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Customer Fintech Readiness (CFR): Assessing customer readiness for fintech in Bangladesh

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ABSTRACT

Financial technology (fintech) has disrupted the traditional financial system by decoupling, decentralizing, and demystifying finance. Effective and scalable adoption of fintech, however, is key to financial inclusion and value creation through new business models. While theoretical frameworks and models in the literature investigate technology adoption in general, a measurement scheme for customer readiness specifically for fintech is absent. We conduct a National Citizen Survey in Bangladesh (N = 1282), review extant literature on fintech adoption factors and variables, distill major themes into seven dimensions. In this paper, we propose the Customer Fintech Readiness (CFR) index to assess readiness to adopt and use customer facing fintech product, platforms and services. We validate the index and establish its easy replicability, albeit with small contingent adjustments. We find that customers in Bangladesh lag behind in readiness for fintech. Our dimension specific scores provide important insights for policy intervention and planning. While our dataset remains gender-imbalanced and depends on customer self-reporting, we delineate ways to fine-tune its construction for better replication of CFR in other countries.

1. Introduction

Progressively cost-effective computing power and internet connectivity changed millions of lives in the last three decades. Sophisticated computers and high-speed networks achieved two things over time – simultaneously and often in interrelated ways: gathering bigger, more varied datasets (often in real time) and harnessing new and more useful insights. Such a paradigm has transformed industries. Financial services is one where digital technologies enable innovative delivery of existing services and allow creation of new ones. Financial technologies (hereafter fintech) combine the "digital" with financial services. Indeed, computers were incorporated into the legacy banking system for decades to lower costs and raise customer experience. Today, fintech has reached a new "tipping point" (Ghose et al., 2016). Unique technological paradigms of the "Second Machine Age" (Brynjolfsson and McAfee, 2016a) are promoting new business models: venturing into hitherto unexplored customer segments, making previously unthinkable products and/or services commercially viable for a variety of customers.

This paper is conceived at a time when the literature absorbs a steady increase in research on fintech (Allen et al., 2020). Indeed, fintech may as well be a defining technology of the ongoing decade, lifting thousands out of poverty, allowing greater access to capital and customers, eliminating market asymmetries (or in the least addressing them), and creating new opportunities for businesses and individuals (Arner et al., 2020a; Di Maggio et al., 2022; I. Lee and Shin, 2018; Mohamed et al., 2021). New technological paradigms of the fourth industrial revolution hold unique opportunities for developing countries (Brynjolfsson and McAfee, 2016a; Buckley and Webster, 2016; Schwab, 2017). Customers across the developing world have started reaping benefits of innovative platforms and services. For example, the promising development of massive online open courses (MOOCs) in Bangladesh, along with countries in Asia-Pacific such as India points to high acceptance of innovative digital platforms for traditional services e.g., secondary and tertiary education (Amit et al., 2022). Yet the degree to which digital solutions can address problems at scale depends on strategic market priorities determined at the policy level (Amit et al., 2023; Senan et al., 2022). Similarly, in promoting financial inclusion across industries and communities in Bangladesh through fintech, technology is only part of the solution (Caire and Spohn, 2022), albeit an important one but not entirely adequate (Amit et al., 2023).

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Fintech offers new avenues for legacy banks (King and Nesbitt, 2020). It has already disrupted traditional finance; going forward it promises to decouple, decentralize and demystify financial services altogether (Basole and Patel, 2018; I. Lee and Shin, 2018). These prove to be exciting developments for incumbents – as well as unique challenges to their once unquestionable hold on the industry. For instance, a startup with an innovative idea on customized financial solution for the tech savvy generation can radically challenge existing financial service providers worth billions: examples can be given for Robinhood in trade and investment, Venmo for payments, M-Pesa for mobile payment services, and Revolut for integrated services.

Fintech offers another potent opportunity: making financial services accessible to previously unreached customers (Arner et al., 2020b; Beck, 2020; Di Maggio et al., 2022; Kong and Loubere, 2021). A great many of these customers (e.g., unbanked and underbanked populations) are marginal socio-economically and thus stand to benefit enormously. A simple yet demonstrative example is robo-advisory service for affordable wealth management and/or personal financial advisory (Baker and Dellaert, 2017). Even more, fintech platforms can be harnessed to close the gender gap such as reducing wage discrimination, making access capital a reality for more women, and managing their financials for greater resilience (Chen et al., 2021; Guo et al., 2021; Mohamed et al., 2021).

Realizing these desirable transformations depends on effective adoption of fintech services at scale. Specially for marginalized communities that stand to benefit the most, fintech-enabled sustainable development (Al-Okaily et al., 2021; Arner et al., 2020a; Deng et al., 2019; Shin and Choi, 2019) presupposes that customers adopt these novel fintech services and continue to use them. It follows that an assessment of customer readiness to adopt these services is in order. The adoption of technology has been studied extensively. However, seminal works such as the Technology Adoption Model (TAM) (Davis, 1985) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) provide a basis to investigate, validate, and expand current understanding of technologies in general. These models and their subsequent expansions do not deal with fintech specifically. Subsequently, the need for a readiness measurement means for fintech adoption and usage, much like the Technology Readiness Index (TRI) for technologies in general, is felt.

Extant literature continues to expanding in scope in identifying factors that relate to adoption of fintech product and service. A large and increasing number of studies identify factors such as demographic variables (Ahmed et al., 2020; Carlin et al., 2017; Hasan et al., 2021), literacy level (Agarwalla et al., 2015; Hasan et al., 2022), concerns with security issues (Ali et al., 2021; Kin Leong Tang et al., 2020; Mahmud et al., 2023; Xie et al., 2021a) and others. But few efforts were taken to synthesize them into a single measurement scale to assess readiness of customers to adopt and use fintech. This study, as part of a series of investigations into fintech ecosystem and sustainable development in Bangladesh, attempts to fill that gap. The paper constructs an integrated fintech readiness scale for customers of retail fintech services.

The rest of the paper is organized as follows: Section 2 presents an overview of the fintech ecosystem in Bangladesh where Mobile Financial System (MFS) has gained strong foothold. Theoretical underpinnings relevant for the current work are summarized in Section 3. Construction of the proposed readiness index and validity assessment thereof are provided in Sections 4 and 5 respectively. Section 6 presents key findings from a nationwide survey of citizens. Applying the index proposed, Customer Fintech Readiness in Bangladesh is provided in Section 7. Section 8 discusses and delineates areas of further work.

2. Customer fintech in Bangladesh

Globally, fintech has evolved significantly since its earlier days in banks and financial institutions. The term encompasses a wide range of technologies for delivering existing as well as novel financial services to customers. The primary focus of the current paper, however, is on customer facing fintech: technology-enabled financial services distributed mainly over online platforms allowing mass delivery of affordable and innovative financial services. Fintech can serve numerous segments of the market – some of which were not viable to serve before e.g., AI algorithms enabling credit access to middle-income households with zero to no credit history (Loten, 2022).

Table 1
Comparative Banking and MFS Data between December 2018 and November 2022.

	Urban	Rural	Total
Physical Bank Branches			
December, 2018	4842	3629	8471
November, 2022	5777	5280	11057
Automated Teller Machines (ATMs)			
December, 2018	7361	2919	10,280
November, 2022	9171	4196	13,367
Point of Sale (POS)			
December, 2018	47,027	1201	48,228
November, 2022	94,039	8992	103,035
Cash Deposit Machine			
December, 2018	916	408	1324
November, 2022	769	444	1213
Cash Recycling Machines (CRMs)			
December, 2018	118	8	126
November, 2022	1866	425	2291
MFS Agents			
December, 2018	505,623	437,887	943,510
November, 2022	751,394	780,011	1531,405
MFS Male Accounts			
December, 2018	15,053,470	21,030,462	36,083,932
November, 2022	48,667,875	60,368,899	109,036,774
MFS Female Accounts			
December, 2018	8491,129	23,093,199	31,584,328
November, 2022	33,695,799	45,393,551	79,089,350

Bangladesh over the preceding two decades has achieved noteworthy progress in extending reach of the financial system to customers. Data from Bangladesh Bank suggests that across several parameters –number of physical bank branches, ATM machines, POS, CRM machines – expansion is visible. As of November 2022, Bangladesh Bank data showed there were a total of 11,057 bank branches of which 5777 were in urban centers and 5280 in rural areas. In December 2018, the total number was 8471. The branch network was expansion was commendable for a country of 148, 460 sq. Km of total land mass. But it was not comparable with neighboring counties like India considering average area covered by each existing branch. Table 1 provides comparative figures for Bangladesh between December 2018 and November 2022. Figs. 1 and 2 also depict the steady rise in issues cards and MFS accounts.

A key highlight of Bangladesh's evolving fintech ecosystem is Mobile Financial Services (MFS). Within roughly 10 years, MFS providers like bKash, Rocket, Nagad, Upay saw massive sign-up. As of November 2022, 188 million accounts were registered. Account number rose at a compound annual growth rate (CAGR) of 29.89% over the preceding four years. MFS providers subverted traditional banks' limitations to reach frontier customers in remote concerns of the country. Despite efforts by the central bank and Bangladesh's fiscal administration to raise banking penetration, it remains low. Data from the World Bank's Global Findex Database 2021 elucidate this point further. Excluding MFS accounts, only 38% of Bangladeshis had accounts with registered banks and non-bank financial institutions; this was 51% in Indonesia, 77% in India, 88% in Malaysia, and 95% in China (Demirgüç-Kunt et al., 2021). Average account ownership across developing countries stood at 71% in 2021 (Demirgüç-Kunt et al., 2021). MFS uptake compensated for this gap in account ownership.

MFS expansion was made possible by the country's deep mobile network penetration on which MFS services were built. Data from

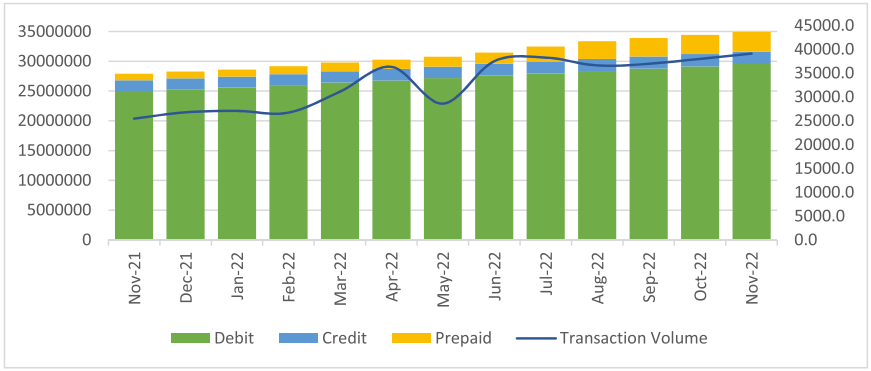

Fig. 1. Monthly Issued Cards and Total Volume of Transaction.

