Digital Finance and Financial Development in South Asia: Evidence from a Novel Digital Finance Index

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Abstract

Despite a rapidly growing body of subsidy on the quality and scope of digital financial services in the developing world, literature lacks a unified, multidimensional index that currently captures the extent of digital finance at the country level. This paper seeks to fill that void and develops a new version of the Digital Finance Index (DFI) for eight economies of South Asia, namely Sri Lanka, India, Bangladesh, Afghanistan, Pakistan, Nepal, Bhutan, and the Maldives, for the period 2004-2024. The index combines 10 indicators into four conceptually linked dimensions, namely Digital Connectivity, Physical Access, Payment Instruments, and Financial Depth, via Principal Component Analysis (PCA). The proposed DFI combines supply-side infrastructure and demand-side usage indicators in a uniform framework and allows for longitudinal and cross-country comparisons, unlike other indices which focus on either narrowly defined infrastructure or demand-side indicators. The study is a contribution to the digital finance literature, providing a replicable composite measure reflecting the dynamic nature of the digital financial landscape in data-poor South Asian contexts, as well as systematically reviewing the theoretical and empirical foundations of each of the index components. The proposed index is anticipated to be used as a diagnostic and benchmarking tool by researchers, policymakers, and development practitioners to assess and support digital financial development in the region.

Keywords: Digital finance; Financial development; Digital Finance Index; Principal Component Analysis; South Asia; Financial inclusion

1. Introduction

Digital finance refers to financial services provided, accessed or used via digital intermediation such as electronic payments, online and mobile banking and technology-enabled intermediation (Ozili, 2018; Khera et al., 2022). There are three differences that are significant. Digital connectivity allows access to such services but is not proof of financial use. Having electronic payment instruments does not necessarily mean that people are using them for transactions. Digital finance is not the focus of conventional banking outreach and

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intermediation, but rather the financial environment in which digital channels will operate. This distinction implies the interpretation of the proposed index.

Financial development is the expansion of the depth, reach and efficiency of financial systems and institutions (Levine, 2005). The conceptual proximity is not a causal relationship for the reasons above, but digital finance could account for these outcomes because it can lower transaction costs and access barriers to finance. An index of outstanding loans and deposits could be mechanically related to financial-development indexes constructed from the same series. The paper thus distinguishes between measuring enabling conditions and testing hypotheses and suggests the use of non-overlapping outcomes in future empirical work.

Existing measurement methods are designed to measure different constructs. Sarma, (2012) and Cámara, (2014) created wider indicators of financial inclusion which don't focus on digital delivery. The Peking University index includes detailed information that is relevant to China but not more widely applicable, and (Khera et al., 2022) are more explicit about digital financial inclusion. The more recent composite measures use different indicators, geographical samples and weighting (Idrees et al., 2024; Kamenga Mapurita and Mayoukou, 2024; Ramesh Hegde and Guruprasad, 2026). The wonderful measurement problem is not just the lack of an index, but the lack of a clear South Asia-focused connectivity measure that allows a comparison of connectivity, access to banks, the number of cards available, conventional banking depth and explicitly recognises that not all inputs measure actual digital use. The contribution is therefore more about a defined measurement framework than about the quest for a superlative indicator for the digital-finance sector. The four dimensions allow for a distinction to be made between enabling infrastructure and electronic payment instruments and conventional financial context. The dimensions should not be used in isolation but can be supplemented by a composite score. To determine if the proposed score reflects financial development rather than digital finance, sensitivity analysis without conventional financial-depth inputs is required.

Geographical scope refers to the eight countries which are usually grouped as South Asia in this study, namely Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. The addition of all eight allows regional coverage and identifies variation among populations in terms of size, geographic dispersion, digital connectivity and banking infrastructure. The selection is not a statistically random sample but is representative of the region and cannot be generalized outside South Asia. Coverage of countries in the period 2004-2024 is suggested for tracking pre- and mid-explosion of digital finance, but coverage, indicator definitions, missing values and comparability should be verified prior to reporting an empirical index.

While extensive literature on digital finance and financial development is available, there is still significant uncertainty on how to measure digital finance and the link between digital finance and financial development, especially in South Asia. There are different financial inclusion and digital financial inclusion indices developed in the past, but they vary in terms of indicator selection, dimensional coverage, methodological approaches and geographical application. Traditional financial inclusion indices focus on access to and use of formal financial services (Cámara, 2014;Sarma, 2012) while digital financial inclusion indices emphasize on digital access, mobile money and electronic payments, and financial technology

adoption (Khera et al., 2022;Idrees et al., 2024;Kamenga Mapurita and Mayoukou, 2024). While they contribute to our understanding, the literature reviewed does not provide a common framework that integrates the specific 4-dimensional and 10-indicator framework proposed in this study to investigate the digital finance and financial development in the context of South Asia.

