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Assessing the Role of FI Index and Its Components in Evaluating Digital Financial Inclusion over Conventional Inclusion In India

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ABSTRACT
Monetary Inclusion is characterized as the most common way of giving banking and monetary arrangements and administrations to all citizenry regardless of their financial status. Its fundamental objective is to incorporate everybody in the public eye by offering essential monetary types of assistance to them without respect for their pay or investment funds. Monetary incorporation is principally worried about offering trustworthy monetary answers for monetarily impeded individuals without separation. Its will probably offer monetary arrangements that are without any proof of imbalance. It likewise promises to be transparent while furnishing monetary guide with no secret expenses or charges. The principle point of this study is to evaluate the Role of FI Index and Its Components in Evaluating Digital Financial Inclusion Over Conventional Inclusion in India. In this paper we represent two different indices, one for conventional financial inclusion and one for digital financial inclusion, were created by integrating access and usage information, respectively, for the conventional financial index. It is concluded that Conventional and digital financial indices were both shown to be equally essential in describing level of financial inclusion; hence, digital financial services are considered as a supplement rather than a replacement for conventional financial services.

KEYWORDS - *Financial Inclusion, Financial Inclusion Index, digital, conventional, usage, barriers, access etc.*

I. INTRODUCTION

Endeavors to make monetary labor and products accessible and modest to all people and organizations, no matter what their own total assets or corporate size, are alluded to as monetary incorporation. Monetary consideration means to separate the hindrances that keep people from taking part in the monetary framework and profiting from its administrations. It's otherwise called "comprehensive money. (The World Bank, 2020)

- Monetary consideration is an undertaking to make consistently monetary administrations reasonable to a bigger piece of the total populace.
- Fintech advancements, such as digital transactions, are making financial inclusion more accessible.
- However, according to the World Bank, 1.7 billion grown-ups internationally don't approach even an essential financial balance.

1.1 Definition of Digital Financial Inclusion

In digital financial inclusion, adults who don't have a bank account are brought into the formal financial sector by giving them financial services through digital devices like mobile phones or other devices with a digital interface. Digital financial inclusion means providing digital financial services to people who aren't well-served or who aren't well-served, and using a mobile phone or other digital device to make it easier for people to get digital financial services (Ozili, 2018). Digital financial inclusion is the process of giving people who aren't able to get formal financial services cheaply access to them. This is done by using existing digital technologies (Ozili, 2020b). A goal of digital financial inclusion is the long-term availability of low-cost digital financial services that bring people who don't have money into the formal financial sector of the economy.

- **Instruments for digital financial inclusion**
- ✓ e-money accounts
- ✓ charge cards
- ✓ MasterCard's
- ✓ versatile cash
- ✓ web banking retail point of Sale (PoS) terminals

✓ agent networks

1.2 Conventional financial inclusion

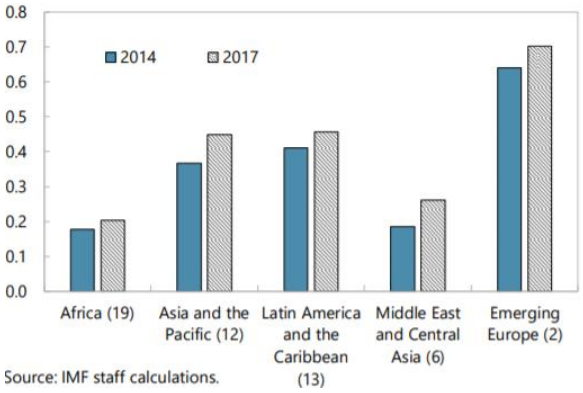
Center frameworks, or the pieces of monetary administrations that are significant. Paid ahead of time put away worth handling, protection guaranteeing motors, credit account handling, virtual cash, unfamiliar trade, and hostile to tax evasion are all important. People who work for regulated financial institutions can get things like a home loan, an auto loan, a chequebook account, and a savings account from them.

➢ **Financial Inclusion Schemes in India**

- Atal Pension Yojana (APY)
- Jeevan Suraksha BandhanYojana.
- Pradhan Mantri Jan DhanYojana (PMJDY)
- Pradhan Mantri MudraYojana (PMMY)
- Pradhan Mantri Suraksha BimaYojana (PMSBY)
- Pradhan MantriVayaVandanaYojana (PMVVY)
- Stand Up India Scheme.
- SukanyaSamriddhiYojana.