Population and Housing Census 2022 showed 56% Bangladeshis used mobile phones; internet penetration stood at 31%. Rise in MFS accounts in conjunction with mobile users has facilitated, among others, mobile payments which is the predominant service in these platforms. Other common fintech services customers can access through popular MFS platforms in Bangladesh include mobile recharge, cash out services, utilities and internet service bill payments, access to credit, and paying government bills. However, services like credit card bill payments, advances from credit card only work for users with a credit access which most users do not have. The Global Findex Database 2021 data also suggested that only 5% of Bangladeshis have access to a credit card.

A host of ancillary services have been added in MFS platforms recently. Convincing data have not emerged yet to suggest that customers have adopted them at scale. For instance, MFS users in Bangladesh can now buy mutual fund shares from their apps. Within a year, around 650,000 people signed up for these saving schemes (The Business Standard, 2022). Considering Bangladesh's macroeconomic performance and evolving demographics, a larger number is expected. This is true for a range of other fintech services as well. They are either in the early stages of market penetration or entirely unavailable in Bangladesh. Internal market demand exists for these services to become widely adopted for greater customer convenience and value creation. This necessitates identifying factors that contribute to customer readiness for fintech adoption. Importantly, before introducing new fintech services in the market by fintech firms and/or legacy banks, it is necessary to assess the current state of customer readiness for fintech service use in daily lives.

3. Technology readiness and fintech adoption: theoretical underpinnings

With rapid development of technology in the last century, a new line of thinking emerged. It was necessary to understand motivations and factors behind the adoption and usage intention of evolving technological products and services. Technology Acceptance Model (TAM), proposed over a quarter of a century ago, was one of the earlier efforts to theorize interrelationships among psychological factors leading to new technology acceptance. TAM was built on top of the Theory of Reasoned Action (TRA) from psychology (D, 1986). Perceived usefulness of using technology along with perceived convenience of use together contribute to behavioral intention for technology use (D, 1986). Since then, TAM has been heavily relied upon and scrutinized for its limitations (Holden and Karsh, 2010). A "respectable amount of work" was dedicated to expanding and investigating factors centering around its core theoretical underpinnings (Marangunić and Granić, 2015).

After over three decades of scientific literature on TAM investigating new factors and their relationships among and despite a number of criticisms e.g., measurement biases (F. D. Davis and Venkatesh, 1996), TAM continues to be a keystone theoretical foundation. In particular, current and expected future research seek to delve into areas such as new factors, inter-factor relationship and influence, specific customer segments, and the space between behavioral intention and actual measurable use of technology (Marangunić and Granić, 2015). The last of these has gained increasing traction. After all, it is necessary to measure how much of behavioral intention actually translated into technology usage.

Another seminal work in the technology adoption domain was the Unified Theory of Acceptance and Use of Technology (UTAUT). Founded on the same strand of psychology literature TAM borrows from, and indeed paying due attention to the structure and theorical constructs of TAM itself, UTAUT proposes a more systemic perspective on technology acceptance and usage (Venkatesh et al., 2003). Apart from the expected benefit and efforts related to use of new technologies, UTAUT put forward "social influence" and "external environmental" variables. A line literature was dedicated to investigating, empirically validating and critically assessing the model – and expand where

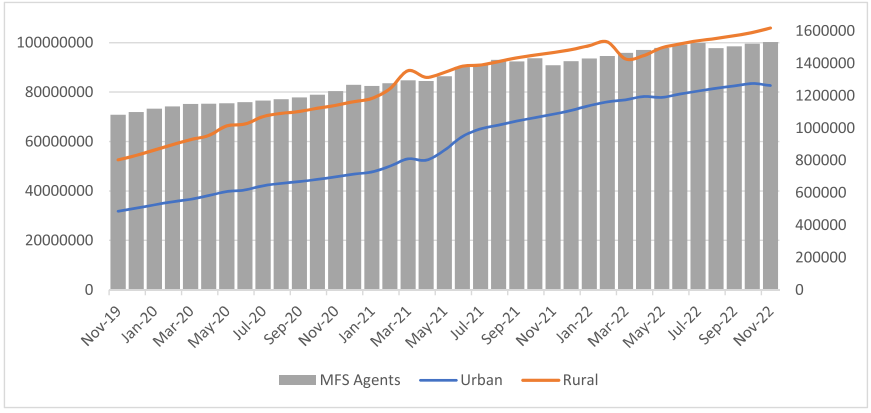

Fig. 2. Monthly Registered MFS Account Numbers and MFS Agents.

appropriate. Although it has also been argued that initial acceptance of the model by researchers may have, in some cases, limited further work into bringing new perspectives (Venkatesh et al., 2016). A common key element of TAM and UTAUT relates to their fundamental approach. Because of their basis in the psychology of behavior they look at the acceptance of technology as primarily a function of customer behavioral constructs. Thereby they focus on psychological factors only, largely avoiding inclusion of other seemingly disjointed variables e.g., technological and financial capabilities. Indeed, these overlooked factors may very much make or break acceptance decision and subsequent intention for usage continuance. These can be about the user as much as about the environment in which the acceptance and/or usage decision is made.

In a similar line of reasoning, albeit with a markedly different approach, the Technology Readiness Index (TRI) was first proposed almost two decades ago (Parasuraman, 2000). TRI gained significant traction in the literature for two reasons mainly. First, it was one of the first efforts taken to methodically quantify levels of customer readiness to use novel technology. TRI was conceived at the start of a new millennium filled with vibrant technological optimism. The timing was perfect since a plethora of technological products, services, and their combinations started to open new doors to customer value.

TRI measured readiness to use technologies. It was based on a large sample of customer attitude towards four key constructs. *Optimism* referred to customer positive attitude towards benefits, convenience, usefulness of new technologies. Individual attitude also varied in terms of adopting *innovative* technologies. Both of these were theorized to positively associate with readiness. On the other side, individuals shared their attitude on *discomfort* from using the technology and the *insecurities* that stem from potential security fears and issues (Parasuraman, 2000). TRI's approach was robust with methodically established reliability and validity measures supporting its appropriateness.

Later on TRI 2.0 was proposed to reflect changing nature of technologies (Parasuraman and Colby, 2015). The multiple-item scale used for the original TRI gained further sophistication in TRI 2.0, while retaining strength of its original approach: a simple yet rigorous method of attitude quantification and a large dataset of on a "battery" of questions for analysis (Parasuraman, 2000; Parasuraman and Colby, 2015). In turn, TRI methodology act as a major theoretical foundation for this work – particularly for measuring, collecting and integrating customer attitude data.

Customer participation in service delivery is another strand of the literature relevant for the current work. Empirical evidence supports the hypothesis that customers participating in service generation and delivery make way for overall service delivery effectiveness. Such participation can contribute in several ways. It can facilitate long-term success of the service provider (Hult et al., 1996; Lukas et al., 1996), support quality assurance and maintenance (Dong et al., 2015; Mills and Moberg, 1982), induce greater customer satisfaction (Currie et al., 2005; Rosenbaum et al., 2005), and effectively harness technology-induced opportunities for cost-saving and value-creation (Marzocchi and Zammit, 2006).

Fintech services are, at their core, customer service instances. Propelled by computing advancement, mobile phone technology, and the ubiquity of internet connectivity, fintech aims to disrupt traditional finance (Ghose et al., 2016; Hoang et al., 2022). More importantly, fintech is enabled by emerging technological paradigms including, but by any means not limited to, artificial intelligence, cloud computing and big data. Fintech brings financial services to customers, as opposed to the traditional model where customers are invited to the service center. Nonetheless, customer participation should prove valuable. This can even be important in allowing fintech to reach a larger customer base with possible winner-take-all effects (Brynjolfsson and McAfee, 2016a; Islam and Salma, 2016; Kong and Loubere, 2021). Fintech's outreach into previously uncharted market segments holds key benefits of financial inclusion (Arner et al., 2020b; Gabor and Brooks, 2017a). Not to mention, this would be on top of generating new economic opportunities for service providers and legacy banks (Collevecchio et al., n.d.; Stulz, 2019; Thakor, 2020).

Extant literature on fintech has thus divulged into several themes. One highlights fintech's impact though new business models, market efficiency implications, favorable unit economics, access to financial services, win-win partnerships, and new value creation opportunities (Arner et al., 2020b; Beck, 2020; Siddik, 2014). The inclusion of hitherto unaddressed market segments (Coffie et al., 2021; Kong and Loubere, 2021) into the financial system is made possible with fintech – two prominent examples being robo-financial advisory and alternative credit rating for marginal customer groups (Philippon, 2019). An example of the later is Applied Data Finance – a New York lender focused on "non-prime" and unbanked individuals in need of unsecured personal loans. Applied Data Finance uses a proprietary method and machine learning to create customer profiles with little to no access to traditional credit history. Across the world, alternative credit rating agencies and their products ae crucial to covering millions of "unbanked" or "underbanked" people. This can open a new frontier of loans disbursement and management and unlock potent growth opportunities in some of the lesser developed pockets of the world economy.

Similarly, wealth management was reserved for the more prosperous segments of the market. Financial advisory services for private wealth management was economically viable only if the client had ample wealth to manage and generate return from. This would justify the high cost of professional remuneration needed to hire talent for fund managing and investment strategy execution. Fintech reduces cost on all relevant fronts i.e., commoditizing financial advisory, decreasing transaction cost, democratizing financial knowledge, increasing accuracy of market prediction to name a few (I. Lee and Shin, 2018). For example, robo-advisory services like Wealthfront reduces cost (from 1.02% to around 0.25% on funds being managed on investment accounts) and provides a wide array of affordable services. A "bundling" of all these opportunities also results in significant reduction in cost.

Conversely, "unbundling" of traditional financial services into "modularized" products tailored for specific customer groups has resulted in increased competition for banks (Basole and Patel, 2018; I. Lee and Shin, 2018). On the delivery front, services can now be delivered through mobile application interfaces, thereby further expanding scope for scaling. An important question remains however: even though fintech allows "invisible primes" to be discovered and served (Di Maggio et al., 2022), how should customers be persuaded to get into fintech service ecosystem in the first place? Afterall, solving the technology part of the problem is only half of the work done (Amit et al., 2022; Senan et al., 2022). For instance, institutionalizing alternative credit-rating models that are sensitive to the needs and constraints faced by women in Asia require building a great deal of trust between the borrower and the financial institutions (Caire and Spohn, 2022).

