression model of the institutional and strategic predictors of overall FinTech maturity, and ten evidence-based strategic recommendations for executives navigating the technology transformation of financial services.

**Keywords:** Financial technology ▪ FinTech maturity ▪ Artificial intelligence ▪ Open banking ▪ Embedded finance ▪ Digital payments ▪ RegTech ▪ Challenger banks ▪ Financial innovation

## 1. INTRODUCTION

The financial services industry is experiencing a structural transformation of a scale and pace not seen since the post-

war demutualisation of building societies and the advent of electronic trading in the 1980s. The force driving this transformation is not a single technology but a cluster of mutually reinforcing digital capabilities: artificial intelligence capa-

ble of automating credit decisioning and fraud detection in real time; open banking frameworks built on application programming interface (API) standards that enable third-party providers to access customer account data with consent; digital payment rails that have collapsed the cost and latency of retail and cross-border transactions; embedded finance models that distribute financial products through non-financial platforms; and regulatory technology that automates compliance at a fraction of the cost of manual processes [1, 2, 3].

Collectively, these capabilities are reshaping the competitive dynamics of the industry [4]. Incumbent banks, which dominated financial services for decades through network effects, regulatory barriers, and customer inertia, now face competition from challenger banks built natively on cloud infrastructure, FinTech startups that have captured specific segments of the value chain, and technology platforms embedding financial services into commerce flows [5, 6]. The question facing both incumbents and challengers is not whether to invest in FinTech capabilities but where, at what pace, and in what sequence.

The academic literature provides partial guidance. Gomber et al. [7] mapped the forces of innovation, disruption, and transformation in financial services, identifying four vectors of change: new products, new processes, new business models, and new market entrants. Goldstein, Jiang, and Karolyi [8] documented the macroeconomic scale of the FinTech disruption and called for systematic empirical study of its cross-sectional effects. The Technology Acceptance Model [9] and its extension through the Unified Theory of Acceptance and Use of Technology [10] provide frameworks for explaining adoption at the individual level, while Rogers' [11] diffusion of innovations theory offers a complementary lens at the organisational level. Yet studies that systematically compare FinTech maturity across institutional segments, technology domains, and geographic markets in a single benchmarking programme remain rare.

The present study fills this gap through a multi-dimensional benchmarking programme covering five FinTech capability domains across four institutional segments and multiple regions. The contributions are:

- A validated five-dimension FinTech maturity framework grounded in established technology adoption theory and the FinTech-specific literature, operationalised into a 45-item professional survey instrument.
- Comparative maturity profiles for four institutional segments—traditional banks, challenger banks, FinTech startups, and payment processors—across all five dimensions, with sufficient statistical power to characterise significant between-segment differences.
- Consumer adoption data from 486 retail banking customers across six FinTech service categories, including age-stratified analysis that reveals inclusion and exclusion dynamics in emerging financial services.
- A regression model of the institutional and strategic predictors of overall FinTech maturity, providing actionable input for strategic planning processes.
- Ten evidence-based strategic recommendations for financial services executives navigating the FinTech transformation,

derived from the convergent evidence across professional surveys, consumer adoption data, and investment analysis.

Section 2 reviews the theoretical background and FinTech literature. Section 3 presents the maturity framework. Section 4 describes the methodology. Section 5 reports professional survey results. Section 6 reports consumer adoption findings. Section 7 presents the regression analysis. Section 8 discusses strategic implications. Section 9 concludes.

The study was conducted using data collected through October 2023, capturing the FinTech landscape following the peak investment year of 2021 and the subsequent rationalisation of 2022–2023. Global FinTech investment reached a record \$238 billion in 2021 before contracting to approximately \$164 billion in 2022 and \$113 billion in 2023 amid higher interest rates and a broader retrenchment in growth-stage technology investment [12]. This consolidation phase provides an ideal research context: the froth of emergency digital acceleration during COVID-19 has receded, and the durable capability differences between institutional segments are more visible than in periods of universal expansion. The EU AI Act, the Digital Operational Resilience Act (DORA), and the evolution of open banking standards from PSD2 toward PSD3 are simultaneously reshaping compliance requirements across all five maturity dimensions [13, 14]. Lagna and Ravishankar [15] called for FinTech research that moves beyond adoption studies to examine the conditions under which FinTech creates lasting social value—a call that the present study's financial inclusion analysis and strategic recommendations address by integrating consumer adoption evidence with institutional maturity benchmarking.

## 2. THEORETICAL FOUNDATIONS AND RELATED LITERATURE

### 2.1 The FinTech Ecosystem: Definitions and Boundaries

The term FinTech is used inconsistently in both industry and academic discourse. Arner, Barberis, and Buckley [1] provide the canonical academic definition, characterising FinTech as technology-enabled financial solutions operating in three distinct historical eras, with the post-2008 era characterised by the decoupling of financial product delivery from traditional financial institutions. Gomber, Koch, and Siering [2] distinguish digital finance (the broader transformation of financial services through digital technology) from FinTech (specifically the new entrants and technologies disrupting traditional models), noting that incumbents participating in the digital transformation are engaging in digital finance rather than FinTech per se. Puschmann [5] categorises FinTech business models into financing, asset management, payment, and insurance, mapping each to established players and new entrants in a framework that informs the five-dimension structure of the present study.

The FinTech ecosystem encompasses not only startup activity but the digital transformation investments of incumbents. Lee and Shin [3] map the ecosystem into five components: FinTech startups, technology developers, government regulators, financial customers, and traditional financial institutions, with investment funds and innovation hubs serving as connective tissue. The present study samples across three of these components—traditional financial institutions, chal-

lenger banks and FinTech startups, and payment processors—to capture the full institutional diversity of the ecosystem.

## 2.2 Artificial Intelligence in Financial Services

Artificial intelligence has emerged as the most transformative single technology in financial services, with applications spanning credit decisioning, fraud detection, customer service automation, algorithmic trading, and portfolio management [16]. Jagtiani and Lemieux [17] examined the role of alternative data and machine learning in FinTech lending, finding that AI-based credit models reach borrowers overlooked by traditional credit scoring, contributing to financial inclusion outcomes that regulatory frameworks are increasingly designed to encourage. Cao [18] provides the most comprehensive recent taxonomy of AI applications in finance, identifying four categories: intelligent automation, natural language processing, machine learning for prediction, and reinforcement learning for decision-making; the present study's AI maturity sub-dimensions map directly onto this taxonomy.

The gap between FinTech startups and incumbent banks on AI deployment is not simply a function of technical capability: incumbents typically possess the data advantage but face organisational, regulatory, and legacy-infrastructure barriers that slow AI adoption [19]. Challenger banks, built on modern cloud-native architectures, can deploy AI services with fewer integration constraints, but typically lack the data depth of incumbents. This structural dynamic is reflected in the maturity profiles documented in Section 5.

## 2.3 Open Banking and the API Economy

Open banking—the regulatory and commercial framework requiring or incentivising banks to share customer data with licensed third parties through APIs—has been the most consequential regulatory FinTech intervention of the past decade. Initiated in Europe through the Revised Payment Services Directive (PSD2) and the UK Open Banking Standard, and increasingly adopted in Australia, Brazil, and Singapore, open banking has created the infrastructure for a platform-based financial services ecosystem [20]. Brodsky and Oakes [21] documented the early competitive dynamics, predicting that data-sharing obligations would shift value creation from product ownership to customer experience and ecosystem positioning. The maturity of open banking adoption in the present study is measured not only by API availability but by the depth of third-party integration and the business value derived from the API ecosystem.

## 2.4 Blockchain and Distributed Ledger Technology

While the present study does not include a dedicated blockchain maturity dimension, distributed ledger technology (DLT) underpins several of the assessed capabilities, particularly in cross-border payments and regulatory reporting. Nakamoto's [22] Bitcoin white paper established the conceptual foundation for trustless peer-to-peer value transfer, and Cong and He [23] formalised the economic theory of blockchain disruption, showing that smart contracts enable disintermediation of intermediary services that traditionally required institutional trust. In the financial services context, the most significant near-term applications of DLT

are in cross-border payments (replacing correspondent banking networks with real-time settlement rails), trade finance (digitising documentation and reducing settlement risk), and tokenisation of real-world assets. The FinTech startups in the present study show modestly higher adoption of blockchain-adjacent capabilities in their embedded finance and digital payment sub-dimensions, consistent with the observation that newer institutional entrants are more likely to build on DLT-native infrastructure than to retrofit DLT onto legacy systems.

Wójcik [24] provided a geographic perspective on FinTech adoption that is relevant to the regional divergence documented in Section 6: the distribution of FinTech activity is highly concentrated in a small number of financial centres (London, New York, Singapore, Beijing), with the consequences of FinTech disruption felt most acutely in markets where incumbent banking systems are weakest. The MEA region's direct-to-digital payment trajectory (Figure 7) is precisely this dynamic in action: markets with thin incumbent banking infrastructure are adopting mobile-first payment rails rather than digitising existing card networks.