To overcome this limitation, this paper introduces an innovative Digital Finance Index (DFI) that combines four dimensions: Digital Connectivity, Physical Access, Payment Instruments and Financial Depth. Digital Connectivity is a technology component of digital finance, measured as: mobile cellular subscriptions per 100 people, fixed broadband subscriptions per 100 people, and people using internet as a percentage of the population. These indicators reflect connectivity needed to access mobile banking and internet banking as well as other digital financial services. Physical Access measures the presence and geographical reach of formal financial systems, measured in terms of commercial bank branches per 100,000 adults, ATMs per 100,000 adults and ATMs per 1,000 square kilometres. This dimension reflects physical infrastructure supporting digital financial services, especially in developing economies, where banking services are still not readily available. Payment Instruments is the ease with which electronic payment services (credit card and debit card) are available per 1,000 adults.

The indicators reflect access to electronic payment mechanisms underpinning cashless payment and shift towards digitally enabled financial services. Financial Depth is defined as the shares of commercial bank deposits and loans in the formal financial system in the economy relative to GDP. These indicators capture the financial-system capacity needed to facilitate the growth of digital financial services, but do not necessarily capture actual digital financial services usage. These dimensions, taken together, capture complementary aspects of the digital financial ecosystem. Digital Connectivity is the technological dimension, Physical Access is the financial service dimension, Payment Instruments are the electronic transaction dimension, and Financial Depth is the institutional financial dimension. Their combination allows for a more comprehensive evaluation of the conditions related to digital finance as compared to individual indicators. What makes the novelty in this is the use of these 10 indicators all in the same four-dimensional framework.

The financial development, digital finance, and economic growth have been explored in the past, but the linkage between a multidimensional Digital Finance Index and financial development in South Asia remains under-researched (Ahmad et al., 2021; Khera et al., 2022; Idrees et al., 2024). The linkage between the proposed four-dimensional DFI and financial development, however, has yet to be examined in a common framework across the eight South Asian economies. There are varying indicators, weighting and geographical coverage in the existing indices, which lead to their cross-country incomparability. Hence, in the present study, it is suggested that Principal Component Analysis (PCA) could be used to build up a composite index with standardized indicators and weights derived by a statistical method. The study includes Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka from 2004 to 2024 and comparisons are made across the region and longitudinally when data is available.

Thus, the main goal is to build a new 10-indicator 4-dimension Digital Finance Index and explore its association with financial development in eight South Asian countries. Financial development in this case is the dependent variable, with the DFI as the main independent variable, and GDP per capita, inflation, trade openness and foreign direct investment are the other controls. The possibility of overlap in measurements due to the addition of deposits and loans will necessitate a separate dependent-variable measure and robustness testing. The study is valuable for developing the ten indicators into a multidimensional digital finance framework; for extending its application to the South Asian context; and as a grounding for studying the link between digital finance and financial development. The main novelty is the index structure that is suggested and the use of the index to understand financial development in the economies of South Asia.

2. Literature Review

A systematic literature review was conducted to explore the impact of digital finance on birth rates and the mediating role of women's economic empowerment. The relevant literature was searched from reputed research databases such as ScienceDirect, Wiley Online Library, Taylor & Francis Online, Emerald Insight, Springer, ResearchGate, MDPI, and Scopus using a set of predetermined keywords. This study includes 70 selected studies, while 161 articles were screened. A detailed overview of the search process is illustrated in Figure 1.

In this study, we examine the impact of digital finance on financial development. Ten different indicators measure digital finance as the independent variable. The dependent variable is financial development. Besides, GDP per capita, inflation, trade openness and FDI are taken as control variables to control other factors which may have an impact on financial development.