1.3 Conventional and digital FI

1.3.1 Index in Conventional FI



Note: There were a lot of countries in the sample. The number in brackets shows that

Figure 1:Index in ConventionalFI

There are a lot of countries where conventional financial inclusion is high. These countries are in the Asia and the Pacific, Latin America and the Caribbean, and Emerging Europe (Figure 1). The conventional financial inclusion index stayed about the same between 2014 and 2017, but eight countries saw a decrease. (Botswana, El Salvador,2017)

1.3.2 Index in Digital FI

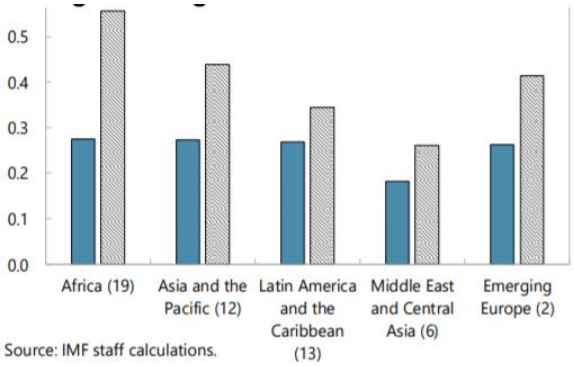


Figure 2:Index in Digital FI

There are a lot of nations in Africa and Asia and the Pacific that have a many individuals who utilize computerized cash (Figure 2). Most nations saw an ascent in their computerized monetary incorporation record somewhere in the range of 2014 and 2017, which was brought about by both access and use factors. Ghana, Benin, and Senegal were the two African nations that saw the most improvement. A portion of the nations in Latin America and the Caribbean and the Middle East and Central Asia saw little or no change.

II. REVIEW OF LITERATURE

Peterson K Ozili (2020) - Digital financial inclusion is the goal of this paper. It also explains what digital financial inclusion is, how it works, who provides digital financial services, what instruments are used for digital monetary consideration, the advantages of computerized monetary incorporation, the dangers of advanced monetary consideration,and the regulatory issues that come up when people use digital financial services. The paper comes to an end with some suggestions for policy and practise in the digital finance ecosystem.

PurvaKhera, Stephanie Ng, et al (2020) -Over the most recent couple of years, advanced monetary administrations have been a big part of making sure everyone has access to money. As long as conventional financial inclusion helps the economy grow, does this same thing happen when people get digital financial inclusion? What makes it possible for more people to use digital money? So why does it move faster in some countries, but not in other places? In Khera et al. (2020), new indices of financial inclusion were developed. This paper looks at these inquiries for 52 agricultural nations. Cross-sectional instrument variable examination shows that the exogenous part of computerized monetary consideration is connected to development in GDP per capita between 2011and 2018. This means that digital financial inclusion can help the economy grow faster.

AraniyarIsukulandBenTantua (2020) -Conventional banking approaches to tackle the issue of financial inclusion in poor nations are ineffective. Opening working and powerful financial organization activities in many agricultural countries is definitely not a monetarily achievable other option, as is turning out to be clear.To operate successfully, banking offices require vast quantities of resources, equipment, and employees. It is impossible to sustain a policy aim that uses banks business workplaces to tackle the issue of monetary incorporation in most emerging countries, where low pay is the standard rather than the special case. Monetary innovation, as indicated by the finishes of the review, gives the instrument, devices, and system to progress monetary consideration in manners that regular financial methodologies can't. Monetary innovation gives a more savvy and less expensive way to drive financial progress.

Gaurav Agrawal and Pooja Jain (2019) - Financial inclusion is a multifaceted concept. Electronic banking activity in rural India contributes to greater usage of financial services and improved living conditions as a result of technological involvement in financial inclusion. As a result, the chapter's main goal is to understand the factors that will drive the adoption of mobile financial services, as well as people's intentions to adopt and use mobile banking services. The research focuses on analysing secondary sources connected to financial inclusion in order to better understand new banking technologies and people's attitudes regarding adoption and use of banking services.

Khera et. al. (2020) By combining the digital features to the measure of financial inclusion through financial institutions such as banks, the improved measurement of financial inclusion for 2014 and 2017 covering 52 EMDEs is constructed. The indices are based on existing literature and include statistics on access and usage supplied by financial institutions and DFSs such as mobile money carriers, fintech businesses, and other new financial entrants.

III. AIM OF THE STUDY

The primary aim of this study is to assess the comparison between conventional and digital financial inclusion using financial inclusion index based on Fi components.

IV. RESEARCH METHODOLOGY

4.1 Data sources and components

Estimating the degree of monetary incorporation is a combative subject. To far, just stockpile side total information -, for example, the quantity of ATMs and bank offices - has been utilized to evaluate monetary consideration (for example Amidzic et al. (2014); Honohan (2008) and Chakravarty and Pal (2013). Be that as it may, in light of the fact that supply side information doesn't represent the limitations experienced by people who are automatically barred from utilizing or getting formal monetary administrations, it gives lacking data regarding the financial system's inclusivity. When it comes to usages, more information from the demand side should be employed.