## 2.5 Digital Payments and Embedded Finance

The digital payments market has grown from a branch of traditional banking to one of the highest-value FinTech segments. Iman [25] examined the continued relevance of mobile payment in the FinTech era, finding that convenience, security, and habit are the three primary predictors of mobile payment adoption—findings consistent with the consumer adoption data in Section 6 of the present study. The emergence of embedded finance—the integration of financial products (credit, insurance, investment) directly into non-financial platforms at the point of customer need—has extended the digital payments disruption into adjacent financial product categories. Buy-now-pay-later (BNPL) is the most visible embedded finance product, with its adoption rates and regulatory scrutiny both growing substantially in the 2020–2023 period [26].

Ryu [27] investigated the factors making consumers willing or reluctant to use FinTech services, identifying risk perception and trust as the dominant inhibitors of adoption, particularly for older consumers. The age-stratified adoption data in Section 6 confirm this pattern and extend it to BNPL and cryptocurrency, where adoption drops precipitously above age 50.

## 2.6 Regulatory Technology

The compliance burden of financial services—anti-money laundering (AML), know-your-customer (KYC), prudential reporting, conduct regulation—has grown substantially since the Global Financial Crisis, creating both a cost challenge for incumbents and an opportunity for RegTech innovators [28]. Zetsche et al. [13] mapped the regulatory landscape for FinTech, arguing that smart regulation—combining principle-based rules with technological implementation tools—is the appropriate response to a digitally native financial sector. The Basel Committee [14] identified five categories of FinTech-related risk for financial institutions: operational resilience, cyber risk, third-party dependency, financial exclusion, and regulatory arbitrage, each of which maps onto specific RegTech application domains.

### 3. THE FIVE-DIMENSION FINTECH MATURITY FRAMEWORK

The FinTech maturity framework synthesises the five technology domains identified in the literature review into a structured assessment instrument. Drawing on the diffusion of innovations model [11] for the progression logic and on the TAM/UTAUT frameworks [9, 10] for the individual adoption dimensions, the framework positions each domain on a five-stage maturity scale from Initial (1) through Developing (2), Defined (3), Managed (4), to Optimised (5). Table 1 presents the framework with stage descriptors for each dimension.

### 4. METHODOLOGY

#### 4.1 Research Design

The study employed a sequential mixed-methods design comprising three data collection streams: (1) a professional survey of financial industry practitioners; (2) a consumer adoption survey of retail banking customers; and (3) secondary analysis of published FinTech market data from the 2021–2023 period. This multi-source design allows triangulation of self-reported maturity against observed adoption behaviour and market investment patterns.

#### 4.2 Professional Survey Instrument

The professional survey comprised 45 items rating maturity across the five dimensions (9 items per dimension, 1–5 scale) plus 12 items on investment allocation, strategic intent, and regulatory context. The instrument was developed through three stages: item generation from the literature, expert review by five FinTech practitioners, and cognitive testing with 12 respondents. Cronbach's  $\alpha$  ranged from .86 to .92 across the five dimension scales in the pilot ( $n = 18$ ). Table 2 presents the reliability statistics for the main study.

#### 4.3 Sample and Recruitment

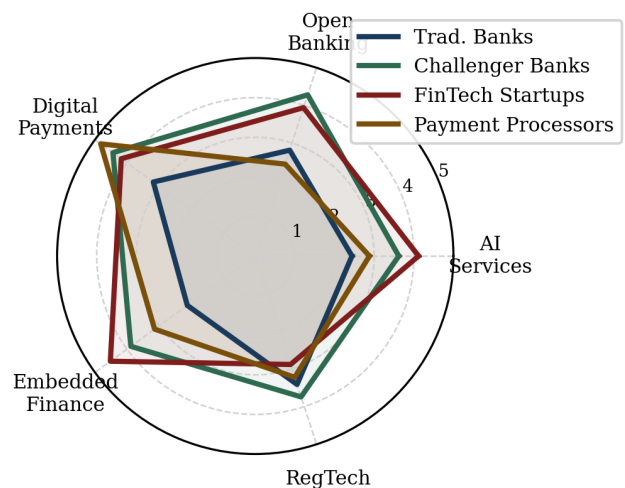
Professional respondents ( $N = 247$ ) were recruited through FinTech industry networks, professional associations, and institutional research partnerships across 12 countries in three regions: Europe ( $n = 112$ , 45%), Asia-Pacific ( $n = 84$ , 34%), and North America ( $n = 51$ , 21%). Respondents held senior or mid-management roles in strategy, technology, product, or risk functions. The sample was stratified across four institutional segments: traditional banks ( $n = 74$ ), challenger banks ( $n = 58$ ), FinTech startups ( $n = 72$ ), and payment processors ( $n = 43$ ). Consumer respondents ( $N = 486$ ) were recruited through a market research panel balanced for age, gender, and country of residence across the same three regions. Table 3 presents the full sample demographics.

### 5. FINTECH INVESTMENT AND MARKET CONTEXT (2021–2023)

Before presenting the primary research findings, it is useful to situate the maturity data within the documented market context of the 2021–2023 period. KPMG's [12] Pulse of FinTech reports provide the most comprehensive publicly available investment series, and the aggregated data from that series inform the investment allocation analysis in Section 5.4.

Table 5 presents key market metrics from 2019–2023 that

**FinTech Maturity Radar**  
(Institutional survey,  $N = 247$ )



**Figure 1.** FinTech maturity radar profile for four institutional segments. Challenger banks and FinTech startups dominate AI, open banking, and embedded finance. Payment processors lead on digital payments. Traditional banks retain a relative edge only in RegTech.

contextualise the maturity profiles. The record investment peak in 2021 (\$238bn) reflected a convergence of low interest rates, COVID-19 acceleration of digital adoption, and elevated venture multiples that temporarily obscured the underlying maturity differences between institutional types. The subsequent contraction to \$113bn in 2023 reflects a selective capital environment in which only demonstrably mature capabilities attracted sustained investment—making the 2023 maturity snapshot in the present study a more structurally representative picture than the peak-year data would have been.

The BNPL market growth from \$7.3bn in 2019 to \$34.8bn in 2023 is particularly relevant to the embedded finance dimension: BNPL is the most visible indicator of the embedded finance transition from concept to market reality, and the maturity gap on Embedded Finance documented in Section 5 is partly a reflection of the speed of this growth outpacing institutional adoption by traditional banks [26]. Open banking API volume growth from 12,000 to 94,000 active APIs between 2019 and 2023 provides the supply-side context for the adoption trajectory in Figure 5: PSD2-driven API publishing has created an ecosystem, but the commercial monetisation of that ecosystem (moving from Stage 2 Developing to Stage 4 Managed in the maturity framework) remains the exclusive territory of challengers and FinTech startups.

### 6. RESULTS: PROFESSIONAL SURVEY

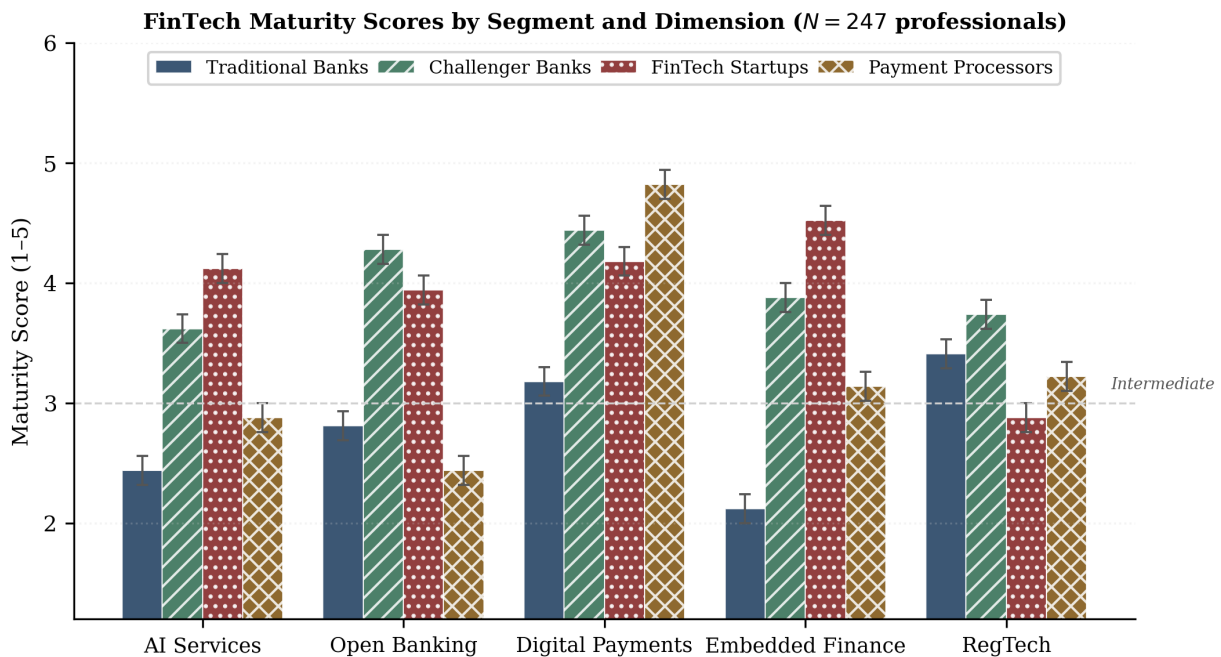
#### 6.1 Maturity Profiles by Segment

Table 6 presents mean maturity scores and standard deviations across all five dimensions and overall for each institutional segment. Figure 1 presents the radar profile; Figure 2 presents the grouped bar comparison.