Here, extant literature investigates factors that affect adoption of fintech. A host of such factors has surfaced over the years. Multiple studies have been replicated in varying market and demographic conditions (Sangwan et al., 2019; Soloviev, 2018). Some of the proposed factors have repeatedly demonstrated significant relations with fintech adoption. Customer satisfaction (Alkhazaleh and Haddad, 2021; Alwi et al., 2019; Barbu et al., 2021), privacy concerns and concerns over security risk (Ahmed et al., 2020; Gerlach and Lutz, 2021; Ryu, 2018) trust in the fintech service provider as well as the overall fintech ecosystem (Dishaw and Strong, 1999; Hassan et al., 2022; Musyaffi et al., 2021; Nathan et al., 2022; Salman and Abd.Aziz, 2015; Solarz and Swacha-Lech, 2021) play important roles in determining fintech adoption. Perhaps not surprisingly, a large number of these studies adopted both TAM and UTAUT to investigate fintech adoption. Perceived variables were found to significantly explain fintech adoption intention and fintech continuance usage intention (Nguyen, 2022;

Poerjoto et al., 2021; Ryu and Ko, 2020; Shiau et al., 2020; Wang et al., 2019). However, scholars have gone beyond customer perception.

The effect of individual level variables such demographic characteristic and literacy rate was investigated and discussed (Carlin et al., 2017; M. Hasan et al., 2022). Higher institutional education has been associated with easier adoption of fintech services (Laidroo and Avarmaa, 2020). Financial literacy – the extent to which customers are aware of financial transactions, feel comfortable with managing personal financials, and are confident interacting with financial ecosystem players – mediate adoption of fintech too (M. Hasan et al., 2022). Older customers may find it more difficult to trust fintech services with their money. In multiple investigations, younger segments of the market were more open to adopting fintech services (Imam et al., 2022). In fact, early adopters of fintech services are mainly young ones with a sizeable income to access a wide range of fintech services (R. Hasan et al., 2021; Imam et al., 2022). It was also found that when considered together, the effect of customer concerns with privacy, information security, and risk of using fintech has a greater impact in determining fintech adoption (Mahmud et al., 2023).

While the literature identifies a host of such factors and maps these with help from theoretical models such as TAM, UTAUT and more, an integrated index is absent. Much like TRI for generic technology readiness, readiness for fintech products and services in particular has not been measured in a systematically. Considering the promise fintech holds for inclusion and new business models, assessment and monitoring of Customer Fintech Readiness will be key. For an emerging nation like Bangladesh, measuring customer readiness for fintech adoption and use can lead to informed policy interventions necessary for sustainable economic development. Such a scheme should ideally incorporate key factors identified so far. Additionally, it should resemble the structure of theoretical constructs proposed by earlier models while keeping easy replication in consideration.

4. Constructing the Customer Fintech Readiness (CFR) index

Readiness to use fintech on a daily basis encompasses technological, demographic, economic, and sentimental variables. As briefly discussed, extant literature delves into each of these to investigate their relationship with fintech use. As literature continues to grow with corroborative evidence from different markets, patterns are increasingly discernible. On the basis of these patterns, our approach was to construct a readiness index for customer facing fintech.

Bangladesh has achieved remarkable progress on the macro-economic and socio-political development front during the last two decades. In that time, millions have been lifted out of poverty. Under the “Digital Bangladesh” initiative, significant policy priorities were assigned to revamp government processes; the endeavor continues as of writing this paper under an extended vision of a “Smart Bangladesh”. Despite encouraging progress made, much is to be done. There remains, for example, stark economic inequalities, which continue to worsen. Any effort to assess overall preparedness to use fintech should have to consider a broad spectrum of characteristics.

4.1. Data collection

Our readiness assessment approach is founded on the National Citizen Survey (NCS) undertaken by the authors. The standardized questionnaire survey was conducted face-to-face with citizens from across 16 districts. Digital penetration is a work-in-progress. Conducting surveys over phone and online would introduce additional biases in the sample. Moreover, customer facing fintech services promise benefits to wide customer audience – specially for marginalized communities. Keeping in mind policy priorities to facilitate technology-enabled banking penetration, our sample included individuals from both sides of the economic spectrum. Importantly, we selected the 16 districts (from among 64 in total) based on poverty ranking. Appendix A provides district ranking and sample selection in Table 8 and a depiction of districts included in NCS in.

Selected individuals (and households) were approached physically with a standard questionnaire; 206 datapoints were gathered from each respondent. These relate to demographic characteristics, financial health and practices, banking service propensity and practices, current technology use, frequency, volume and nature previous fintech use (if any), concerns with fintech, mental preparedness to use fintech, current satisfaction and obstacles faced, and more. The survey also allowed one open ended response at the end to allow participants express normative recommendations and/or personal feedback on fintech use in their respective lives. Datapoints were gathered by survey representatives and recorded onto handheld tablet computers. The entire dataset was then compiled, coded, and cleaned by the authors for further analysis and index construction. Our dataset consisted of 1282 responses. Survey respondents consisted of 14% female citizens and 86% male. As per the 2022 census, female and male ratios were approximately 50.50% and 49.50% respectively (Bangladesh Bureau of Statistics, 2022). As such, our sample was gender imbalanced. However, given the poverty-based stratified random sampling conducted in this study, gender ratios at the household level could not be controlled.

Among those surveyed, 21% had primary education as their highest level of institutional educational training. 24% reported their highest level of education to be secondary. From higher secondary, the survey found around 17% of respondents. Around 11% and 6% of respondents had graduate level and post-graduate level education respectively. Within each gender, most of the female respondents were from primary and secondary levels. There was sufficient variation across other variables as well. Average monthly income of respondents was BDT 22,220 and average monthly expenditure was BDT 18,250 (USD 205 and USD 168.50 respectively as per prevailing exchange rate). Table 2 provides descriptive statistics of continuous variables. Fig. 3 depicts selected variables from the survey.

4.2. Readiness dimensions

Table 3 distills selected works in the literature into seven key dimensions of customer readiness for fintech: a) demographic characteristics, b) financial health, c) literacy, d) e-readiness, e) mental preparedness, f) existing fintech use, and g) overall sentiment. CFR was based on patterns of factors emerging in extant literature. Variables under each dimension were coded and normalized on a scale of 0–100. For customer rated data (e.g., mental preparedness) on multiple-point Likert scale, equal interval levels in appropriate order was assigned to derive a numeric value. For instance, in mental preparedness to used fintech in daily use value labels were as follows: not prepared at all (20), low prepared (40), average preparedness (60), prepared (80), adequately prepared (100). Average of variables in each dimension was then taken as the dimension score. We briefly describe here the seven dimensions, variables used in each, and the corresponding transformation methods and value labels. Appendix C provides more details on variable operationalization.

4.3. Demographic characteristics

Following evidence from previous studies of a negative correlation with age (Hasan et al., 2022; Imam et al., 2022) and a largely positive association with higher levels of institutional education (Niu et al., 2020), we included the two variables appropriately. Respondent age was normalized. On average, we assumed a 20-step increment in fintech readiness with each additional level of institutional education. Higher levels of institution education equip a person for wider fintech use and address some of the concerns related to security, financial fraud, and privacy (Laidroo and Avarmaa, 2020; Niu et al., 2020).

Table 2
Descriptive Statistics of Selected Variables from NCS Dataset.

Variable	Obs	Mean	Std. Dev.	Min	Max
RespondentAge	1282	38.635	12.88	18	85
Monthly expenditure	1282	18249.532	13153.52	2000	200000
Exp HouseRent	1282	529.866	2119.534	0	25000
Exp Food	1282	9617.813	6680.842	0	100000
Exp Utilities	1282	1237.066	1316.735	0	9000
Exp Education	1282	2239.807	3347.995	0	35000
Exp Healthcare	1282	1512.286	2754.498	0	60000
Exp Entertainment	1282	483.241	970.461	0	10000
Exp HouseHelpSalary	1282	155.359	817.157	0	14000
Exp Misc	1282	1478.31	2071.427	0	30000
Monthly Income	1282	22219.64	17974.89	0	250000
Annual Savings	1282	22157.331	91474.191	0	2500000
Bank visit month	428	2.163	2.437	0.005	25
Data usage	501	16623.695	45662.006	20	900000
FrequencyMB	1282	3.677	16.325	0	506
VolumeMB	1282	3665.583	15022.018	0	401000
InternetBankingFre~y	1282	0.023	0.331	0	8
InternetBankingVol~e	1282	181.747	3094.296	0	90000

4.4. Financial health

To construct the financial health dimension, two variables were used: monthly income and annual savings of respondents. Monthly savings for the respondents varied significantly among respondents. Citizens from the lower quintiles reported savings on an annual basis since most have a yearly savings goal. Both of these variables were normalized from 1 to 100 and averaged for dimension score.

4.5. Financial literacy

The financial literacy dimension in our index consists of three variables measuring frequency of bank-visits per month, confidence level respondents have in performing banking activities, and level of awareness of bank transactions. The state of online banking in Bangladesh is inadequate in semi-urban and rural areas. Despite spread of MFS accounts, interaction with banks is possible primarily through

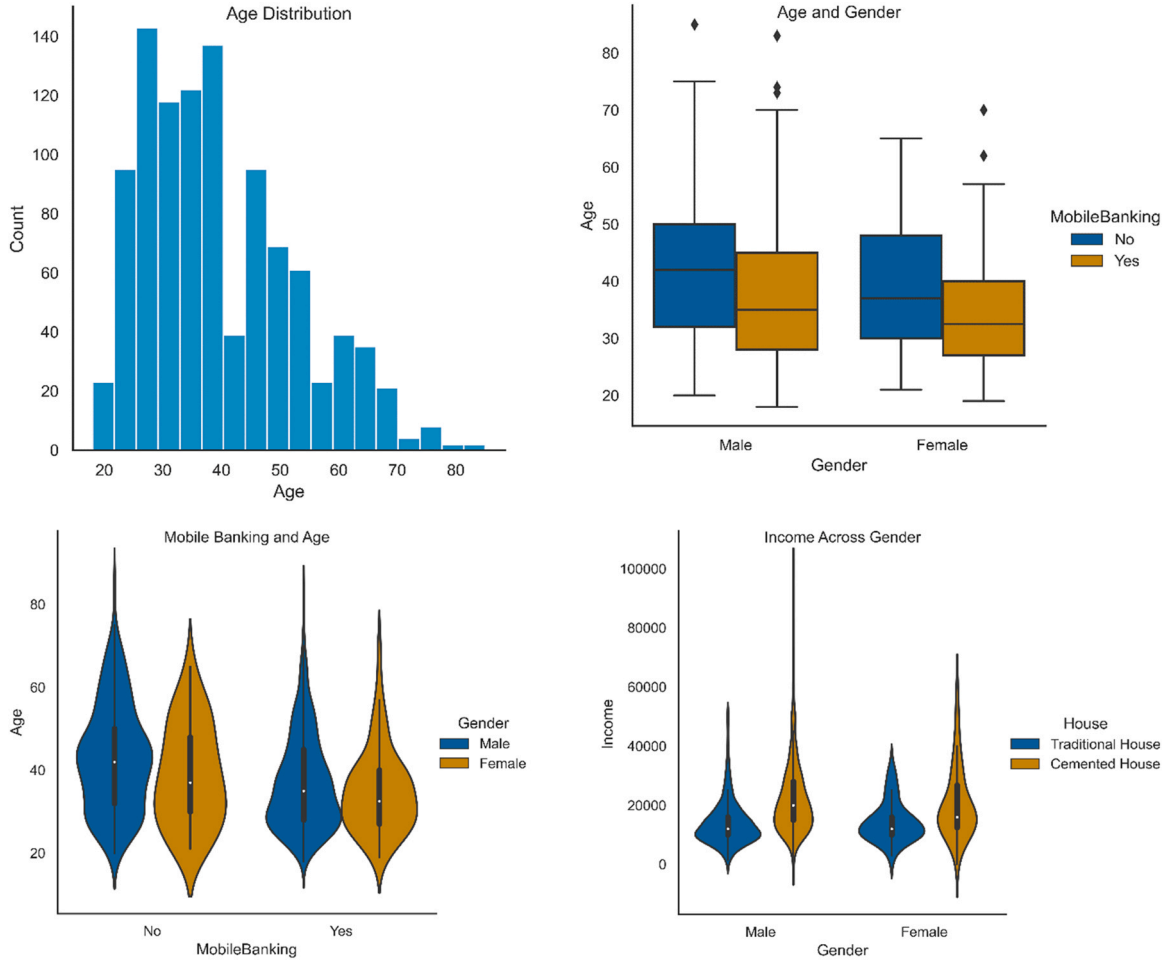

Fig. 3. Distribution of Selected Variables in NCS.