In summary, earlier attempts to evaluate financial inclusion have been either insufficient in terms of data due to a lack of data on financial exclusion or have been plagued by methodological issues (Camera &Tuesta, 2014). Furthermore, a study of the literature shows that assessments of the financial inclusion index do

not include data on digital banking, which is an essential feature in defining financial inclusion. As a result, for the conventional index from 2004 to 2019, we mix data on "access," "use," and "barriers," whereas just "access" and "usage" are used for the digital index. Table 1 provides a Data sourcesand components in ourmodel.

- Access
- Usage
- Barriers

Table1: Data sourcesand components in ourmodel

ConventionalFIIndex	Source	DigitalFIIndex	Source
Access No. of ATMs per 100,000 adults.No.ofbranchesper100,000adults.	FAS-IMF	**Access** Mobilecellularsubscriptionper100people. Numberofregisteredmobilemoneyaccounts. %ofmobileinternetusers.	ITU FAS-IMFITU
Usage		**Usage**	
No.ofdepositaccountswithcommercial		Mobilepaymentsaccounts.	
banksper1,000 adults.		No.of mobile moneytransactionsper 1000adults.	
No.ofborrowersfromcommercialbanksper1,000adults.	FAS-IMF	Makesonlinepurchasesorpayanonline bill	MCIT
No.ofdebitcardsper1,000 adults. No.ofcreditcardsper1,000 adults.			
		Madeanonlinepurchaseviaamobile.	
Barriers No.ofcommercialbankbranchesper1000**km²**. No. ofATMsper1000**km²**.BorrowedfromaFIinruralareasSavedatFIruralaged 15+	FAS-IMFFAS-IMF WBFindex WBFindex		

4.2 Index construction:

The technique given by Sahay et al. is followed in this study (2020). As a result, we create a multidimensional composite monetary incorporation list for India, which incorporates both traditional bank-based and advanced monetary consideration files. The complete monetary incorporation file is isolated into two files, giving disaggregated data on the monetary framework's inclusivity, which helps policymakers in zeroing in their endeavors on the areas that require advancement. In spite of the fact that PCA is one-sided for the loads of the pointers, three-stage PCA assists with beating this imperfection. Since each sub-record is characterized by a gathering of emphatically connected markers, it is smarter to gauge the sub-lists first rather than the general list in one stage utilizing every one of the pointers simultaneously.The 1st stage of PCA involves combining marks of "access," "use," and "obstructions" that lay out the aspects or sub-files that are utilized to build regular monetary consideration files. Dissimilar to Sahay et al., (2020), we incorporate a third aspect,"barriers," to include people who are unable to use formal financial services and therefore present a fuller picture. The digital financial inclusion index, on the other hand, was created by combining measures of "access" and "use" that characterize the aspects. That is, for each list the three endogenous factors Yu, Ya , Ybbecause they are unseen, their related parameters must be approximated. (β, φ, α) in the following equation system:

The conventional financial inclusion index's aspects of "use," "access," and "barriers" are calculated using the equation system below:

$$Y^a = \beta_1 \text{ ATMs} + \beta_2 \text{ branches of bank} \quad (1)$$

$$Y^u = \alpha_1 \text{no. of credit cards} + \alpha_2 \text{no. of debit cards} + \alpha_3 \text{ deposits accounts} + \alpha_4 \text{ Loans} \quad (2)$$

$$Y^b = \varphi_1 \text{ branches km}_2 + \varphi_2 \text{ ATM km}_2 + \varphi_3 \text{ savings} + \varphi_4 \text{ borrowings} \quad (3)$$

The corresponding formulas system is used to calculate the dimensions of "use" and "access" of the Digital financial inclusion index:

$$Ya = \beta 1 \text{ versatile memberships} + \beta 3 \text{ portable cash accounts} + \beta 4 \text{ portable web clients} \quad (4)$$

$$Yu = \alpha 1 \text{ Mobile installments accounts} + \alpha 2 \text{ Mobile cash exchanges} + \alpha 3 \text{ online installments} + \alpha 4 \text{ Mobile internet based installments} \quad (5)$$

In order to figure out each index's score, we first track down the scores for every one of the three head parts of each aspect. The principal components of each dimension are the linear combination of their input indicators, as explained above:

$$PC_K = \sum \acute{\eta}_{kp} X_p \quad (6)$$

In Equation (6), $\acute{\eta}_{kp}$ is the relationship coefficient between the k-th head part and the no. of p markers or sub-files, or the loading of each component. The weighted average of each PC is then determined for each

dimension score, as follows:

$$\boldsymbol{Ds_t^a} = \frac{\sum_{j,k=1}^{4} \boldsymbol{\lambda_j^a PC_{kt}^a}}{\sum_{j,k=1}^{4} \boldsymbol{\lambda_j^a}} \qquad (\mathbf{7})$$

$$\boldsymbol{Ds_t^u} = \frac{\sum_{j,k=1}^{4} \boldsymbol{\lambda_j^u PC_{kt}^u}}{\sum_{j,k=1}^{4} \boldsymbol{\lambda_j^u}} \qquad (\mathbf{8})$$