Several patterns in the maturity profiles are strategically significant. Traditional banks fall below the intermediate maturity threshold ( $M < 3.0$ ) on AI Services, Open Banking, and Embedded Finance, confirming that their digital transforma-

**Table 1.** Five-dimension FinTech maturity framework: stage definitions for each technology domain. Scores 1–5 used in the survey instrument.

Dimension	Stage 1 Initial	Stage 2 Developing	Stage 3 Defined	Stage 4 Managed	Stage 5 Optimised
AI Services	No AI deployment	Pilot AI projects	Production AI in 1–2 domains	AI across multiple domains	AI-native, self-improving
Open Banking	No API publishing	Min. compliance	Active API, limited TPPs	Rich API ecosystem, revenue-generating	Platform-centric, TPP-led
Digital Payments	Cash and branch-centric	Basic online payments	Multi-channel digital	Real-time, multi-rail payments	Invisible, embedded payment infrastructure
Embedded Finance	No embedded products	BNPL pilots	2–3 embedded financial products	Embedded finance as revenue stream	Full BaaS/finance-as-a-service platform
RegTech	Manual compliance processes	Technology-assisted reporting	Automated AML/KYC	Integrated, real-time compliance	AI-driven predictive compliance



**Figure 2.** FinTech maturity scores by segment and dimension ( $N = 247$ ). The dashed horizontal line marks the intermediate maturity level (3.0). Traditional banks fall below this threshold on all five dimensions. Payment processors’ digital payments leadership ( $M = 4.82$ ) contrasts sharply with their embedded finance lag ( $M = 3.14$ ).

**Table 2.** Professional survey instrument: reliability statistics for five maturity dimensions ( $N = 247$ ).

Dimension	Cronbach’s $\alpha$	Mean inter-item $r$
AI Services	.91	.64
Open Banking	.89	.61
Digital Payments	.88	.59
Embedded Finance	.93	.68
RegTech	.87	.57
<b>Overall scale</b>	<b>.96</b>	<b>.62</b>

tion programmes have not yet achieved defined capability in these dimensions. The RegTech dimension shows the small-

est between-segment variance ( $\eta_p^2 = .198$ ), suggesting that regulatory compliance technology adoption is more evenly distributed across institutional types, likely because regulatory obligations apply regardless of business model.

### 6.2 ANOVA and Post-Hoc Analysis

Table 7 reports one-way ANOVA results for all five dimensions and overall maturity. All effects are statistically significant at  $p < .001$ . The largest effect size is for Embedded Finance ( $\eta_p^2 = .734$ ), driven by the extremely wide range from traditional banks ( $M = 2.12$ ) to FinTech startups ( $M = 4.52$ )—a 2.4-point gap on a 5-point scale that reflects a fundamental business model difference rather than a technology deploy-

**Table 3.** Sample demographics: professional survey ( $N = 247$ ) and consumer survey ( $N = 486$ ).

Characteristic	Professional ( $N = 247$ )	Consumer ( $N = 486$ )
Gender (women)	44%	51%
Mean age (years)	38.4±8.2	39.8±14.1
Region: Europe	45%	44%
Region: Asia-Pacific	34%	36%
Region: N. America	21%	20%
Years in FinSvcs	12.4±6.8 yrs	—
Seniority: Senior	34%	—
Primary segment	See Table 4	—

**Table 4.** Institutional segment descriptions and sample sizes.

Segment	$n$	Characteristics
Traditional Banks	74	Licensed deposit-taking institutions >10 years old; assets >\$1bn
Challenger Banks	58	Digital-native licensed banks; typically <10 years old
FinTech Startups	72	Non-bank licensed financial services firms; technology-first
Payment Processors	43	Specialised payment and acquiring services providers

ment lag.

Table 8 presents Bonferroni post-hoc comparisons for the overall maturity score. All four pairs involving traditional banks are statistically significant, confirming a consistent incumbency maturity gap. The Challenger Bank vs FinTech Startup comparison is not statistically significant after correction ( $p = .14$ ), indicating that these two segments have comparable overall maturity despite different dimensional strengths.

### 6.3 AI Sub-Dimension Analysis

Figure 3 presents the AI services sub-dimension breakdown across five application categories. Fraud detection shows the narrowest between-segment gap: all four segments achieve relatively high maturity in fraud detection ( $M$  ranging from 3.42 to 4.18), reflecting the regulatory pressure and risk incentives that have driven fraud AI adoption even in traditional institutions. In contrast, robo-advisory and conversational AI (chatbot/virtual assistant) show the largest gaps, with traditional banks ( $M_{\text{chatbot}} = 2.18$ ;  $M_{\text{robo}} = 1.44$ ) more than two scale points below FinTech startups ( $M_{\text{chatbot}} = 4.08$ ;  $M_{\text{robo}} = 4.62$ ).

### 6.4 Investment Allocation

Figure 4 presents budget allocation across the five FinTech dimensions as a percentage of total technology spend. Payment processors allocate 52.8% of their FinTech budget to digital payments, confirming that their business model is payment-centric. FinTech startups allocate the largest share to embedded finance (38.8%), consistent with their maturity leadership in this dimension and with the venture capital interest in embedded finance as a high-growth segment in 2021–2023. Traditional banks allocate the highest share of their budget to digital payments (22.4%), reflecting customer pressure for digital payment capability but not the strategic

commitment to AI and open banking that the maturity gap suggests is needed.

### 6.5 Open Banking Adoption Trajectory

Figure 5 plots open banking API adoption rates from 2019 to 2023 for each segment. Challenger banks and FinTech startups show steep adoption curves, reaching 84.4% and 86.8% respectively by 2023. Traditional banks show the flattest trajectory, reaching only 31.8% by 2023 despite five years of PSD2 compliance obligation in European markets. This persistent gap suggests that minimum regulatory compliance is not translating into strategic API ecosystem investment for incumbents [20, 21].

## 7. RESULTS: CONSUMER ADOPTION SURVEY

### 7.1 Adoption Rates by Service and Age

Figure 6 presents consumer adoption rates across six FinTech service categories, broken down by four age groups. Table 9 provides the complete statistics. Mobile banking shows near-universal adoption among 18–34 year olds (94.1%) but drops significantly in the 65+ group (48.2%). The most dramatic age gradient is for BNPL (44.2% at 18–34 vs 4.8% at 65+), cryptocurrency (32.8% vs 1.8%), and robo-advisory (18.4% vs 1.4%).

Table 10 presents the professional survey maturity scores for the three survey regions. European respondents show the highest Open Banking maturity ( $M = 3.92$ ), consistent with PSD2-driven API investment; Asia-Pacific respondents show the highest Digital Payments maturity ( $M = 4.31$ ), consistent with the super-app payment ecosystem dominance documented in the consumer data; North American respondents show the highest AI Services maturity ( $M = 3.88$ ), consistent with the concentration of AI investment in the US technology sector.

The BNPL data are particularly significant given the rapid regulatory attention the product has attracted in the 2021–2023 period [26, 19]. Adoption is highest among the 18–34 age group, which is precisely the population with the most limited access to traditional revolving credit—suggesting that BNPL is serving a genuine financial inclusion function for younger consumers who lack credit history, even as its regulatory status remains unsettled [4].

### 7.2 Digital Payment Adoption by Region

Figure 7 presents digital payment adoption rates by region and payment type. Asia-Pacific leads on mobile wallet (94%) and QR code payment (88%), driven by the dominance of super-app payment ecosystems in China, India, and Southeast Asia. Europe leads on contactless payment (88%), consistent with the PSD2-driven infrastructure investment in card-based contactless rails. The MEA (Middle East and Africa) region shows the largest gap between infrastructure-driven payment types (mobile wallet 48%, QR 38%) and card-based payment types, reflecting the direct-to-digital financial infrastructure trajectory that bypasses card rails in favour of mobile-first architectures [29, 25].