Table 3
Factors Affecting Fintech Adoption and Use Distilled in Seven Key Dimensions.

Dimension	Factors	Related Work
Demography	Demographic characteristic of the customer/user e.g., age, gender	Alice Huong et al. (2021) Clements (2020) Chen et al. (2021) Gulamhuseinwala et al. (2015a) Hasan et al. (2022) Imam et al. (2022) Pedrosa and Do (2011) Sioson and Kim (2019)
Financial Health	Financial and economic characteristic of the customer/user e.g., current income, savings, consumption pattern	Amit et al. (2023) Hau et al. (2019) Mohamed et al. (2021) Rizvi et al. (2018) Senan et al. (2022) Solarz and Swacha-Lech (2021)
Literacy	Institutional as well as non-institutional literacy e.g., level of education, financial literacy	Agarwalla et al. (2015) Hasan et al. (2022) Laidroo and Avarmaa (2020) Niu et al. (2020)
E-Readiness	The extent to which customers/users are ready to adopt digital technologies e.g., connectivity, digital literacy	Azad (2016) Gerlach and Lutz (2019) Jünger and Mietzner (2020) Nathan et al. (2022) Parasuraman (2000) Salman and Abd.Aziz (2015);Setiawan et al. (2021)
Mental Preparedness	Factors affecting customer/user mental preparedness to adopt and continue use of fintech services in daily lives e.g., customer reported level of acceptance	Dishaw and Strong (1999) Hasan et al. (2021) Jin et al. (2019) Kong and Loubere (2021);Kusumawati et al. (2020) Le (2021) Salman and Abd.Aziz (2015);Setiawan et al. (2021) Stewart and Jürjens (2018)
Fintech Use	Degree of existing use of fintech services e.g., mobile banking, internet banking, ATMs	Amit et al. (2022) Azad (2016) Carlin et al. (2017) Gabor and Brooks (2017b) Gerlach and Lutz (2019) Hasan et al. (2021) Hwang and Kim (2018) Shareef et al. (2018) Urumsah et al. (2022)
Sentiment	Perceived variables that affect customer/user sentiment towards fintech services and/or platforms e.g., security risk, privacy concerns, usefulness	Ali et al. (2021) Hasan et al. (2021) Hwang and Kim (2018) Kin Leong Tang et al. (2020) Le (2021) Mu and Lee (2017) Poerjoto et al. (2021) Xie et al. (2021b)

physical visits to the nearby bank branch. The number of times the respondent visited a bank in a given month was normalized. To label respondents' assessment of their confidence in performing banking activities, we used equal intervals for the five-point Likert scale.

4.6. E-readiness

Citizens' e-readiness was measured with four variables: type of access to a computer, reported levels of computer operation skill, reported levels of smartphone use skill, and monthly data usage measured in megabytes of internet data purchased each month.

Computer access, although formerly a prerequisite for internet banking, can be argued to have decreased in importance given majority of internet banking services are accessible through smartphones. Nonetheless, familiarity with computer-based fintech use and computer literacy in general can be expected to help Customer Fintech Readiness. Multiple studies have found a positive association between internet use and fintech adoption. No least because of the need to stay connected over the internet for receiving the vast majority of fintech services. The first of the four factors in this dimension were labelled appropriately and data usage was normalized.

4.7. Mental preparedness

Respondents' reported level of mental preparedness was labelled appropriately. This is the only variable in this dimension, thus no average was calculated. We used an equal interval labelling for the five-point Likert scale used to collect data. Customers who report to be mentally prepared to use fintech in daily lives can be expected to adopt new fintech services, all other factors held constant.

4.8. Fintech usage

Our dataset consisted of both fintech users and non-users. Respondents who used a fintech service at least twice a month were defined as fintech user for our calculation. We found around 30% of our

respondents were fintech users. Almost all of that stemmed from mobile banking platform e.g., money transfer, deposits, bill payments etc. Frequency and volume of mobile banking usage varied significantly however. We normalized monthly frequency of mobile banking use and monthly volume of transactions in such platforms to calculate score in this dimension.

4.9. Overall sentiment with fintech

Apart from financial and technological readiness, customer perception on costliness of fintech use as well as satisfaction with previous fintech use should play a major role in determining readiness. Three variables were considered for this dimension. In this case, all three were collected using multiple-item Likert scales. Customer perception of costliness of fintech services contribute negatively to willingness to use new fintech services. Accordingly, we reverse-ordered the equal interval value assignment for this costliness (Urumsah et al., 2022; Xie et al., 2021a). Customer satisfaction was labelled as before. The survey also collected respondent agreeableness on ease of fintech availability. We hypothesize that respondents are better prepared to use fintech if they already perceive these as available around them (logistically), as opposed to on paper only (theoretically).

4.10. CFR index

An important decision had to be made in combining the seven dimensions for the CFR index. One alterative was to take another iteration of arithmetic average. Although an average-of -average approach would be simple and easily replicable, it had one major problem. The presupposition that all of the seven dimensions contribute equally to Customer Fintech Readiness was neither logically defendable nor empirically founded. As a country transitions from one stage of fintech development into another (Soloviev, 2018), the relative weight of each dimension should evolve to reflect varying importance. For instance, as citizens achieve higher levels of financial prosperity, more weight would shift to “usage”, replacing proportionally off of “financial health”. Average-of-average would not account for a mechanism to change weights accordingly. Specifically, when deployed through arithmetic mean for both iterations, another problem is the implicit compensation. If averaged arithmetically, high score in one dimension would compensate lower score in another. Enough empirical evidence is unavailable, to the best of our knowledge, to justify use of average-of-average with arithmetic mean despite these two drawbacks.

Previous studies used a different statistical approach. The Technology Readiness Index (TRI), for instance, was constructed using dimensionality reduction (Parasuraman, 2000). We avoid this path. Using Principal Component Analysis (PCA) and its accompanying statistical methods provides a rigorous way of working with multiple items in a survey data. However, PCA induced dimensionality reduction and its resultant indices become unique to the context in which the survey was conducted, thereby limiting replication and mass use in cross national circumstances.

Fintech is rising across a multitude of markets each having their own unique set of challenges and opportunities. We adopt a much simpler yet situationally appropriate means: weighted average of dimension scores. For this, we conducted depth interviews with a panel of twenty-one experts. Participants were from industry, academia, development, finance, and advisory services with respective experiences ranging from 6 years to 34 years (mean of 22 years). Each expert assigned weights to the seven dimensions. In calculating CFR, we weighted each dimension as per the average weight assigned by the panel. Table 4 provides dimension weights for the CFR.

The weighted average approach addresses aforementioned drawbacks while being fairly simple. Researchers in other markets can replicate the scale without significant alteration to the weights assigned, provided the markets in which CFR is being replicated fall largely within the development stage Bangladesh is currently in. Additionally, researchers should also note the maturity of their respective fintech markets of interest to assess readiness through CFR.

5. Assessment of CFR’s validity

Apart from proposing the CFR, one key objective of the current paper was to asses customer readiness for fintech adoption and use in Bangladesh. The promises fintech can only be realized for the broader population if customers are ready to embrace them in the first place. Readiness as such incorporates both willingness and capability. CFR incorporates both of these facets through seven dimensions: demographic characteristics, financial health, financial literacy and e-readiness broadly fall under capability to use fintech. Mental preparedness, current use of fintech, and overall sentiment encompass willingness. However, the other purpose of the study was to construct a widely applicable, easily replicable index for Customer Fintech Readiness assessment. Both of these require establishing validity of the scale proposed here.

With regards to CFR’s construct validity – the extent to which the scale measures key facets of what it aims to measure – significant efforts were taken to review extant literature and map factors that contribute specifically to readiness for customer facing fintech services. The seven dimensions, by and large, incorporate all key facets. The Nationwide Citizen Survey (NCS) gathered a large number of datapoints from individuals of varying demographic, economic, and technological features. Incidentally, the current paper is part of a series of research works the authors performed to investigate fintech ecosystem in Bangladesh, adoption factors of fintech among Bangladeshi customers, and fintech’s impact on sustainable development for emerging economies. The current work drew heavily from insights gathered from these.

Additionally, we followed two ways of assessing CFR’s construct validity (Parasuraman and Colby, 2015). First, three multivariate regressions were estimated with CFR score was the predictor. To address confounding variable concerns, we add respondents’ age and monthly expenditure as predictors. For predicted variables for the three models, we used three expectations. In NCS, respondents answered a series of questions related to expectation of near-future fintech services use (e.g., making investment through fintech platforms). We calculated the total number of expectations for each customer from three different sources. This was also done for expectations from fintech service providers (e.g., more cash out points) and the government (e.g., service quality supervision). Customers selected multiple from these as per their expectations.

Assuming CFR adequately measures customer readiness for fintech use, CFR score should be a significant predictor of aforementioned expectations. Moreover, CFR score should be positively associated with number of customer-reported expectations in each of the three cases. This follows logically from the premise that readier customers are clearer in what to expect as well as are more engaged in expecting to use a range of services. Results from the three regression models suggest that CFR score is positively associated with a) number of fintech services expected to in the near future, b) number of expectations from fintech service providers, and c) number of expectations from the government. Appendix B Tables 9, 10, and 11 exhibit regression coefficients, levels of significance, and R-squared values for the three models. These models explain 17.18%, 17.32%, and 13.94% of the three expectations (in that order). All three models are significant at the 1% level. More importantly, in each case, CFR coefficients are positive and statistically significant at the 1% level.

To further assess construct validity of CFR, we performed one-way ANOVA. Mean CFR score and ANOVA were estimated for two instances. First, for groups of customers with different levels of agreeableness on fintech’s impact on social development. We did the same for impact on national economic development and betterment of the environment. All three were from a five-point Likert scale with an additional option for

Table 4
Weights Assigned to the Seven Dimension of CFR.