$$\boldsymbol{Ds_t^b} = \frac{\sum_{j,k=1}^{4} \boldsymbol{\lambda_j^b PC_{kt}^b}}{\sum_{j,k=1}^{4} \boldsymbol{\lambda_j^b}} \qquad (\mathbf{9})$$

where Ds_trepresents the scores of the three dimensions "access," "usage," and "barriers" for the t th perception; λj (j = 1,..., p) is the j-th eigenvalue of every one of the three aspects, addendum j alludes to the quantity of head parts that likewise rises to the quantity of pointers or sub-lists, and p is the number of principal components. Finally, PC_{kt} is the t th observation's score for each dimension. Assume that λ1 >λ2 >⋯>λj, where j addresses the variance of the kth PC, which indicates that the first PC captures the most variation in each dimension, and so on. In a nutshell, the first PC explains the most important information from the raw data. The following equations are employed since the major goal of our study is to create a full and informative index that captures all of the information from all individual indicators used in each dimension, rather than minimizing the data dimensionality that will affect our index.The second stage of PCA is to apply the same PCA techniques to the two indices, conventional and digital financial inclusion indices, to obtain the following estimate for overall financial inclusion index.

$$FI_i = \frac{\sum_{j,k=1}^{p} \lambda_j P_{ki}}{\sum_{j,k=1}^{p} \lambda_i} \qquad (10)$$

As a result, the financial inclusion index is written as:

$$FI_i = \frac{\sum_{j=1}^{3} \lambda_j (\varphi_{j1} \lambda_i^a + \varphi_{j2} \lambda_i^u + \varphi_{j3} \lambda_i^b)}{\sum_{j=1}^{3} \lambda_j} \qquad (11)$$

$$FI_i = \omega_1 (FI_T) + \omega_2 (FI_D) + \mathcal{E}$$

When you look at each year's Financial Inclusion Index, you can see what the λj is the eigenvalue for the jth principal component φ_jIs the number of times each sub-index was factored in. Rearranging equation (11) shows how much each dimension W_i; In the final financial inclusion index, this is done. These weights show how important each aspect is to the in general monetary consideration file. Since this aspect has a ton of weight,each aspect is to the in general monetary consideration file. Since this aspect has a ton of weight, better.

$$W_i = \frac{\sum_{j=1}^{3} \lambda_i \varphi_{jk}}{\sum_{j=1}^{3} \lambda_i}, k = 1,2,3 \qquad (12)$$

V. DATA ANALYSIS AND RESULT

It's in this section that we show you what we learned. Before PCA can be used, two tests should be finished: Kaiser-Meyer-Olkin and Bartlett's trial of sphericity. These tests ensure that our example size is sufficient, and that the markers we picked are connected together. To utilize PCA, the KMO test should be more noteworthy than or equivalent to 0.5 and the Chi Square measurement in Bartlett's Test of Sphericitymust be greater than or equal to 0.05. (Table 2).

Table2:For both traditional and digital datasets, the Kaiser–Meyer–Olkin Measure and Bartlett's Test of Sphericity

Measure	Conventional(2004– 2019)	Digital(2004–2019)
Kaiser–Meyer–Olkin	0.648	0.602
Bartlett'stestofsphericity	425.014*(45)	172.178*(21)

Notes:*issignificantat5%levelofsignificance.Figuresinparenthesesindicatethedegreeoffreedom

Furthermore, each dimension's indication was standardised to a value between 0 and 1, with 0 indicating financial exclusion and 1 indicating financial inclusion.

5.1 Assessment ofconventional FI index

The eigenvalues of each sub–index and the latent variables are determined using the PCA approach; the three dimensions of our conventional financial inclusion index, access (Y_a), use (Y_u), and barriers (Y_b), are estimated using the PCA method. In our study, we only evaluate principal components with Eigenvalues larger than one (Kaiser, 1960). The calculated principal components and normalised weights from first-stage PCA are

shown in Table 3. The loading vector for each principal component is represented in the table by columns (2, 3, 4, and 5). Each PC's eigenvalues are listed in the last line of each sub-file (aspect).

Table3:Estimates for Normalized Weights& PC based on conventional FI index

Variable	PC1	PC2	PC3	PC4	Norm. weights
Access – Estimate Ya					
No. of ATMs per 1000 adult	0.6062	0.6062	-	-	0.413
No. of Branches per 1000 adult	0.6062	-0.6062	-	-	0.426
Eigen values	1.7105	0.1687	-	-	
Usage – Estimate Yu					
Debit cards	0.4156	-0.02432	0.0072	-0.7382	0.2677
Credit cards	0.4047	-0.3517	-0.6143	0.3062	0.2558
Number of deposits	0.3504	0.7375	0.0107	0.2517	0.2326
Number of borrowers	0.4037	0.3731	0.5874	0.3217	0.2563
Eigen Values	3.4578	0.3254	0.0708	0.0147	
Barriers – Estimate Yb					
No. of ATMs per 1000 km^2	0.4055	0.1168	-0.2057	-0.7201	0.2586
No. of Branches per 1000 km^2	0.3684	0.6453	0.2643	0.3387	0.2412
Rural Borrowings	0.3823	-0.4645	0.5384	0.0581	0.2465
Rural Savings	0.4086	-0.2723	-0.567	0.4363	0.2552
Eigen Values	3.5576	0.2778	0.0432	0.0204	