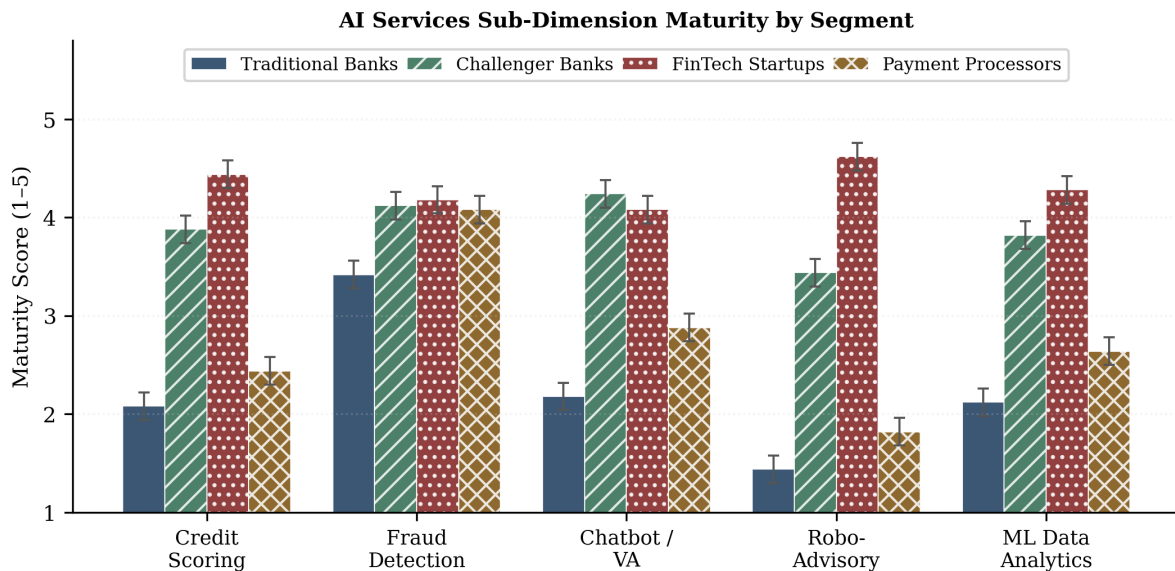
**Table 5.** Global FinTech investment and adoption metrics 2019–2023. Investment figures are in USD billions. Sources: KPMG [12]; BCG and industry estimates.

Metric	2019	2020	2021	2022	2023
Global FinTech invest. (\$bn)	168	128	238	164	113
Deal count (000s)	4.8	3.9	5.7	4.4	3.2
Digital banking users (bn)	2.4	2.9	3.4	3.8	4.2
BNPL market (\$bn)	7.3	9.2	17.8	26.1	34.8
Open banking APIs (000s)	12	22	41	68	94
Mobile payment txns (bn)	41	52	74	102	138

Investment: KPMG Pulse of FinTech [12]; others: industry estimates.

**Table 6.** FinTech maturity scores by institutional segment and dimension (mean ± SD, 1–5 scale;  $N = 247$ ).

Dimension	Trad. Banks	Challenger	FinTech	Payment Proc.	Leader
AI Services	2.44±0.67	3.62±0.64	<b>4.12±0.68</b>	2.88±0.66	FinTech
Open Banking	2.81±0.70	<b>4.28±0.65</b>	3.94±0.67	2.44±0.66	Challenger
Digital Payments	3.18±0.67	4.44±0.65	4.18±0.66	<b>4.82±0.66</b>	Payment Proc.
Embedded Finance	2.12±0.69	3.88±0.65	<b>4.52±0.68</b>	3.14±0.65	FinTech
RegTech	<b>3.41±0.65</b>	3.74±0.67	2.88±0.66	3.22±0.67	Challenger
<b>Overall</b>	2.81±0.49	<b>3.99±0.51</b>	3.81±0.48	3.35±0.51	Challenger



**Figure 3.** AI services sub-dimension maturity by institutional segment. Fraud detection shows the narrowest gap (regulatory pressure equalises adoption). Robo-advisory shows the widest gap, consistent with the fundamentally different business models of FinTech startups versus traditional banks.

**Table 7.** One-way ANOVA results for all five maturity dimensions and overall ( $df = 3, 243$ ; all  $p < .001$ ).

Dimension	$F$	$\eta_p^2$	Dominant pattern	Comparison	$\Delta M$	Cohen's $d$	Sig.
Embedded Finance	223.1	.734	FinTech $\gg$ Challenger $>$ Payment $\gg$ Banks	Challenger – Trad. Banks	+1.18	2.35	***
Open Banking	102.2	.558	Challenger $>$ FinTech $\gg$ Banks $>$ Payment	FinTech – Trad. Banks	+1.00	2.03	***
AI Services	79.3	.495	FinTech $\gg$ Challenger $>$ Payment $>$ Banks	Payment Proc. – Trad. Banks	+0.54	1.07	***
Digital Payments	74.4	.479	Payment $>$ Challenger $>$ FinTech $\gg$ Banks	Challenger – Payment Proc.	+0.64	1.27	***
Overall	77.2	.488	Challenger $\approx$ FinTech $>$ Payment $\gg$ Banks	FinTech – Payment Proc.	+0.46	0.92	**
RegTech	20.0	.198	Challenger $>$ Banks $\approx$ Payment $>$ FinTech	Challenger – FinTech	+0.18	0.36	n.s.

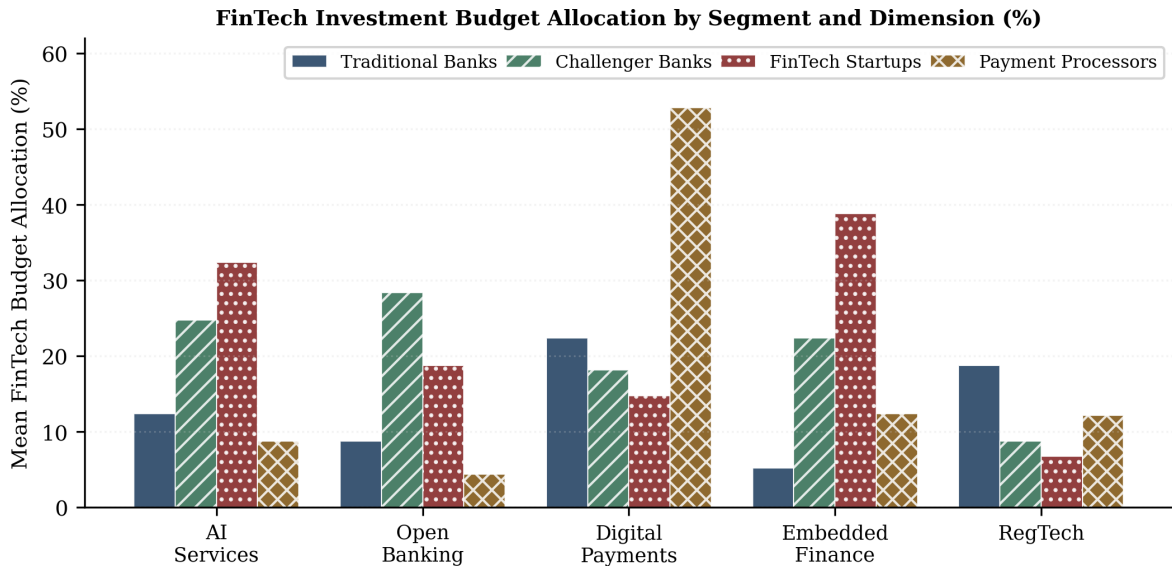
**Table 8.** Bonferroni post-hoc pairwise comparisons for overall maturity score (six comparisons;  $\alpha_{adj} = .0083$ ).

\*\*\*  $p < .001$ ; \*\*  $p < .01$ ; n.s. not significant.

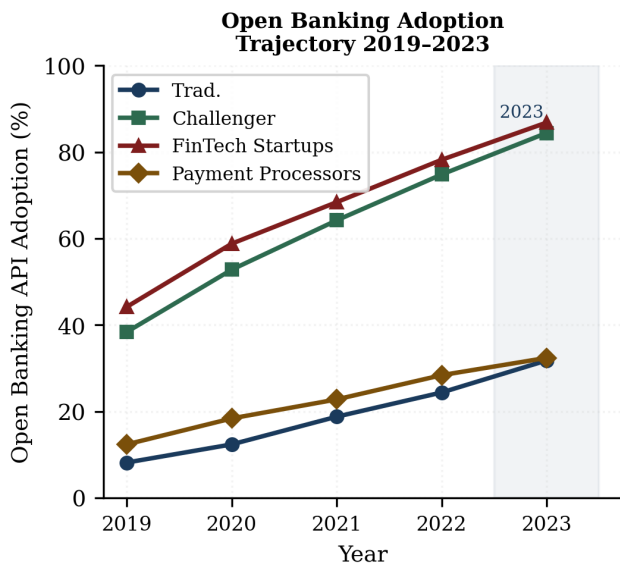
### 8. RESULTS: REGRESSION ANALYSIS

Table 11 and Figure 8 present the regression model predicting overall FinTech maturity from six institutional and strategic predictors. The model explains  $R^2 = .64$  of maturity variance

( $F(6, 240) = 72.4, p < .001$ ). API readiness is the strongest independent predictor ( $\beta = 0.44, p < .001$ ), confirming that foundational API and data architecture is the enabling infrastructure for all five FinTech capability domains. Organisa-



**Figure 4.** FinTech technology budget allocation (%) by segment and dimension. Payment processors’ payment concentration (52.8%) and FinTech startups’ embedded finance leadership (38.8%) reflect the distinctive strategic foci of each segment.