Dimension	Demographic	Financial Health	Financial Literacy	E-Readiness	Mental Preparedness	Fintech Usage	Overall Sentiment
Weights	12.82%	10.82%	15.78%	21.06%	11.96%	16.41%	11.16%

Table 5
Mean CFR Scores by Perception of Fintech's Impact.

Domain of Impact	Not agree at all	Slightly agree	Neutral	Agree	Totally agree	F-statistics	Bartlett's Chi-2 Test Statistic	Sig
Social Development	21.23	23.95	29.24	28.17	34.61	103.59	72.21	* **
Economic Development	21.41	23.89	25.92	28.87	33.49	91.90	79.56	* **
Betterment of the Environment	21.77	26.42	27.49	29.36	33.39	77.03	38.80	* **

citizens who did not know much about the impact. Table 4 shows the mean CFR scores, F-statistics, and Bartlett's chi-square test statistics for equality of variance. All F-statistics are significant at the 1% level. The three domains of impact in Table 5 are ordered according to F-statistic; social development domain has the highest F-statistic. As expected, we saw consistently higher mean CFR scores for respondents at higher levels of agreeableness (with the only exception being "agree" for social development domain, the small decline in CFR score compared to the previous group being insignificant). Respondents who had higher mean CFR score agreed more on the beneficial impact of fintech for the society, the national economy, and the environment.

Second, we calculated mean CFR scores and performed ANOVA for different groups of customers. This grouping was based on perception on obstacles faced during fintech use (Likert scale) e.g., - technological skill being an obstacle to fintech use. Mean CFR scores, F-statistics, and Bartlett's Chi-2 square statistic are summarized in Table 6. All test statistics are significant at the 1% level. Mean CRF scores were consistently lower in groups that reported high degrees of perceived obstacles to using fintech. This was expected as well. Respondents with higher CFR scores are less likely to perceive high obstacles to fintech. In both instances of comparison of means, CFR scores exhibited expected patterns across groups. This analysis further provided evidence in support of CFR's construct validity.

6. Key findings from national citizen survey

6.1. Customer banking behavior

Inclusion in the formal banking channel is a prerequisite for the financial development of individuals and communities. Value-adding financial products and services e.g., mortgage loans can be delivered through a bank. But cost and logistical constraints of extending banking services in marginalized areas were a hurdle for legacy banks. Around 62% of the respondents in our survey said they do not have a bank account. And 38% of the respondents said they have at least one bank account in a formal banking channel. Moreover, the Chi-2 statistics for test of independence between account ownership and gender was significant at the 5% level.

Bank account ownership varies considerably across groups. We looked at account ownership across gender, age, income classes, and levels of annual savings among respondents. Women lagged behind men in account ownership. Around 30% of female respondents reported having a bank account and compared to 39% of male respondents. Overall, bank account ownership was higher among younger respondents. Account ownership among respondents aged between 15 and 25 was 25%, 42% for respondents aged 25–34, 45% for 35–44, 17% for ages between 65 and 74.

Younger respondents reported more frequent visits to the bank on average compared to their older counterparts. For respondents aged 15–24, the average bank visit per month was 3.55. For ages 25–34, it was 2.23 times per month. According to our data, 82% of respondents said they can perform their banking activities on their own. Only 16% said they take help from someone and around 2% reported taking someone with them to the bank to help them. For female citizens, ratio of independent banking operations was lower at 62%, while 34% said they take help from someone in performing their banking operations and 4% reported taking someone with them to the bank.

6.2. Computer, smartphone, and data usage

Access to computers, smartphones, and the internet forms the basis for fintech use and its expansion. A "recombinant innovation" like fintech (Brynjolfsson and McAfee, 2016b) was possible due to existing technologies. Providing access to computers and smartphones has been a key priority of the Bangladesh government's "Digital Bangladesh" agenda. Over the last decade, the government took enormous investments to ensure higher levels of digital access. The recognition of technology's role in transforming Bangladesh from a "factor-driven" economy to an "innovation-led" economy continues (Ministry of Planning, 2020).

In the National Citizen Survey (NCS), computer access rate was 18%. The rest 82% of respondents reported not having access to a computer in any way. According to respondents' assessment of their computer skills, majority of individuals reported low or moderate levels. Around 56% of respondents reported having "some skills" in using a computer. Only 14% reported being "skilled" and 11% reported being "very skilled". Male respondents reported higher levels of skills compared to female respondents on average. An intriguing observation emerges from looking at reported skills for computers vs smartphones. Even when with low or no skills at all operating a computer, they

Table 6
Mean CFR Scores by Perceived Degree of Obstacle in Fintech Use.

Obstacles	Very low	Low	Neutral	High	Very high	F-statistics	Bartlett's Chi-2 Test Statistic	Sig
Economic conditions	39.12	30.19	25.21	19.01	15.77	116.27	55.12	* **
Service intuitiveness of the platform	40.00	29.90	25.19	20.33	17.86	68.72	19.65	* **
Confidence in using technology	38.88	31.25	25.70	22.18	18.23	65.96	17.90	* **
Knowledge of financial transactions	41.18	31.79	24.75	20.64	18.75	143.83	24.96	* **
Educational qualification	39.72	31.73	24.12	20.43	16.59	173.70	19.23	* **
Technological skill	42.09	35.44	25.68	20.88	16.24	206.60	49.84	* **

reported having average skills operating smartphones.

The majority of respondents in our survey reported owning mobile phones of any type (smartphone or dumbphone). Contrary to the dearth of access to computers, most respondents had access to their mobile phones. Phone ownership on average was 90% in NCS. Female phone ownership was slightly below average at 83%. Phone ownership was consistently higher in younger age groups. For people aged between 15 and 24 phone ownership was a whopping 97%. This steadily declined to around 60% for people aged between 65 and 74.

According to our data, 54% of individuals did not have internet access. Notwithstanding access to a computer, access to a phone, and the type of phone used, this is a major hurdle for fintech service platforms to expand their user base and score of service. Internet usage was higher among younger respondents. For respondents aged between 15 and 24, the internet usage rate was the highest at 88%. For respondents aged 25–34, 35–44, 45–54, and 55–64 the usage rate was 64%, 42%, 24%, 14% respectively. Total average data consumption per month was 15,000 megabytes. The male average was slightly higher at 15,264 compared to the female average of 12,520. Data consumption was higher in younger segments and increased with an increase in monthly income.

6.3. Mobile banking usage

A majority of respondents owned a mobile banking account at least with one of the available mobile wallet service providers. In the NCS, 72.85% of respondents reported ownership of a mobile banking account. Account ownership was slightly higher among male respondents. But the test statistic of Pearson Chi-2 test of independence between age and gender was not significant at the 5% level. We also found a gradual decline in account ownership in higher age groups.

We looked at mobile banking account ownership across economic segregation. No particular relationship between monthly income or expenditure was found. This is interesting given how we expected higher income classes to have higher levels of mobile banking account ownership. However, this can be explained by the relatively low transaction cost of mobile banking services. Due to account opening convenience, all income classes have access to at least a baseline level of mobile banking facilities. However, account ownership was found to be higher as respondents' annual savings increased.

To investigate the role of demographic and economic factors, we also ran a logistic regression model and assessed the importance of these variables in determining mobile banking account ownership. We found that respondents' age, monthly income, traditional bank account ownership, and smartphone usage were significant predictors of mobile banking account ownership. At the same time, the type of mobile phone being used was significant. Using a smartphone made the respondent 87.1% likely to have a mobile banking account; this was 60.1% for normal (dumb) phone users. All coefficients were significant at the 1% level and the model had a pseudo-R-squared value of 15.3%.

6.4. Concerns with fintech use

Around 27% of respondents were "more or less concerned" about privacy in fintech platforms. Only 4% of respondents considered privacy a very low concern for them. At the same time, a significant portion of respondents (17%) reported not knowing any issues regarding privacy in our survey. Across gender, our data showed no significant difference. A distinct pattern emerged across different age groups. Firstly, very high levels of concern were less prevalent in the youngest age group in NCS. Around 19% of people aged between 15 and 24 had high levels of privacy concerns. This jumped to 30% for respondents aged 25–34%, and 26% for respondents aged between 35 and 44. Beyond this age group, high levels of privacy concerns again start to decline. But the proportion of respondents with no knowledge regarding privacy concern increases. This pattern of high concern for financial scams in using fintech services was gender agnostic. Age also revealed a clear pattern in concerns for financial scam. In the youngest group, scam concern was the lowest (27% with high concerns).

6.5. Customer perception on satisfaction and costliness

Overall, 37% of fintech users reported being either satisfied or highly satisfied with fintech services. Less than 1% of respondents reported high dissatisfaction. Satisfaction regarding overall fintech services was slightly higher among women: 30% of women reported they were 'satisfied' with fintech services (compared to 29% in men) and 14% of women reported being 'highly satisfied' (compared to 7% in men).

Across age groups, we found younger respondents reporting to be more satisfied or highly satisfied than their older counterparts. This portion was the highest in our youngest age category. Almost 60% of survey respondents aged between 15 and 24 reported satisfaction regarding fintech services. Fintech satisfaction was reported higher among government job holders (64%). This group was also ahead in terms of adoption, use, and their perception of fintech services and benefits. Students (54%) were found to have the second highest level of fintech satisfaction.

Around 8% of survey respondents reported fintech services were 'very cheap' and around 25% of the respondents said they considered these 'cheap'. Around 20% of the respondents reported fintech services to be 'costly'. And respondents who reported fintech services to be very costly made up around 1% of the survey sample. Women's attitude towards the costliness of available fintech services was slightly more pronounced on both ends of the spectrum. Around 16% of female respondents considered fintech services to be 'very cheap'. This was 7% among men.

Respondents were asked the maximum fee they were prepared to pay for BDT 1000 (USD 9.23) worth of cash out on mobile banking platforms. Our survey finds that on average, BDT 8.5 (USD 0.078) was the maximum fee respondents were ready to pay for BDT 1000) worth of cash out. The biggest group consisted of 50% of respondents reporting their maximum fee per BDT 1000 cash out between BDT 10 (USD 0.092) and 14 (USD 0.13). Interestingly, only 4% of the respondents reported their maximum preferable cash-out fee to be between BDT 20 (USD 0.18) and 25 (0.23). Women's maximum cash-out fee on average was BDT 7.99 (USD 0.074) and men's maximum was BDT 8.57 (USD 0.079).

7. Customer Fintech Readiness in Bangladesh

In the last two decades, significant policy support was provided for financial inclusion in Bangladesh. MFS providers like bKash, Nagad, and Upay brought mobile payment services to customers across the country. Even though people were outside of the banking system – bank accounts being a non-mandatory requirement for opening MFS accounts – an alternative payment system nonetheless allowed marginal customers to benefit from reduced cost and more convenience. For households where the main income earner migrated to a city from a rural area, remitting money back home on time was now possible and very much affordable.