We can see that simply the main part of each aspect has an eigenvalue bigger than 1, so we'll stick with it for our investigation. In terms of the weighting system, we can see that, while the weights are not uniformly distributed, no single indication dominates the others, which is a desired requirement for index development. The biggest weight is given to the quantity of ATMs per 1,000 grown-ups in the access dimension, despite the fact that the weights are virtually similar. This suggests that the number of ATMs is more essential (with a larger relative weight) in driving this dimension than the number of branches. In fact, in emerging nations like India, this outcome is sensible, on the grounds that banks have found it restrictively costly to work in far off areas, especially in provincial regions where most of exchanges are led in real money; thus, ATMs are offering fundamental monetary types of assistance there. Table 4 shows that the main head part clarifies 90.03 percent of the general fluctuation in the entrance aspect, demonstrating that the two markers are estimating the equivalent idle structure. Although the loads are for the most part practically identical in the utilization aspect, we found that check cards (0.2677) and Visas (0.2558) had the biggest continuous loads. This finding recommends that the charge cards variable is more important than different factors that characterize this aspect. This observing shows that in agricultural countries like India, most individuals needs essential monetary products like check cards and request accounts. Furthermore, despite all signs contribute to the first principal component. However, by providing their large loadings to the second and third parts, the quantity of stores and the quantity of borrowers contribute a piece of their data to those parts. Thus, having a charge card, opening a bank account, or applying for a line of credit in India represents a broader area of financial inclusion. Simply said, persons who have borrowed money or had a credit card have already utilised another fundamental financial instrument, for example, making a ledger or a finance account. This result is obvious, considering that only 33% of grown-ups have ledgers, as indicated by the World Bank. Table 4 further uncovers that the primary part, which represents 87.17% of the all out information in this aspect, has an equivalent commitment from every one of the four markers. This exhibits that the four markers are recognizing a similar hidden design.

Although the weights are uniformly distributed in the barriers dimension, we discovered that the number of ATMs per 1000 km2 (0.2586) and reserve funds in provincial areas (0.2552) had the biggest sequential loads. This recommends that the most significant barrier defining this aspect is distance, trailed by a lack of cash. Once again, the outcome met our expectations. According to the World Bank research, the most significant barriers to holding a bank account in India are distance and a lack of sufficient finances.

Table4:VarianceExplained and Cumulative Variance by Components inconventional FI by PCA

Component	VarianceExplained	CumulativeVariance
Access– EstimateYa		
PC1	90.03%	90.03%
PC2	7.8%	100%
Usage– EstimateYu		
PC1	87.17%	87.17%
PC2	7.39%	94.57%
PC3	2.14%	89.55%

PC4	0.37%	100%
Barriers– EstimateYb		
PC1	83.64%	83.64%
PC2	6.48%	94.15%
PC3	1.18%	91.34%
PC4	0.53%	100%

Finally, we execute the KMO test (Table 5) to determine the factors' applicability, and we get an appraisal for each aspect Ya, Yu, and Yb. also their worth by applying the weights recovered from PCA to Equations (1–3), as shown in Table 6.

Table 5:Conventional FIindex - KMOtest

Variable	KMO
AccessDimension	Overall(0.5102)
NumberofATMs	0.5102
NumberofBranches	0.5102
UsageDimension	Overall(0.6447)
NumberofCreditcards	0.6287
NumberofDebitcards	0.5814
Numberofdeposits	0.5774
Numberofborrowers	0.7145
BarrierDimension	Overall(0.7520)
NumberofATMsKm^2	0.7042
NumberofbtranchesKm^2	0.7228
Borrowedrural	0.8214
Savedrural	0.7004

Table 6: Conventional FI Index through components

	Access	Usage	Barriers	FIIndex2019
Conventional Index	0.49	0.15	0.20	0.39

5.2 Assessment of digital FI index

PCA approach was utilized to decide the eigenvalues of each sub-file and the idle factors; access (Ya) and use (Yu) that characterize the two components of our advanced monetary incorporation record were likewise assessed, like the main stage processes continued in the regular monetary consideration file. In our study, we only evaluate principal components with Eigenvalues larger than one (Kaiser, 1960). The calculated main components and normalised weights from first-stage PCA are shown in Table 7. The loading vector for each primary component is represented in the table by columns (2, 3, 4, and 5). Each PC's eigenvalues are listed in the final row of each sub-index (dimension).