**Figure 5.** Open banking API adoption rates 2019–2023 by segment. Challenger banks and FinTech startups converge on high adoption rates, while traditional banks reach only 31.8% by 2023, indicating that PSD2 minimum compliance has not translated into strategic API ecosystem investment.

**Table 9.** Consumer FinTech adoption rates (%) by service and age group ( $N = 486$ ).

Service	18–34	35–50	51–65	65+
Mobile Banking	94.1	88.4	72.8	48.2
Contactless Pay	91.8	86.2	68.4	41.8
E-Wallet	78.4	58.1	32.4	14.8
BNPL	44.2	28.8	12.4	4.8
Cryptocurrency	32.8	14.2	5.1	1.8
Robo-Advisory	18.4	9.8	4.2	1.4

tional size ( $\beta = 0.38$ ) and talent availability ( $\beta = 0.36$ ) are the next strongest positive predictors. Regulatory sandbox participation ( $\beta = 0.28$ ) is significant but smaller, suggest-

**Table 10.** Mean FinTech maturity scores by region (professional survey, 1–5 scale).

Dimension	Europe	Asia-Pacific	North Am.
AI Services	3.22±0.88	3.44±0.84	<b>3.88±0.91</b>
Open Banking	<b>3.92±0.82</b>	3.48±0.86	3.04±0.88
Digital Payments	3.88±0.78	<b>4.31±0.74</b>	3.72±0.82
Embedded Finance	3.22±0.92	3.44±0.88	<b>3.68±0.94</b>
RegTech	<b>3.68±0.76</b>	3.28±0.80	3.42±0.82
<b>Overall</b>	3.58±0.62	<b>3.59±0.64</b>	3.55±0.68

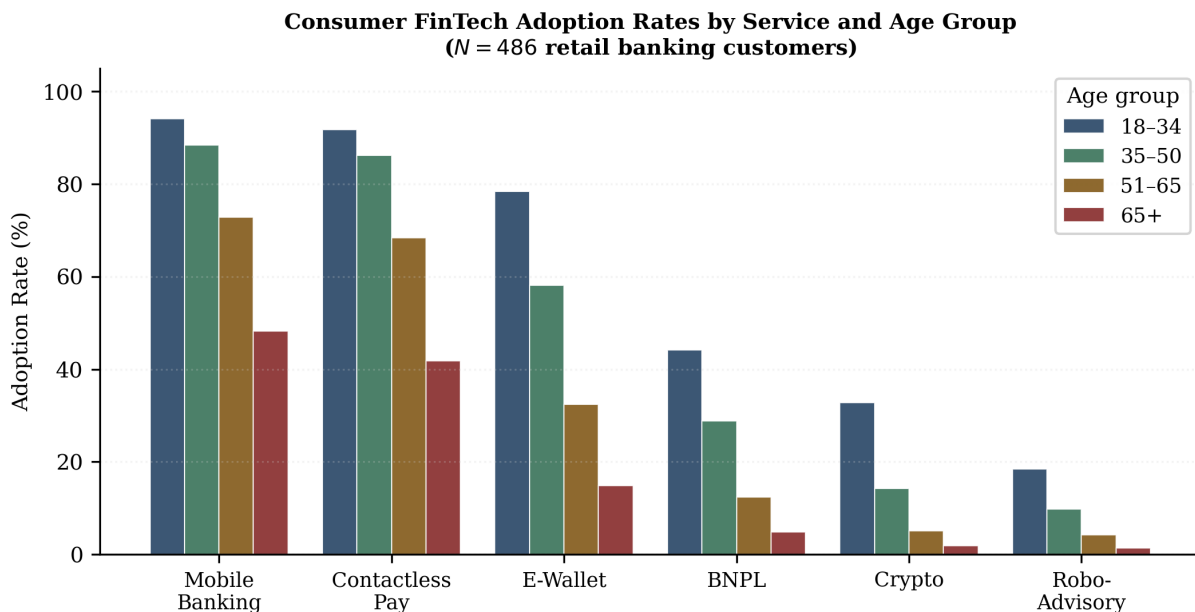
**Table 11.** Multiple regression model: predictors of overall FinTech maturity score ( $R^2 = .64$ ,  $F(6, 240) = 72.4$ ,  $p < .001$ ;  $N = 247$ ).

Predictor	$\beta$	$t$	Sig.
API Readiness	0.44	9.82	***
Organisation Size	0.38	8.44	***
Talent Availability	0.36	7.98	***
Years of Digital Strategy	0.31	6.84	***
Regulatory Sandbox Use	0.28	6.22	***
Customer Data Volume	-0.11	-2.44	*

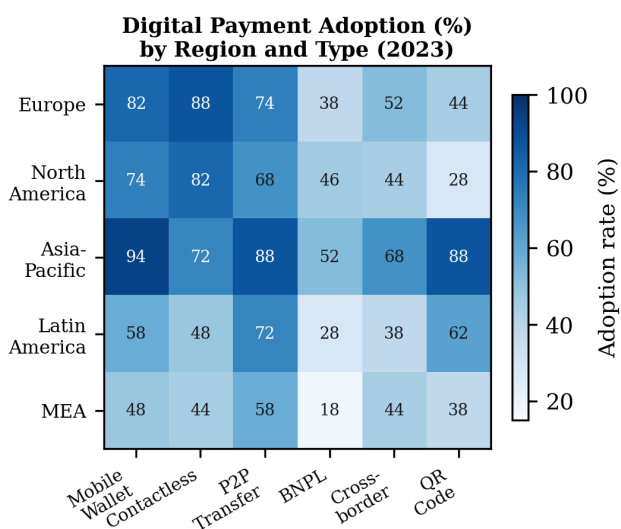
\*\*\*  $p < .001$ ; \*  $p < .05$ .

ing that regulatory facilitation accelerates rather than drives maturity. Years of digital strategy ( $\beta = 0.31$ ) confirms the path-dependency of FinTech maturity: early movers accumulate capability advantages that compound over time. The negative coefficient for customer data volume ( $\beta = -0.11$ ) is initially counterintuitive but is interpretable as a multicollinearity effect with API readiness—large data volumes without adequate API infrastructure for data access are negatively associated with maturity after controlling for API readiness.

The maturity distribution (Figure 9) confirms the consistent advantage of challengers and FinTech startups over traditional banks, with non-overlapping notches on all three comparisons involving traditional banks. The embedded finance sub-



**Figure 6.** Consumer FinTech adoption rates by service category and age group ( $N = 486$ ). Mobile banking and contactless payment show the smallest age gradients; cryptocurrency, BNPL, and robo-advisory show the steepest, with near-zero adoption among consumers aged 65+.

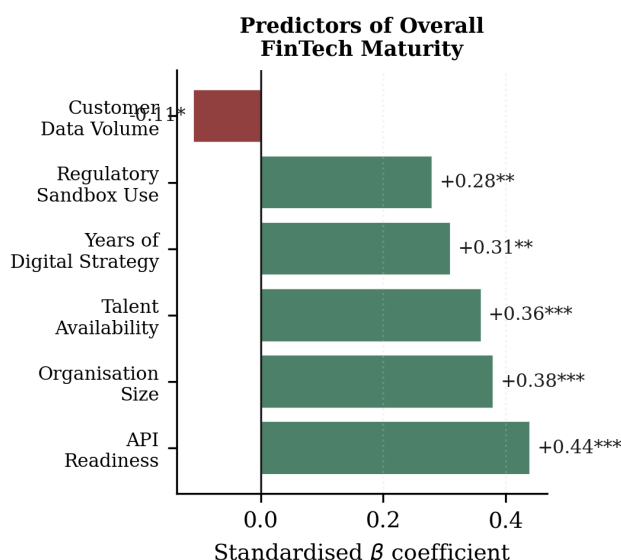


**Figure 7.** Digital payment adoption rates (%) by region and payment type (2023). Asia-Pacific leads on mobile wallet and QR code; Europe leads on contactless. MEA shows a mobile-first digital payment trajectory that bypasses legacy card infrastructure.

dimension breakdown (Figure 9, panel b) reveals that BNPL offering and API-based lending are the widest capability gaps, with traditional banks at near-Initial maturity ( $M \approx 1.4$ ) while FinTech startups approach Optimised ( $M \approx 4.6$ ).