Similarly, for small and medium enterprises (SMEs) owners, MFS platforms provided an affordable and safe transaction medium alterative. As described in Section 2, the rise in MFS account numbers was accompanied by a steady increase in total transaction volume. In all likelihood, MFS is expected to see phenomenal growth as new services are added into their mobile application interfaces e.g., mutual fund schemes, shopping bill payments, application for emergency loans. These platforms seem to move towards "superapp" status enjoyed by the largest platforms in places like China.

But popularity and mass adoption of MFS platforms did not translate into a wider variety of fintech services in Bangladesh's financial

ecosystem per se. Essential fintech infrastructure like white label automated teller machines (WLATM), for instance, are still to come. Alternative credit rating algorithms have not taken hold till now, despite availability of data from the gigantic user base of MFS platforms. The vast majority of shops outside of the most developed urban centers in the country lack point-of-sales or QR code mechanisms. In short, fintech ecosystem in the country is in the early stages in terms of variety of services and acceptance of novel platforms at scale. However, fintech holds enormous potential for Bangladesh. Digital penetration, access to internet, a large young customer base with growing purchasing power and increasing awareness of benefits from technology-based services means the domestic market is ripe for fintech innovation.

Applying CFR index proposed in this paper onto NCS data yielded a number of insights. Our findings suggest the market is not entirely ready for innovative services yet. Shortcomings are primarily in areas of citizen financial health, e-readiness, and financial literacy as mentioned in this section. Bangladesh scores 26.62 on CFR. Table 7 lists average scores in the seven dimensions. As suggested by the data, the country ranks well in terms of demographic characteristics conducive to fintech use, mental preparedness of customers for daily fintech use, and overall sentiment on uses of fintech. Poor scores are obtained for financial health of customers, financial literacy and e-readiness. The dimension that measures existing fintech usage provided a particularly bleak picture. The near zero figure for existing fintech use is notable but not unexpected. Existing and novel players are trying to venture into new segments. But seen in the context of overall fintech readiness, existing MFS use is not significant. Although account numbers continue to rise in MFS platforms, majority of users continue to use these for small scale mobile payments.

Average CFR was lower among women (23.02) compared to men (27.18). Interestingly, overall readiness was higher in higher age categories. Younger customers were found to adopt fintech services easily in previous studies. In terms of sentiment and mental preparedness, younger users were more likely to accept new fintech services and continue to use them. Similar to other technologies, fintech was not an exception. However, along the CFR scale which considers seven key dimensions, younger customers in Bangladesh are not as ready as it would appear on the surface. Indeed, CFR from NCS data tells us fintech readiness is higher consistently in older age groups. It was lowest for citizens 20 years of age or below, highest for senior citizens aged 60 or above.

Fintech readiness was not equally distributed across districts. Considerable variation was observed in average CFR scores across the 16 districts included in our survey. Among the eight divisions Dhaka and Chittagong ranked the highest. Not surprisingly these two were the most prominent urban centers in the country. While fintech promises benefits for customers across the socio-economic spectrum, overall readiness in our findings was higher in areas where economic development is most at work. This pattern was true for the individual districts within each division as well. Places with greater prevalence of extreme poverty had significantly lower CFR scores. Across occupation, we see consistent trends as seen in other parts of chapters presented earlier in this report. Government job holders are ahead of almost all other occupations across fintech use and awareness measures. In this case, they are also at the top of occupations in terms of fintech readiness scores. Bangladesh government with their Digital Bangladesh agenda have been pushing for higher levels of digital literacy for more than a decade now.

Table 7
Average Scores Across Seven Dimensions of CFR.

Dimension	Female Score	Male Score	Aggregate Score
Demographic Characteristic	51.85	56.02	55.45
Financial Health	4.15	5.00	4.89
Financial Literacy	15.69	20.81	20.12
E-Readiness	12.18	19.58	18.57
Mental Preparedness	48.62	53.79	53.09
Fintech Usage	0.17	0.92	0.82
Overall Sentiment	45.21	49.03	48.51

It is understandable those who are working at the frontline of government policy implementation will hold wider understanding of fintech use and their expected benefits. Thus, government job holders having higher levels of fintech readiness scores in our survey makes sense according this line of reasoning. Government hob holders are followed by non-residents. Since mobile financial services platforms provide unique cost saving advantages to non-residents Bangladeshis who regularly send money to members at home, fintech readiness score is higher in this category too. Students constitute another major group with high level of fintech readiness score. All three of these groups exhibited on average fintech readiness score of above and around 40% which is considerably higher than the overall average of 28.78%.

Socio-economic background influence fintech readiness score. Perhaps as another confirmation to this, our data shows respondents living in cemented houses with a fintech readiness score of around 33%, higher than the overall average. Those who reported as living in traditional houses (in semi-urban and rural areas specially) had a lower than average fintech readiness score of around 23%.

Monthly expenditure is a proxy for financial health. Even at the aggregate level, higher monthly expenditure can accurately reflect overall likelihood of fintech readiness since respondents at high monthly expenditure groups also fall into higher education, higher levels of awareness, and higher use of current fintech use. At the same time, they are likely to have better access to technology and likely to exhibit lower levels of concern over fintech use. Our survey data confirms this. Respondents in higher levels of monthly expenditure consistently had higher average fintech readiness scores. Future commercial efforts for fintech penetration and policy intervention will have to focus on individuals and households with lower levels of monthly expenditure.

Customers in higher levels of monthly income generally scored higher in CFR. At the lowest range of monthly income, average CFR was 21.34. This increased to as much as 64.59 – around three times that of national average. Notably, financial health was but one of the seven dimensions. In fact, a very high monthly income and savings is not required per se for the type of fintech services currently operating in the country. However, going forward more niche services may be targeted for specific income groups. Financial health had 10.82% weight CFR scale. Nonetheless, the effect of financial health of the customer in determining overall fintech readiness and in overriding other factors was notable.

Individuals who has high levels of concern for information security and cashless community had low fintech readiness scores. A major hurdle fintech service providers need to overcome to penetrate larger parts of the population is the sheer power of habit of using physical currencies. It is difficult for users to shift from centuries-old notion of using a currency with physical and tactile presence to something is almost abstract and lacks any physical presence at all. This logically affects the perceived security and trustworthiness of fintech service for users at an early stage of fintech use. In our data, individuals who reported their concern for a cashless community to be “very high” had an average fintech readiness score of 28%. This was higher for individuals reporting their concern for cashless community to be “very low” at 38%. More importantly, individuals who reported to not know anything at all about concerns over cashless community had fintech readies score of around 18%. Fintech service providers need to focus more on the

undecided part of the current and future customer base to formulate a positive and rational view of fintech services and the benefits it represents for the communities of the future.

Marked difference was found in average CFR for citizens from urban and semi-urban/rural areas. The NCS questionnaire also asked citizens to specify their house type, transportation medium among other things. For urban citizens, notwithstanding any other variable, average CFR was 30.75. In semi-urban/rural areas it was 20.48. With lower education, readiness fell. In NCS, the highest category of institutional education was post-graduate degree, where average CFR was 42.76. For citizens with only primary schooling, this was 8.48. On average, we found a 57% increase in CFR for each additional degree in the national institution education system. This corroborates evidence from other markets where literacy and fintech readiness was observed with positive association among them. Citizens with higher levels of education are more likely to be aware of benefits from these services. At the same time, they are more likely to rationally judge the potential risks associated with fintech use and way to mitigate them.

8. Discussion

Within a context of rising MFS acceptance, favorable demographics and economics, and transformative potential for financial landscapes of emerging economies, this paper proposed an index to assess citizens' level of readiness to use fintech products and services. To do so, a multiple-domain readiness index, the Customer Fintech Readiness (CFR), was constructed. CFR considered a range of variables measuring citizens' demographics, financial health, financial literacy, existing fintech usage, e-readiness, mental preparedness, and fintech sentiment. This study was done on Bangladesh – a country where decades of commendable macrocosmic growth and stability has created a conducive digital and infrastructure environment for further fintech development. Mentioned earlier, fintech holds the potential to create significant value for customers. Importantly, it can facilitate financial inclusion in places where the banks lagged behind in bringing people into the financial system. That facilitating role is underpinned by large scale adoption of fintech services. But fintech's potential is limited if acceptance and usage of fintech products and services is inadequate.

This paper reviewed extant literature for factors and theoretical underpinnings. Our findings corroborate a number of patterns while providing new evidence for further analysis. Similar to previous findings we found institutional education positively contributing to overall fintech readiness. But contrary to others (Gulamhuseinwala et al., 2015b; Yonghee Jack Kim et al., 2015) CFR for older age groups in our findings were consistently higher. This can be explained. First, we used a multi-dimensional index where mental preparedness and overall sentiment constituted only two of the seven dimensions. These are two areas where younger users were found to be ahead of older counterparts. Another dimension was concerned with e-readiness where regardless of age, citizens in Bangladesh have room for improvement. As a result, the relative weight of these variables meant financial health and literacy gained greater importance. The latter two are areas where older citizens were ahead.

Consistently in our analyses, gender disaggregated CFR showed lower average readiness of women. Women ranked lower than men across all seven dimensions in CFR. Moreover, dimension score shows that gender difference was most pronounced in financial literacy. Whether through reducing wage differential, access to capital for entrepreneurship, or by increasing financial resilience fintech has proven to close the gender gap (Chen et al., 2021; Guo et al., 2021; Sioson and Kim, 2019). For a country such as Bangladesh, women empowerment can be further propelled by fintech. To do so, policy interventions will be necessary to address the asymmetry of average scores across the seven dimensions of CFR, as shown in this paper. Such intervention will have to be on top of macro efforts to raise fintech readiness at the granular level.

It is important to discuss the clear pattern observed with regards to fintech readiness and institutional education. With higher institutional education, fintech readiness increased substantially. Considering all other factors constant, this alone raised readiness by a big margin. The increase was larger at tertiary than in secondary or primary stages. Fintech platforms do not require sophisticated understanding of financial transactions. In fact the entire point of fintech is to democratize, de-couple, and demystify finance for customers in specialized segments of the market (Allen et al., 2020; Jagtiani and Lemieux, 2017; I. Lee and Shin, 2018). Intuitiveness of the user interface is one way to attract and retain customers within fintech service ecosystem (S. Lee, 2017; Wahab et al., 2021). Most fintech platforms offer such intuitive user interfaces to optimize customer experience. Assuming a lack there is putting friction in customer attraction and retention, lower readiness can be attributed to perceived factors in our sample.

The CRF index and its attendant findings for citizens in Bangladesh contribute to the literature in a number of ways. To the best of our knowledge, this is the first attempt to "package" the idea of customer readiness of fintech along with all its relevant dimensions and variables. Previously, theoretical models and index constructions were aligned with broad technology adoption. Considering the phenomenal rise in customer fintech applications, services, and products across the globe during the last decade, and expecting a boom in the ongoing one, assessment of customer readiness is important for countries that stand to benefit from fintech's transformative potential. Although CRF is critically evaluated for reliability and validity, future research work can further expand and modify components in our proposed index.