Table7: Estimates of Normalized Weights and PC based on digital FIindex

Variable	PC1	PC2	PC3	PC4	Normalizedweights
Access– EstimateYa					
No.ofMobileSubscriptionsper100people	0.4167	0.7312	0.1437	-	0.3158
%ofMobile Internet Users	0.5063	-0.2314	-0.7374	-	0.3786
No.ofregisteredMobileMoneyAccountsper1,000people	0.4812	-0.3721	0.5337	-	0.3627
EigenValues	2.40838	0.45013	0.02835	-	-
Usage – EstimateYu					
%ofpopulationmakesanonlinepaymentthroughamobiledevice	0.4065	-0.08145	-0.5080	-0.5015	0.2521
% of population makes an online purchaseorpayabill	0.3841	-0.5815	-0.0043	0.4934	0.2457
No.ofMobileMoney Transactionsper1,000Adults	0.4024	0.636	0.7854	0.3608	0.2502
MobilePaymentsAccounts	0.3825	0.6006	-0.1734	0.4616	0.2496
EigenValues	3.6062	0.1614	0.0782	0.2201	-

We can see that simply the principal part of each aspect has an eigenvalue bigger than 1, so we 'll stick

with it for our investigation. In terms of the weighting system, we can see that, while the weights are not uniformly distributed, no single indication dominates the others, which is a desired requirement for list improvement. For the entrance aspect, we found that the percent of Mobile Internet Users (0.3786) is given the most weight, trailed by the quantity of enlisted Mobile Money Accounts per 1,000 individuals (0.3627), and the quantity of Mobile Subscriptions per 100 individuals (0.3158). This proposes that the level of Mobile Internet Users is more fundamental (has a bigger relative weight) in driving this dimension than the other two indicators. Despite the fact that the percentage of the population that has a smartphone has climbed significantly in recent years, reaching 90% in 2019, simply 1.8 percent of the populace has a portable cash account, and just 3.5 percent conducts online buys or takes care of bills utilizing their cell phone (MCIT, 2020). Thus, having a cell phone is certainly not a solid mark of computerized admittance and might be viewed as a required however lacking necessity for utilizing advanced monetary administrations. Table 8 further uncovers that the three markers contribute similarly to the primary part, which represents 83.65% of the all out data in this aspect. This exhibits that the secret construction of the three pointers is something very similar. Deciphering the meaning of the level of portable web clients in driving the entrance aspect, then again, ought to be finished with alert. As indicated by ongoing investigations, individuals from the center to upper financial classes utilize their versatile information for instructive administrations, data search, or different administrations like checking their record, moving cash, shopping on the web, or covering bills, while individuals from the lower financial classes just utilize their portable information for correspondence and amusement purposes like Facebook and sending voice notes through the WhatsApp application (Correa et al., 2018). In India, 94% of web clients matured 16 to 64 utilize their versatile information for long range interpersonal communication applications, 79% for amusement or video applications, and 44% for gaming, separately, while just 17% utilize portable banking applications. This study exhibits that a huge level of versatile web clients doesn't suggest high advanced monetary incorporation, in light of the fact that computerized consideration is a multi-layered interaction that incorporates both the entrance gadget and the computerized abilities and administrations that are utilized through their portable information.

Although the weights are roughly equal, we discovered that percent of populace makes a web-based installment through a cell phone has the most noteworthy weight (0.2521), trailed by No. of Mobile Money Transactions per 1,000 Adults (0.2502), percent of populace makes an internet based buy or cover a bill (0.2457), and Mobile Payments Accounts (0.2496). The level of individuals who make a web-based installment utilizing a cell phone is the most urgent sign in driving the usage aspect, as per this end. Somewhere in the range of 2018 and 2020, the level of Indians who make online installments utilizing their cell phones expanded quickly (MCIT, 2020), mirroring the Indian government's huge exertion as of late to foster maintainable computerized monetary administrations that will work with the shift toward a less-cash economy and more electronic installments. Aside from portable banking, these administrations incorporate initiating installment entryways and applications like myFawry, m-wallets, and versatile trader installments (QR code).Furthermore, whereas all indicators contribute to the first main component, the second principal component does not. However, by contributing their large loadings to the second and third parts, the quantity of versatile cash exchanges and portable installment accounts appoints a piece of their data to those parts. Thus, having a portable cash record or going through with any exchange utilizing a cell phone addresses a bigger area of computerized monetary incorporation in India. People that have a versatile installment account as well as attempt any exchange utilizing his portable have utilized fundamental monetary administrations, for example, having cash in the bank and are carefully mindful of the utilization of such advanced administrations since versatile installments in India depends on a bank-drove model and versatile organization administrators. Table 8 further uncovers that the four pointers contribute similarly to the principal part, which represents 81.82 percent of the absolute data in this aspect.This demonstrates that the four indicators are detecting the same underlying structure.