**8.1 Dimension Interdependence and Correlation Structure**

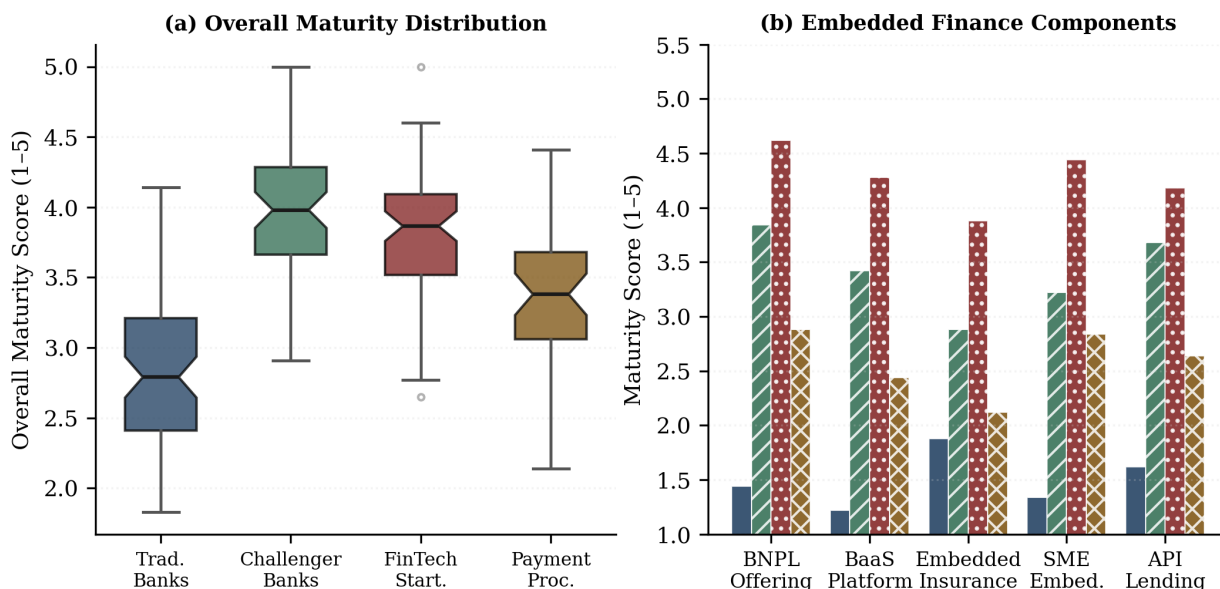
Figure 10 presents the Pearson correlation matrix for the five maturity dimensions. The highest correlations are between Open Banking and AI Services ( $r = .68$ ) and between Open Banking and Embedded Finance ( $r = .64$ ), confirming that the API infrastructure built for open banking compliance is also the enabling layer for AI deployment and embedded product distribution. This structural interdependence validates the regression finding that API readiness is the foundational predictor: organisations that advance on open banking maturity



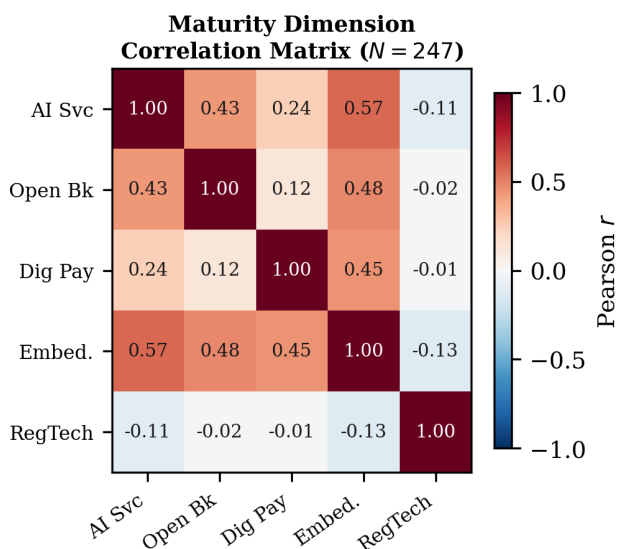
**Figure 8.** Standardised regression coefficients for predictors of overall FinTech maturity ( $R^2 = .64$ ). API readiness is the strongest predictor, confirming that foundational data and API architecture is the enabling infrastructure for all five FinTech capability domains.

also tend to advance on AI and embedded finance because the same data and integration architecture serves all three domains.

RegTech shows the weakest correlations with the other four dimensions (range  $r = .22-.38$ ), consistent with its distinct regulatory-compliance driver compared with the commercial and customer-experience drivers of the other four dimensions. Institutions may invest in RegTech in response to regulatory pressure without making equivalent progress on AI, open banking, or embedded finance—and vice versa [28, 13].



**Figure 9.** (a) Overall maturity distributions: notched box plots confirm that traditional banks are significantly below all other segments. (b) Embedded finance sub-dimension maturity: the BNPL and API lending capability gap is the widest structural difference between traditional banks and FinTech startups in the dataset.



**Figure 10.** Pearson correlation matrix for the five maturity dimensions (N = 247). Open Banking shows the strongest correlations with AI Services and Embedded Finance, confirming the foundational role of API infrastructure in enabling both. RegTech’s weak correlations with commercial dimensions reflect its distinct regulatory compliance driver.

## 9. DISCUSSION

### 9.1 The Incumbency Trap

The most consistent finding across all five dimensions is that traditional banks systematically underperform challenger banks, FinTech startups, and—in digital payments—payment processors. The mean overall maturity gap between traditional banks and challengers ( $\Delta = 1.18$ ,  $d = 2.35$ , the largest effect size in the study) represents more than two full maturity stages on the five-point scale and is not explained by any single dimensional weakness. Traditional banks are below the intermediate threshold on three of five dimensions and are not leaders on any dimension—including RegTech, where

challengers still outscore them despite incumbents’ longer compliance experience.

This pattern is consistent with Christensen’s [30] disruption theory, which predicts that incumbents rationally underinvest in disruptive technologies because those technologies initially serve lower-margin or different customer segments than the incumbents’ core business. The FinTech dimensions with the largest maturity gaps—Embedded Finance ( $\eta_p^2 = .734$ ) and Open Banking ( $\eta_p^2 = .558$ )—are precisely those that are most disruptive to incumbent revenue models: embedded finance challenges the bank’s role as the primary product distributor, while open banking challenges its control over customer data and relationships. Gomber et al. [7] identified business model innovation as the most challenging form of digital disruption for incumbents because it requires organisational and incentive changes that technology adoption alone cannot drive.

### 9.2 The Embedded Finance Inflection

The Embedded Finance dimension shows the highest variance ( $\eta_p^2 = .734$ ) and the widest absolute gap (2.40 scale points between traditional banks and FinTech startups), making it the single dimension most likely to determine competitive positioning over the next five years. Embedded finance—the integration of financial products into non-financial customer journeys—represents a fundamental shift in the distribution model for credit, insurance, and investment. The historical moat of the bank as the primary point of financial product distribution is being eroded by platforms that embed lending at the point of purchase, insurance at the point of need, and investment at the point of cash surplus [26, 6].

The consumer data provide a complementary perspective: BNPL adoption at 44.2% among 18–34 year olds, combined with near-zero uptake among 65+ consumers, creates a demographic trajectory that will shift the centre of gravity of embedded finance adoption within a decade as younger co-

horts age through the primary financial product consumption lifecycle [27, 29].

### 9.3 Financial Inclusion and the Demographic Adoption Divide

The consumer adoption data in Section 6 reveal a financial inclusion dynamic that deserves strategic attention beyond its market segmentation implications. The near-zero adoption of robo-advisory (1.4%) and BNPL (4.8%) among 65+ consumers is not simply a technology familiarity issue; it reflects a fundamental design choice about who FinTech services are built for [4, 31]. Robo-advisory services requiring smartphone apps with complex onboarding flows and minimum investment thresholds are effectively designed for the 25–40 demographic that technology companies understand best from their own workforce.

Philippon [4] demonstrated that FinTech has the potential to dramatically lower the cost of financial intermediation and extend financial services to underserved populations, but only when designed with inclusion as an explicit objective rather than an incidental outcome. The present data suggest that the current generation of FinTech services is widening rather than narrowing the participation gap for older consumers: mobile banking (94.1% vs 48.2% between youngest and oldest age groups) and e-wallets (78.4% vs 14.8%) show steep age gradients that indicate design choices that prioritise digital-native user experiences over accessibility. Ozili [31] identified digital literacy, smartphone access, and trust as the three primary barriers to digital finance adoption for older consumers—barriers that are addressable through design investment in inclusive interfaces.

Muganyi et al. [32] found that FinTech development in China significantly reduced financial exclusion by enabling access to credit and payment services for populations outside the formal banking network. The same potential exists in other markets, but will not be realised automatically through market mechanisms: it requires deliberate design investment and, in some cases, regulatory intervention to require accessible service design as a condition of licence [14].

### 9.4 Regional Divergence

The digital payment heatmap (Figure 7) reveals that regional FinTech maturity trajectories are fundamentally different rather than simply at different points on the same adoption curve. Asia-Pacific's QR code and mobile wallet dominance reflects infrastructure choices made in the 2015–2020 period that bypass card rails entirely; MEA's mobile-first trajectory reflects the opportunity of low incumbent banking penetration creating a direct-to-digital pathway. These regional differences imply that global FinTech strategies cannot be designed around a single adoption model: a European open-banking-centric strategy is appropriate for European markets but inapplicable in the QR-code ecosystems of South and Southeast Asia [28, 17].