Our work is also first to measure fintech readiness in Bangladesh. It is a market where fintech has taken off with notable success of MFS platforms and where novel fintech solutions stand to capture significant value. However, it is also market where enough investigation has not been conducted for further insights. An investigation of the Bangladesh fintech ecosystem will yield fundamental learnings for other markets. A plethora of economic and behavioral variables make the Bangladesh ecosystem intriguing to study. However, overall readiness for fintech adoption and use demands an ecosystem view. In particular, the role of open innovation dynamics in fintech startups and the financial services ecosystem is key. Such dynamics impact firms, innovation clusters, industries, and the economy. Open innovation dynamics among three actors i.e., SMEs, big businesses, and communities at large cyclically affect economic growth dynamics – both at firm and country levels (JinHyo Joseph Yun et al., 2018). As such, economic systems are in a constant state of flux wherein interaction between actors cyclically either preserve or influence overall balance. This results in either accelerated growth or the stifling thereof.

Open innovation dynamics have also been investigated within a network of firms where incumbent firms interact with open innovation elements from emerging startups (Gay, 2014). While pharmaceuticals industry was explicitly investigated, fintech as an ecosystem should also retain such open innovation dynamics. Incumbent financial institutions are constantly interacting with fintech SMEs, being challenged by alternatives, acquiring new technologies, business models, and target segments, and providing ecosystem and legacy support to create win-win business cases (Hornuf et al., 2021; Juengerkes, 2016; Mikhaylov et al., 2023).

The new technological paradigms of the Second Machine Age have pave the way for an evolution of innovation dynamics from a closed state to an increasingly more open dynamics (Poot et al., 2009). There is evidence that SMEs in recent years are increasingly engaged in open innovation practices and systems (van de Vrande et al., 2009). In fact, an "ambidextrous" approach to manage the transition towards open innovation in the fintech ecosystem is both required and enabled by

Industry 4.0 technolgoies i.e., Artificial Intelligence, big data, blockchain, and the Internet of Things (IoT) (Jinhyo Joseph Yun et al., 2021). Internal and external organizational policies definitely have a role to play (Igartua et al., 2010). Here too, technology is a predominant but not sufficient driver. To foster open innovation dynamics within organizations and among collaborating firms in the innovation ecosystem, firms need appropriate cultural transitions – not least in the financial services landscape that is poised for fundamental transformations (Fasnacht, 2018). But at the same time, organizational key figures such as founder entrepreneurs or CEOs through their characteristics and approaches also influence such transitions towards open innovation dynamics (Barrett et al., 2021). The roles of entrepreneurs, incumbent banks, and ecosystem enablers (e.g., regulators, technology providers) need to be further assessed in light of open innovation dynamics for better fintech adoption readiness.

9. Limitations and future research

The current study proposed the Customer Fintech Readiness (CFR) index to measure readiness to adopt customer facing fintech in daily lives by customers across a country. Measuring customer readiness to adopt innovative fintech services at scale is important since such adoption in prerequisite to socio-economic benefits fintech promises. Our study is one of the first in the literature to attempt to measure such readiness from the perspective of seven dimensions. However, there were at least two limitations to CFR that future research should consider and possibly address. First, CFR relied on customer reported data. The standard questionnaire used in National Citizen Survey collected responses from 1282 individuals through interviewers. Despite best efforts to control for interviewer bias, we recognize that customer reporting may have been influenced by interviewer differences across districts. Moreover, customer reported data could not be independently validated. There were no nationwide datasets complied by independent researchers or government agencies on customer use of fintech or technology in general. Future replication efforts can account for possible interviewer bias by maintaining interviewer uniformity (e.g., same group of interviewers across districts). However, online survey questionnaires cannot be used. Target population in high-poverty areas will have difficulty access these.

Second, our dataset was gender imbalanced. This was due to the poverty-based stratified random sampling used in the study. Each successive iterations of administrative subunits were ranked according to poverty and the two extreme candidates were selected to preserve representation of both sides of the socio-economic spectrum. This ensured good economic representation but compromised on gender representation. The use of statistical tools e.g., Synthetic Minority Oversampling Technique (SMOTE) can be used to address such sample imbalances (Chawla et al., 2002; Ijaz et al., 2018; Pears et al., 2014). For instance, to investigate factors contributing to fintech adoption, sample imbalance was addressed with SMOTE by Mahmud et. al. (2023). While SMOTE is an effective method in modelling scenarios, the purpose of this paper was to assess readiness. Future replication should control for gender while contracting their respective nationwide samples. This will allow for validating the gender-based findings from this study. At the same time, it will improve generalizability of CFR findings in the given country.

Future researchers can also replicate the index and perform a country-level comparative analysis of fintech readiness – overall as well as dimension specific. In that regard, the CFR provides a way to quantify readiness for further investigation. Macro-level investigation of readiness and other factors can be performed only when there is a reliable and valid way to measure Customer Fintech Readiness. Future research is important to further fine-tune the variables and construction method of CFR. The current work was constrained by absence of national dataset on citizens' use of other technologies. As such, National Citizen Survey conducted by the authors to collected data from citizens across the country. Existing and interested customers of fintech self-reported. Researchers can critically evaluate the appropriateness of self-reported data in assessing fintech readiness. Further review may be necessary on the logic and mathematical construction used for the CFR. Whether the use of confirmatory factor analysis and feature elimination tactics would bring more rigor to the CFR needs to be investigated.

10. Concluding remarks

This work was part of a series of research undertaken by the authors. In a recently published work, adoption factors of fintech in Bangladesh were modeled (Mahmud et al., 2023). Ongoing work by the authors studies the Bangladeshi fintech ecosystem, its organization, evolution, opportunities and challenges; further work looks into the sustainable development impact of fintech.

Fintech holds transformative potential. Disrupting traditional finance, technology-enabled financial services can create value for customers and promote a more inclusive and resilient financial services for specialized segments of the market. To enable such an environment would require customer readiness to adopt fintech services at large. At later stages of ecosystem development, adoption of fintech requires a range of readiness dimensions. Considering these, this paper proposed an index that measure fintech readiness for customers in Bangladesh. The scale considered demography, financial health and literacy, e-readiness, mental preparedness and sentiment on fintech for a broader view of readiness. Further research can critically evaluate and expand the proposed construction and organization of the CFR and replicate it for different markets. Apart from empirical corroboration, such work is expected to result in readiness assessment of other ecosystems as well as directions for policy interventions.

Appendix A. : Sample selection in national citizen survey

Out of the 64 districts in Bangladesh divided in 8 divisions, we took 16 districts for sampling citizens in the National Citizen Survey (NCS). From each division, 2 districts were selected. District selection was based on poverty levels. For appropriate representation of citizens on both sides of the socio-economic spectrum, districts in each division were ranked on weighted average poverty score as per Bangladesh Bureau Statistics (BBS) method. The districts with lowers and highest weighted scores were selected. District rankings are provided in Table 8 below. In case more than one ranked the same in either of the slots, random selection of one of them was followed.

After selecting a district, geographic variation was preserved by selecting the main administrative unit and the one farthest from that. This was done in three iterations in total until the smallest unit was accounted for. At this point, systematic sampling was followed to select 10 datapoints from 2 wards within unit (the hierarchy was: district [16], sub-district or Upazila [32], Union [64], Ward [128] respectively). Entire population of a Ward was divided by 10. Data collection started from a randomly selected house, afterwards every nth (n = population of the ward/10) house was approached. A total of 20 samples were collected from each Union, 10 from each Ward, resulting in a total of 1282 instances. (Fig. 4).

Table 8
District poverty ranking for sample selection in NCS.

Division	District	Total	(1)	(2)	(3)	(4)	(5)	Weighted Average Score
Barisal	Barguna	6	0	0	1	5	0	3.83
	Barisal	10	0	0	4	5	1	3.70
	Bhola	7	0	5	0	2	0	2.57
	Jhalokati	4	0	1	2	0	1	3.25
	Patuakhali	8	0	0	2	4	2	4.00
	Pirojpur	7	0	0	4	2	1	3.57
Chittagong	Bandarban	7	0	0	0	1	6	4.86
	Brahmanbaria	9	7	2	0	0	0	1.22
	Chandpur	8	0	0	3	3	2	3.88
	Chittagong	30	8	11	8	3	0	2.20
	Comilla	17	0	6	11	0	0	2.65
	Cox's Bazar	8	0	4	2	1	1	2.88
	Feni	6	5	1	0	0	0	1.17
	Khagrachhari	9	0	0	0	1	8	4.89
	Lakshmipur	5	0	0	2	1	2	4.00
	Noakhali	9	2	2	2	1	2	2.89
	Rangamati	10	0	0	1	1	8	4.70
Dhaka	Dhaka	55	45	8	1	1	0	1.24
	Faridpur	9	6	3	0	0	0	1.33
	Gazipur	13	7	6	0	0	0	1.46
	Gopalganj	5	0	0	3	2	0	3.40
	Kishoreganj	13	0	0	0	1	12	4.92
	Madaripur	4	4	0	0	0	0	1.00
	Manikganj	7	0	2	4	1	0	2.86
	Munshiganj	6	6	0	0	0	0	1.00
	Narayanganj	5	5	0	0	0	0	1.00
	Narsingdi	6	4	2	0	0	0	1.33
	Rajbari	5	0	0	2	3	0	3.60
	Shariatpur	6	0	4	2	0	0	2.33
	Tangail	12	0	3	7	2	0	2.92
Khulna	Bagerhat	9	0	2	6	1	0	2.89
	Chuadanga	4	0	0	3	1	0	3.25
	Jessore	8	0	0	4	4	0	3.50
	Jhenaidah	6	0	0	1	4	1	4.00
	Khulna	15	0	1	1	13	0	3.80
	Kushtia	6	1	3	2	0	0	2.17
	Magura	4	0	0	0	0	4	5.00
	Meherpur	3	0	0	2	0	1	3.67
	Narail	3	1	2	0	0	0	1.67
	Satkhira	7	1	6	0	0	0	1.86
Mymensingh	Jamalpur	7	0	0	0	0	7	5.00
	Mymensingh	13	0	1	5	6	1	3.54
	Netrokona	10	0	0	0	7	3	4.30
	Sherpur	5	0	0	0	3	2	4.40
Rajshahi	Bogra	12	1	2	5	4	0	3.00
	Joypurhat	5	0	2	3	0	0	2.60
	Naogaon	11	0	0	1	7	3	4.18
	Natore	7	0	3	2	2	0	2.86
	Chapai Nawabganj	5	0	0	0	1	4	4.80
	Pabna	9	0	0	6	1	2	3.56
	Rajshahi	15	3	10	1	1	0	2.00
	Sirajganj	9	0	0	3	6	0	3.67
Rangpur	Dinajpur	13	0	0	0	0	13	5.00
	Gaibandha	7	0	0	0	0	7	5.00
	Kurigram	9	0	0	0	0	9	5.00
	Lalmonirhat	5	0	0	0	3	2	4.40
	Nilphamari	6	0	0	0	0	6	5.00
	Panchagarh	5	1	1	2	1	0	2.60
	Rangpur	8	0	0	0	4	4	4.50
	Thakurgaon	5	0	0	0	5	0	4.00
Sylhet	Habiganj	9	1	6	2	0	0	2.11
	Moulvibazar	7	3	2	2	0	0	1.86
	Sunamganj	11	0	6	3	1	1	2.73
	Sylhet	13	4	9	0	0	0	1.69