Table8:VarianceExplained and Cumulative Variance by Component sindigital FI byPCA

Component	Variance Explained	Cumulative Variance
Access – Estimate Ya		
PC 1	72.54%	72.54%
PC 2	14.26%	89.01%
PC 3	0.95%	100%
Usage – Estimate Yu		
PC 1	81.82%	81.82%
PC 2	4.24%	96.23%
PC 3	2.14%	91.36%
PC 4	0.57%	100%

We next apply the Kaiser–Meyer–Olkin (KMO) test (Table 9) to determine the appropriateness of each component. By assigning the weights derived from PCA to Equations (4 – 5), we obtain an estimate for each dimension Y_a and Y_u, as shown in Table 10 and their respective values.

Table 9:DigitalFIindex – KMO test

Variable	KMO
AccessDimension	Overall(0.5334)
Mobilecellularsubscriptions(per100people)	0.5838
%ofMobileInternetUsers	0.4942
Numberofregisteredmobile money accountsper1,000adults	0.5253
UsageDimension	Overall(0.6516)
Mobilepaymentsaccounts	0.6238
Numberofmobile moneytransactionsper1,000 adults	0.7057
Makesonlinepurchasesprpayanonlinebill	0.6206
madeanonlinepurchaseviaamobile	0.6603

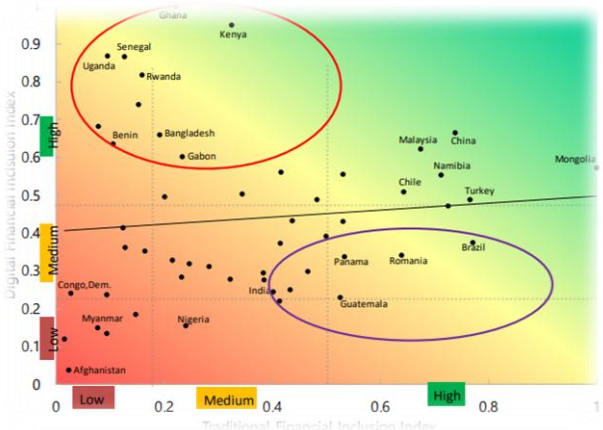
Table 10:DigitalFI Index through components

	Access	Usage	FIIndex2019
Digital index	0.10	0.13	0.30

5.3 Assessment of Overall FI

5.3.1 Assessment based on different countries

The introduction of the digital financial inclusion index enhances the ranking of complete financial inclusion for countries with high digital financial inclusion but low conventional financial inclusion by a substantial margin (the cluster of countries indicated by red circle in Figure 3). Countries with a well-developed banking infrastructure and high bank penetration, but with a low adoption of fintech, on the other hand, witness a fall in their overall rankings (those indicated by purple circle in Figure 3). In other words, when digital measures of inclusion are taken into consideration, people in countries with similar levels of conventional financial inclusion (as typically captured in existing literature) may have entirely unexpected experiences in getting to and using financial organizations when customary extents of consolidation are not contemplated. Models are Kenya,Botswana, and Jordan, which are all ranked in the same range on the conventional financial inclusion index (Figure 4). While Botswana maintains a similar position in terms of the complete financial inclusion index, Kenya is in the top third of the list and Jordan is in the bottom third of the list of the countries included in our sample. Additionally, Uganda ranks among the top quartile and Togo ranks among the bottom quartile in the comprehensive measure, whereas both Uganda and Togo rank among the bottom quartile in conventional financial inclusion, whereby Uganda rates among the top quartile and Togo ranks among the bottom quartile. (Honohan, P. 2008)



Note: The terms "high," "medium," and "poor" refer to nations that rank in the 75th percentile or above, the 25th to 75th percentile, and the 25th percentile or lower, respectively, on the index.

Figure 3: Digital Vs. Conventional FI Index, 2017

Fintech is the sole driver of financial inclusion progress in several nations (Figure 5). Between 2014 and 2017, most nations showed advances in both conventional and digital financial indexes. However, in eight countries, a gain in the advanced consideration file was trailed by a decline in the traditional incorporation score. In everything except two cases, sub-parts of the traditional list show that this is because of an abatement popular

(use) as opposed to getting to (supply) (Zimbabwe and Romania). This might indicate that technology-related financial services are displacing conventional financial institutions, and/or that banks are transitioning toward technology-based service delivery rather than physical presences.