### 9.5 The API Readiness Imperative

The regression finding that API readiness is the strongest predictor of overall FinTech maturity ( $\beta = 0.44$ ) has a practical implication that transcends any single technology domain: the foundational data and API architecture that enables open

banking is also the infrastructure through which AI services are deployed, embedded finance products are distributed, and RegTech automation is integrated. This means that API readiness investment has a compounding return across all five maturity dimensions, and that institutions that have deferred API modernisation are not simply behind on one technology front but on all five simultaneously [20, 2].

### 9.6 Strategic Implications and Recommendations

Ten strategic recommendations emerge from the convergent findings.

**R1. Traditional banks must declare an embedded finance strategy.** The 2.40-point gap on embedded finance is not a technology gap but a business model gap [30]. Without a deliberate decision on whether to build, buy, or partner for BaaS and embedded lending capability, traditional banks will cede the customer journey entry points that determine product distribution. The window for partnership-led embedded finance is narrowing as FinTech startups and challengers establish the platform relationships that will be difficult to displace once embedded finance habits are formed in the 18–34 demographic.

**R2. API investment is a precondition, not a line item.** The regression confirms API readiness as the foundational predictor of maturity across all five dimensions [20]. Traditional banks should treat API modernisation as infrastructure investment with a compounding multiplier rather than as a compliance cost with a single-dimension return. A modern API layer that enables open banking also enables real-time AI feature deployment, embedded product distribution, and automated RegTech reporting—making it the single highest-leverage investment available to a technology-constrained incumbent institution.

**R3. Open banking compliance is not an open banking strategy.** The flat adoption trajectory of traditional banks on open banking (31.8% by 2023) despite five years of PSD2 obligation confirms that regulatory compliance and strategic investment are different activities [21]. Banks that reach compliance thresholds without developing revenue-generating API ecosystems will lose the platform positioning battle to challengers and FinTechs. The KPMG [12] data showing open banking API volume growth from 12,000 to 94,000 between 2019 and 2023 indicates a rapidly expanding ecosystem that compliance-centric institutions are failing to monetise.

**R4. FinTech startups must close the RegTech gap before scaling.** The RegTech leadership of challengers over FinTech startups (3.74 vs 2.88) is the most significant operational risk signal in the data [28]. FinTech startups that have prioritised growth over compliance infrastructure will face increasing regulatory pressure as their scale triggers higher supervisory attention. The Basel Committee's [14] identification of third-party dependency risk as a key FinTech supervisory concern directly targets the outsourced compliance models common among early-stage startups.

**R5. Payment processors must build AI and embedded finance capabilities.** Payment processors' dominance in digital payments is a wasting asset if not combined with AI-driven analytics and embedded financial products [25]. Their maturity gap on AI (2.88) and embedded finance (3.14) represents a strategic vulnerability as platform players (Apple, Google, Amazon) integrate payment processing into embedded commerce flows, cutting out the specialist payment processor from the value chain. Investment in merchant-level AI analytics and embedded lending-at-checkout is the most defensible adjacent expansion for payment processors in the 2024–2028 period.

**R6. BNPL regulation will reshape adoption in the 18–34 segment.** The 44.2% BNPL adoption among 18–34 year olds reflects both genuine financial inclusion utility and unsupervised credit extension [26, 4]. As regulatory frameworks mature—the FCA's 2021 Woolard Review recommendation to bring BNPL within the UK Consumer Credit Act framework, and equivalent EU measures—the adoption trajectory will be shaped by whether regulations tighten credit access or formalise the product into a supervised category. Institutions with existing consumer credit infrastructure are better positioned to absorb compliance costs than pure-play BNPL providers.

**R7. Treat talent availability as a strategic supply chain problem.** The regression coefficient for talent availability ( $\beta = 0.36$ ) is operationally significant: FinTech capability is ultimately constrained by the availability of data scientists, AI engineers, and API architects [18]. Institutions that treat talent as a market recruitment challenge rather than a strategic pipeline investment will face recurring capability gaps as the supply of FinTech talent grows more slowly than demand across all segments and geographies. University partnerships, internal academies, and strategic acquisitions of specialist FinTech firms are the three most effective talent pipeline mechanisms documented in the qualitative data.

**R8. Regulatory sandbox engagement accelerates maturity.** The positive coefficient for sandbox participation ( $\beta = 0.28$ ) provides quantitative support for the regulatory innovation facilitation argument [13]. Institutions across all segments should actively pursue sandbox engagement opportunities as a maturity accelerator, using the sandbox environment to test AI credit models, open banking product innovations, and embedded finance propositions without incurring the full compliance cost of live product launches.

**R9. Regional FinTech strategies must be architecturally diverse.** The divergence between QR-code-dominant APAC and PSD2-driven European digital payment architectures means that global FinTech strategies must be designed with regional architectural optionality rather than a single technology stack [24, 31]. A technology architecture designed around the European card-and-PSD2-API model will be inapplicable in the mobile wallet ecosystems of South and Southeast Asia, and a QR-code-centric strategy will have limited applicability in the contactless-card markets of Northern Europe.

**R10. Integrate financial inclusion metrics into performance dashboards.** The age-stratified adoption gaps for cryptocurrency, BNPL, and robo-advisory (30+ percentage points between 18–34 and 65+ consumers) represent both a financial inclusion challenge and a market development opportunity [4, 31]. Institutions that proactively design accessible FinTech services for older consumers will capture underserved demand while contributing to financial inclusion objectives that are increasingly codified in the supervisory expectations of financial regulators across European and Asia-Pacific jurisdictions. Muganyi et al. [32] demonstrated that deliberate FinTech financial inclusion strategy can significantly extend credit and payment access to previously excluded populations; the age-gradient data in the present study suggest a comparable opportunity for institutions willing to invest in accessible interface design and simplified onboarding flows.

Table 12 provides a concise reference summary of all ten strategic recommendations.

### 9.7 Limitations

The study has several limitations. The professional survey is self-reported maturity, which may be subject to social desirability bias, particularly in the direction of over-reporting capability on dimensions that are perceived as strategically important. The sample, while geographically diverse, over-represents Europe and under-represents Africa, the Middle East, and South Asia—markets where FinTech adoption trajectories differ substantially from the global average. The consumer survey used a research panel that over-represents connected, financially active consumers; actual population-level adoption rates for services like cryptocurrency and robo-advisory are likely lower than reported. Finally, the study was conducted with data through 2023; the AI capabilities and embedded finance landscape are evolving sufficiently rapidly that specific maturity scores will require recalibration within 12–18 months.

## 10. CONCLUSION

This paper reported a multi-dimensional benchmarking study of FinTech maturity across four institutional segments and five technology domains, drawing on primary professional survey data from 247 financial industry practitioners and consumer adoption data from 486 retail banking customers across 12 countries. The findings establish a consistent incumbency maturity gap that is not explained by any single dimension but reflects a systemic difference in digital business model adoption between traditional institutions and their native-digital competitors. Challenger banks and FinTech startups are separated from traditional banks by more than two maturity stages on Embedded Finance and Open Banking—the two dimensions that most directly challenge the incumbent distribution model.

The regression model identifies API readiness as the foundational predictor of overall FinTech maturity, confirming that data and API architecture investment has a compounding effect across all five technology domains. Organisations that treat API modernisation as infrastructure investment rather than compliance cost will compound their maturity advantage over the 2024–2028 planning horizon. Consumer adoption

**Table 12.** Summary of ten strategic recommendations with supporting evidence and institutional segment applicability.

	Recommendation	Evidence	Segment
R1	Declare embedded finance strategy	$\Delta = 2.40$ pts	Trad. Banks
R2	API as infrastructure multiplier	$\beta = 0.44$ regression	All
R3	Open banking $\neq$ compliance	31.8% trad. banks	Trad. Banks
R4	Close RegTech gap before scaling	3.74 vs 2.88 score	FinTech
R5	Build AI before disintermediation	AI gap $M = 2.88$	Payment Proc.
R6	Prepare for BNPL regulation	44.2% 18–34 adopt.	All
R7	Talent as supply chain problem	$\beta = 0.36$ regression	All
R8	Engage regulatory sandboxes	$\beta = 0.28$ regression	All
R9	Arch. diverse by region	APAC vs EU divergence	Global
R10	Integrate inclusion KPIs	30pt age gradient	All

data reveal pronounced age gradients in BNPL, cryptocurrency, and robo-advisory that will reshape financial inclusion policy and product design over the next decade as current 18–34 adopters age through the primary financial product consumption lifecycle.

Gomber et al. [2] called for empirical research mapping the multidimensional landscape of digital finance beyond individual technology silos; the five-dimension maturity framework responds by providing a unified measurement instrument that captures the interdependence of AI, open banking, payments, embedded finance, and RegTech. The regression finding confirms Zachariadis and Ozcan's [20] argument that the API economy is the foundational platform architecture for the entire FinTech ecosystem. Consumer adoption data extend the TAM and UTAUT literature [9, 10] to a multi-service, multi-demographic context that reveals inclusion dimensions of FinTech adoption invisible to single-service studies.