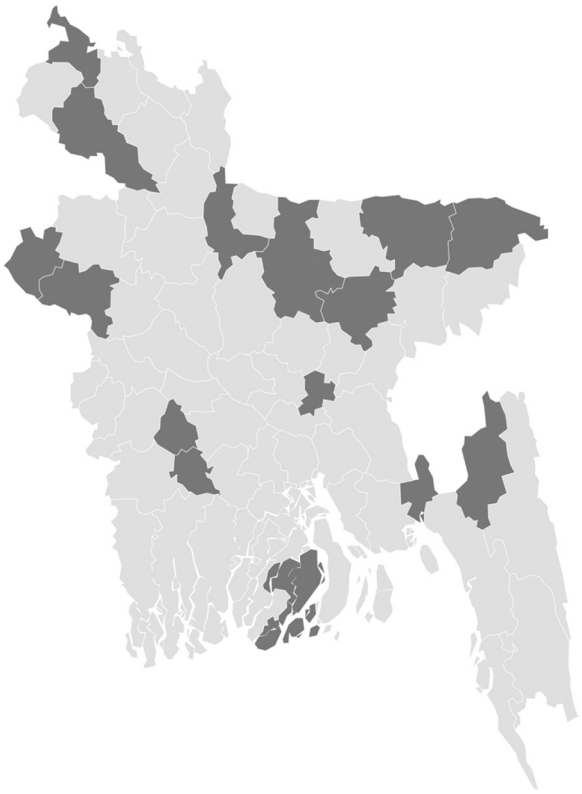

Fig. 4. Selected Districts (in darker shade) in the Nationwide Citizen Survey.

Appendix B. Regression model estimates for validity assessment

See Tables 9–11 here.

Table 9
Regression model estimates with future fintech service expectations as dependent variable **Model 1: Future services as dependent variable**.

Future_services	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
CFR	0.112	0.009	13.12	0	0.095	0.129	* **
RespondentAge	-0.001	0.007	-0.08	0.938	-0.014	0.013	
Monthly_expenditure	0	0	-2.13	0.034	0	0	* *
Constant	1.067	0.4	2.66	0.008	0.281	1.852	* **
Mean dependent var	3.775		SD dependent var		2.960		
R-squared	0.172		Number of obs		1282		
F-test	88.361		Prob > F		0.000		
Akaike crit. (AIC)	6185.744		Bayesian crit. (BIC)		6206.369		

* **p < .01, * * p < .05, * p < .1

Table 10
Model estimates with future expectations from service providers as dependent variable **Model 2: Expectations from service providers dependent variable**.

Exp_FSP	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
CFR	0.105	0.008	13.49	0	0.09	0.121	* **
RespondentAge	-0.005	0.006	-0.85	0.396	-0.018	0.007	
Monthly_expenditure	0	0	-5.20	0	0	0	* **
Constant	2.648	0.366	7.23	0	1.93	3.366	* **
Mean dependent var	4.674		SD dependent var			2.709	
R-squared	0.173		Number of obs			1282	
F-test	89.258		Prob > F			0.000	
Akaike crit. (AIC)	5956.360		Bayesian crit. (BIC)			5976.985	

* **p < .01, * * p < .05, * p < .1

Table 11
Model estimates with future expectations from the government as dependent variable **Model 3: Expectations from government as dependent variable**.

Exp_GOV	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
CFR	0.049	0.004	11.04	0	0.041	0.058	* **
RespondentAge	-0.006	0.004	-1.69	0.092	-.013	0.001	*
Monthly_expenditure	0	0	-2.85	0.004	0	0	* **
Constant	2.524	0.209	12.07	0	2.114	2.934	* **
Mean dependent var	3.425		SD dependent var			1.517	
R-squared	0.139		Number of obs			1282	
F-test	68.990		Prob > F			0.000	
Akaike crit. (AIC)	4521.832		Bayesian crit. (BIC)			4542.457	

* ** p < .01, * * p < .05, * p < .1

Appendix C. CFR dimensions and variable operationalization

In this section, we briefly describe the seven dimensions, variables used in each, and the corresponding transformation methods and value labels used. Each variable is scaled from 1 to 100. We added these variables and took the average to formulate the dimension score. As a result, each dimension is scales from 1 to 100.

1. Demographic

For demographic measurements, we considered two variables. Age of respondents and their level of education. Following findings from previous sections, higher age was deemed to hurt overall fintech readiness. This was primarily due to concern factors and technical readiness. Higher levels of institutional education were deemed to have a positive impact on fintech readiness. This was also found in several sections of this report. Age was scaled from 0 to 100 and subtracted from 100 as follows:

$$Age_s = 100 - \left\{\frac{age_i - \min(age)}{\max(age) - \min(age)} * 100\right\}$$

In this case, Age_s is the standardized age. At first, the minimum age in the survey is deducted from age_i of the respondent and is then divided by the range of age values found in the survey. This is multiplied by 100 to scale. Finally, we subtract it from 100 to incorporate the negative relationship. (Table 12).

Levels of institutional education of the respondents were also converted into numeric values on a scale of 1–100 using the following value-labeling:

On average, we assumed a 20-step increment in fintech readiness with each additional level of institutional education. Higher levels of institution education equip a person for wider fintech use and address some of the concerns related to security, financial fraud, and privacy.

Table 12
Value Labels for Respondent Education.

Response	Value
None	0
Primary	20
Madrasa (kawmi)	20
Secondary	40
Higher Secondary	60
Graduate	80
Post-graduate	100
Other	100

2. Financial health

As part of our survey, we collected data on several financial and economic variables. However, in our analyses, only a handful was particularly relevant in explaining dependent variables in previous sections. To construct the financial health dimension of our score, we used two variables related to financial health: the monthly income and annual savings of the respondents. As with other variables, both monthly income and annual savings were scaled from 1 to 100 and averaged for dimension score.

3. Financial literacy

The financial literacy dimension in our scale consists of three variables which look into the number of times the respondent visits the bank per month, their assessment of how confident they are performing activities, and their overall awareness of bank transactions. The number of times the

respondent visited a bank in a given month was scaled from 0 to 100. To label respondents' assessment of their confidence in performing banking activities, the following value label was used:

See Table 13 here.

Table 13
Value Labels for Confidence Banking Alone.

Response	Value
Not confident at all	20
Low confident	40
Slightly confident	60
Confident	80
Very confident	100

In transforming respondents' assessment of awareness of bank transactions, we used the following value labels:

See Table 14 here.

Table 14
Value Labels for Awareness of Bank Transaction.

Response	Value
No knowledge at all	20
Very low knowledge (only deposit and withdrawal)	40
Some knowledge (deposit scheme and loan scheme)	60
Above average knowledge (LC, stock market, financial report, ratios, etc.)	80
Expert (certified financial analyst)	100

In both of these cases, an equal interval step increment was used for increasing levels of confidence and awareness of fintech readiness.

4. E-readiness

We incorporated 4 measures to assess respondents' e-readiness for fintech use. Access to mobile technology is a must for fintech use at the most level. Especially in terms of mobile financial services, the minimum technology the user needs is access to a phone (preferably a smartphone) and access to high-speed internet. Better phones and access to high-speed internet become increasingly important for a wider scope of services. For internet banking, however, access to a personal computer becomes important. Respondents who had access to a computer were assigned 100 and those who did not were assigned a 0. We used the following value labeling to transform respondents' assessment of their computer skills:

See Table 15 here.

Table 15
Value Labels for Computer Skills.

Response	Value
Not skilled at all	20
Very low skills	40
Some skills	60
Skilled	80
Very skilled	100

To transform respondents' assessment of their smartphone-use skills, the following value labeling was used:

See Table 16 here.

Table 16
Value Labels for Smartphone Skills.

Response	Value
Not skilled at all	20
Very low skills	40
Some skills	60
Skilled	80
Very skilled	100

We also considered respondents' data usage per month. Existing data usage is an effective proxy for future openness to use wider and more sophisticated fintech services. The next generation of fintech services will likely demand higher levels of internet use. Data usage per month was measured in megabytes and was scaled from 0 to 100.

5. Mental preparedness

Respondents were asked to also evaluate their assessment mental preparedness for fintech use on a day-to-day basis. To transform their assessment, the following value labeling was used:

See Table 17 here.

Table 17
Value Labels for Mental Preparedness.

Response	Value
Not prepared at all	20
Low prepared	40
Average preparedness	60
Prepared	80
Adequately prepared	100

Higher levels of perceived mental preparedness should constitute an important aspect of the overall fintech readiness assessment. For this reason, this single variable constituted an entire dimension for our overall scale.

6. Current fintech usage

Current fintech usage, perhaps obviously, is another important predictor of the future readiness of newer fintech services. Our survey incorporated several types of measures looking into mobile banking usage, internet banking usage, frequency of mobile and internet banking services used, and the average volume of money transacted on these platforms. Very few respondents were found to actively use internet banking services. We had to prevent the scale from becoming artificially inflated by including internet banking variables. Thus, current fintech usage only considered the frequency of mobile banking use and the average volume of mobile banking use. Both of these variables were scaled from 0–100. Average of these scaled variables were taken for the dimension score.

7. Overall sentiment related to fintech use

User sentiment related to fintech can be from different angles. Indeed, our survey incorporated multiple lines of sentiment assessment questions to get an overall view of user sentiment. For this scale, we incorporated the three most salient sentiment aspects: respondents' assessment of fintech costliness, assessment of satisfaction with fintech use, and assessment of fintech service availability. To transform respondents' assessment of fintech costliness, satisfaction and availability, we used the following value labeling:

See Tables 18–20 here.

Table 18
Value Labels for Fintech Costliness.

Response	Value
I don't use fintech	0
Very costly	20
Costly	40
Neutral	60
Cheap	80
Very cheap	100

Table 19
Value Labels for Fintech Satisfaction.

Response	Value
I don't use fintech	0
Highly dissatisfied	20
Dissatisfied	40
Neutral	60
Satisfied	80
Highly satisfied	100

Table 20
Value Labels for Fintech Availability.

Response	Value
I don't know	0
Not available at all	20
Not available	40
Neutral	60
Available	80
Highly available	100

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