Figure 4: Comprehensive vs. conventional FI Index

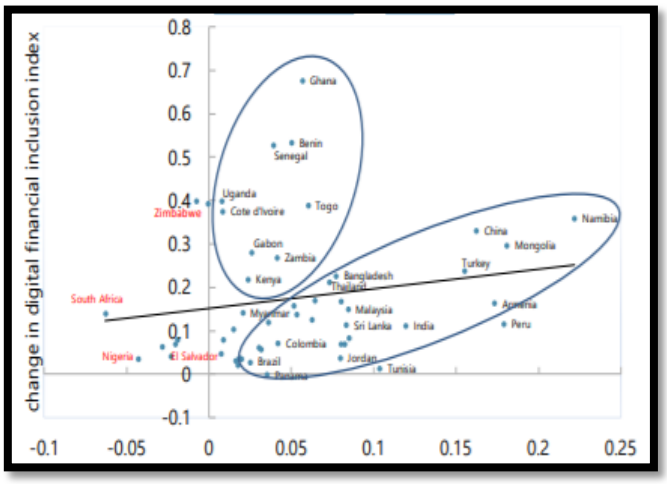


Figure 5: Changes from 2014 – 2017 in FI indices

5.3.2 Assessment of overall FI index in India

In the second stage, we use PCA to determine the loads of both "ordinary monetary consideration" and "computerized monetary incorporation" in the general last far reaching FI record for India, following similar cycles as in the past. KMO has a general worth of 0.5102, as shown in Table 11.

Table11: Overall FI index – KMO test

Variable	KMO
ConventionalFIIndex	0.5102
DigitalFIIndex	0.5102
Overall	0.5102

As a result, the criteria employed are appropriate also steady with our discoveries. Both "customary monetary record" and "computerized monetary file" are similarly fundamental in depicting all out monetary incorporation in India, according to the findings. This finding suggests that in a developing country like India, digital banking is viewed as a supplement to existing financial services rather than a replacement. To widen access and boost use of conventional financial services among disadvantaged populations and small enterprises, digital payments and e–money are only available through conventional formal banking institutions. As a result, digitization is considered as the sole method to speed up the delivery of conventional financial services. We calculate the total financial inclusion index using the weights supplied by PCA to the two financial indices. India is categorized as one of the emerging nations with a reasonably high degree of financial inclusion (FI index > 0.5), according to the findings. Although both conventional and digital financial inclusion play an equal role in determining India's overall financial inclusion index, digital finance is assuming a critical and positive part in upgrading monetary consideration in India, as evidenced by the high increase in the level of inclusiveness that's including data on digital payments, mobile money, and other digital indicators. Between 2017/2018 and 2018/2019, India's digital financial inclusion expanded by 11% and 27%, respectively, resulting in significant advances in both access and utilization of formal financial services, with conventional financial inclusion increasing by 87 percent. As a result, India's total financial inclusion level has risen from a low of 0.39 to a reasonably high level of inclusion (0.49).

Table12: VarianceExplained and Cumulative Variance by Component sinoverall FI by PCA

ConventionalFIIndex		DigitalFIIndex		OverallFIIndex	
PC1	0.8815	PC1	0.8226	PC1	0.8626
PC2	0.884	PC2	1	PC2	1
PC3	1				

VI. CONCLUSION

Financial inclusion improves the country's financial system on a whole. It improves the availability of

financial resources. Most significantly, it makes saving a more difficult idea for impoverished people in both urban and rural locations. In this, Overall, comprehensive financial inclusion increased in most nations during the same time, taking into account both conventional and digital measures; nonetheless, in specific nations, the advancement was only determined by computerized techniques. Whenever advanced monetary incorporation factors are remembered for the general proportion of monetary consideration, the gauge of varieties in monetary incorporation between nations becomes more accurate.

The major goal of this study is to create a composite multidimensional index to quantify India's financial inclusion. Although a few studies have attempted to evaluate the financial system's inclusivity for India, none have quantified the country's financial inclusion. The findings indicated that "Barriers" and "Usage" are important factors in influencing the degree to which conventional financial indexes are used. As a result, policymakers must include individuals who are involuntarily barred from utilising formal financial services in order to achieve greater financial inclusion. As a result, digitization was considered as the sole method to include individuals who were previously excluded into official financial services. The findings given in this study demonstrated that the Indian government's efforts to digitise financial services had transformed India from a low to a reasonably high level of monetary incorporation. All the more explicitly, our far reaching record shows that the expanding traditional and computerized "utilization" and "access" to formal monetary administrations, alongside bringing down "Hindrances" to incorporate the people who were recently barred from utilizing formal monetary administrations,determines the degree of the formal financial system's inclusiveness. As a result, digital financial inclusion is considered as a supplement to conventional financial inclusion rather than a replacement. Based on the conclusions, the government should focus on the following to increase financial inclusion in India, based on our empirical findings:

Making the transition to a credit only economy will rush monetary incorporation. This alludes to the digitization of all administration installments. At long last, reinforcing computerized monetary exchange framework like e-cash and versatile cash frameworks is viewed as an indispensable advance toward more extensive monetary incorporation. At long last, to convince people to use formal monetary administrations through advanced channels, improving buyer security against dangers, misrepresentation, and loss of protection is essential.

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