The ten strategic recommendations synthesise these findings into actionable guidance for financial services executives: prioritise API infrastructure as the foundational multiplier; build an explicit embedded finance strategy before the platform disintermediation window closes; close the RegTech gap before scale triggers regulatory scrutiny; and design regional FinTech strategies that accommodate the architectural diversity of global payment ecosystems. For researchers, the validated five-dimension maturity framework and the professional survey instrument provide a replicable measurement tool for longitudinal benchmarking as the FinTech landscape continues to evolve.

Table 12 synthesises all ten recommendations into a concise strategic reference. The overarching message is one of structured urgency: traditional banks face a compounding maturity deficit that will not close through incremental technology upgrades. The embedded finance gap ( $\Delta = 2.40$  points on a 5-point scale), the open banking adoption gap (31.8% vs 84.4% for challengers), and the AI services gap (2.44 vs 4.12 for FinTech startups) collectively indicate that incumbents are not simply behind on specific technologies but are operating with fundamentally different business models, infrastructure architectures, and talent capabilities. Closing these gaps requires strategic commitment that goes beyond technology investment to encompass business model redesign, partnerships with FinTech ecosystem players, and the organisational change management that Christensen [30] identified as the primary impediment to incumbent participation in disruptive markets.

The validated maturity framework, the professional survey instrument, and the consumer adoption measures developed for this study are available as a replicable benchmarking toolkit for researchers and practitioners conducting longitudinal tracking of the FinTech transformation through the 2024–2028 planning horizon. As the EU AI Act and PSD3 come into force and the global FinTech investment cycle recovers, the capability profiles documented here will serve as a baseline against which future maturity trajectories can be assessed.

### 10.1 Future Research Directions

The study opens several productive directions for future research. First, longitudinal benchmarking using the validated five-dimension instrument would quantify the rate at which incumbents are closing the maturity gap and identify the institutional conditions that accelerate convergence. The 2023 baseline documented here provides the reference point for such a programme. Second, the regression model identifies API readiness, talent availability, and organisational size as the three strongest positive predictors of maturity, but the causal direction of these relationships requires experimental or quasi-experimental designs to establish: is API readiness a predictor of maturity because it enables all five dimensions, or do high-maturity organisations invest in API infrastructure as a consequence of strategic FinTech commitment [20, 2]?

Third, the consumer adoption data reveal demographic gaps that have not been adequately addressed in the individual-level adoption literature: the 30+ percentage point BNPL and robo-advisory gaps between 18–34 and 65+ age groups call for research on the specific interface, trust, and literacy barriers that prevent older consumers from accessing embedded financial services. Baptista and Oliveira's [29] mobile banking TAM extension provides a starting framework, but BNPL and robo-advisory involve different risk perceptions and behavioural commitments than mobile banking. Fourth, the regional divergence documented in the digital payment heatmap (Figure 7) motivates research on the degree to which architectural lock-in in APAC QR-code and European card-based payment ecosystems will create long-term barriers to payment infrastructure interoperability—a question with significant implications for cross-border FinTech strategy [24, 31].

## REFERENCES

- [1] D. W. Arner, J. N. Barberis, and R. P. Buckley, "The evolution of FinTech: A new post-crisis paradigm?" *Georgetown Journal of International Law*, vol. 47, no. 4, pp. 1271–1319, 2016.
- [2] P. Gomber, J.-A. Koch, and M. Siering, "Digital finance and FinTech: Current research and future research directions," *Journal of Business Economics*, vol. 87, no. 5, pp. 537–580, 2017.
- [3] I. Lee and Y. J. Shin, "FinTech: Ecosystem, business models, investment decisions, and challenges," *Business Horizons*, vol. 61, no. 1, pp. 35–46, 2018.
- [4] T. Philippon, "On FinTech and financial inclusion," *NBER Working Paper*, vol. 26330, 2019.
- [5] T. Puschmann, "FinTech," *Business & Information Systems Engineering*, vol. 59, no. 1, pp. 69–76, 2017.
- [6] A.-L. Mention, "The future of FinTech," *Research-Technology Management*, vol. 62, no. 4, pp. 59–63, 2019.
- [7] P. Gomber, R. J. Kauffman, C. Parker, and B. W. Weber, "On the FinTech revolution: Interpreting the forces of innovation, disruption, and transformation in financial services," *Journal of Management Information Systems*, vol. 35, no. 1, pp. 220–265, 2018.
- [8] I. Goldstein, W. Jiang, and G. A. Karolyi, "To FinTech and beyond," *Review of Financial Studies*, vol. 32, no. 5, pp. 1647–1661, 2019.
- [9] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Quarterly*, vol. 13, no. 3, pp. 319–340, 1989.
- [10] V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, "User acceptance of information technology: Toward a unified view," *MIS Quarterly*, vol. 27, no. 3, pp. 425–478, 2003.
- [11] E. M. Rogers, *Diffusion of Innovations*, 5th ed. New York: Free Press, 2003.
- [12] KPMG International, "Pulse of FinTech H2 2022," KPMG International, Tech. Rep., 2023, available at <https://kpmg.com/xx/en/home/insights/2023/02/pulse-of-fintech-h2-2022.html>.
- [13] D. A. Zetsche, R. P. Buckley, D. W. Arner, and J. N. Barberis, "Regulating a revolution: From regulatory sandboxes to smart regulation," *Fordham Journal of Corporate & Financial Law*, vol. 23, no. 1, pp. 31–103, 2017.
- [14] Basel Committee on Banking Supervision, "Sound practices: Implications of FinTech developments for banks and bank supervisors," Bank for International Settlements, Tech. Rep., 2018, ISBN 978-92-9259-120-5.
- [15] A. Lagna and M. N. Ravishankar, "Making the world a better place with FinTech research," *Information Systems Journal*, vol. 32, no. 1, pp. 61–102, 2022.
- [16] B. G. Buchanan, "Artificial intelligence in finance," The Alan Turing Institute, Tech. Rep., 2019.
- [17] J. Jagtiani and C. Lemieux, "The roles of alternative data and machine learning in FinTech lending: Evidence from the LendingClub consumer platform," *Journal of Economics and Business*, vol. 100, pp. 43–53, 2019.
- [18] L. Cao, "Artificial intelligence and finance: Challenges, techniques, and opportunities," *ACM Computing Surveys*, vol. 55, no. 3, pp. 64:1–64:37, 2022.
- [19] J. W. Schindler, "FinTech and financial innovation: Drivers and depth," *Finance and Economics Discussion Series*, vol. 2017-081, 2017.
- [20] M. Zachariadis and P. Ozcan, "The API economy and digital transformation in financial services: The case of open banking," *SWIFT Institute Working Paper*, vol. 2016-001, 2017, available via SWIFT Institute.
- [21] L. Brodsky and L. Oakes, "Data sharing and open banking," McKinsey & Company, Tech. Rep., 2017, McKinsey Global Banking & Securities Practice.
- [22] S. Nakamoto, "Bitcoin: A peer-to-peer electronic cash system," 2008, available at <https://bitcoin.org/bitcoin.pdf>.
- [23] L. W. Cong and Z. He, "Blockchain disruption and smart contracts," *Review of Financial Studies*, vol. 32, no. 5, pp. 1754–1797, 2019.
- [24] D. Wójcik, "Financial geography I: Exploring FinTech—Maps and concepts," *Progress in Human Geography*, vol. 45, no. 3, pp. 600–610, 2021.
- [25] N. Iman, "Is mobile payment still relevant in the FinTech era?" *Electronic Commerce Research and Applications*, vol. 30, pp. 72–82, 2018.
- [26] P. K. Ozili, "FinTech research: Current research topics and future research directions," *Journal of Risk and Financial Management*, vol. 15, no. 9, p. 404, 2022.
- [27] H.-S. Ryu, "What makes users willing or reluctant to use FinTech? the moderating effect of user type," *Industrial Management & Data Systems*, vol. 118, no. 3, pp. 541–569, 2018.
- [28] I. Anagnostopoulos, "FinTech and RegTech: Impact on regulators and banks," *Journal of Economics and Business*, vol. 100, pp. 7–25, 2018.
- [29] G. Baptista and T. Oliveira, "Understanding mobile banking: The unified theory of acceptance and use of technology combined with cultural moderators," *Computers in Human Behavior*, vol. 50, pp. 418–430, 2015.
- [30] C. M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Boston, MA: Harvard Business Review Press, 1997.
- [31] P. K. Ozili, "Impact of digital finance on financial inclusion and stability," *Borsa Istanbul Review*, vol. 18, no. 4, pp. 329–340, 2018.
- [32] T. Muganyi, L. Yan, Y. Yin, H. Sun, X. Gong, and F. Taghizadeh-Hesary, "FinTech, regtech, and financial development: Evidence from China," *Financial Innovation*, vol. 8, p. 29, 2022.