Ten indicators were chosen based on two functions: access prerequisites and transaction instruments and formal financial context (Khera et al., 2022;Kamenga Mapurita and Mayoukou, 2024). Physical Access measures both commercial bank branches per 100,000 adults and ATMs per 100,000 adults and ATMs per 1,000 square kilometres. Digital Connectivity includes mobile cellular subscriptions per 100 persons, people using the internet as a percentage of the population and fixed broadband subscriptions per 100 persons, which enable, but do not guarantee digital financial use. Payment Instruments were divided into debit and credit cards per 1000 adults and represents the number of electronic payment instruments with which adults are able to pay compared to the frequency with which adults use them, or their value. Financial Depth measures the ratio of outstanding commercial-bank deposits and loans to GDP, as a measure of formal-sector intermediation. The last dimension is explicitly called 'conventional financial depth', and for this reason it is a dimension that is conceptually very far from digital finance, so it deserves a separate score and sensitivity test. The following indicators have been proposed and are shown in Figure .

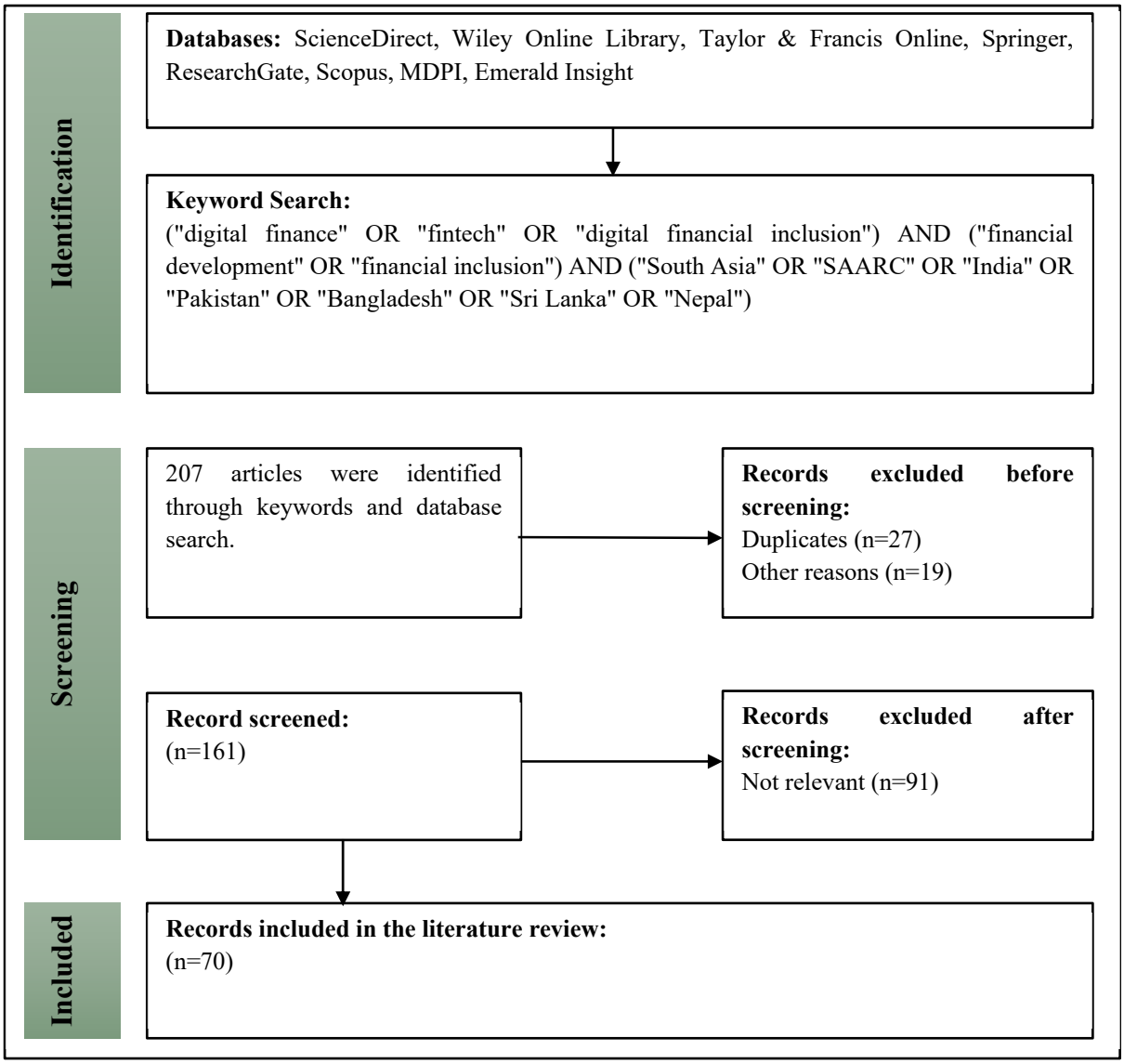


Figure 1: Literature Search Strategy.

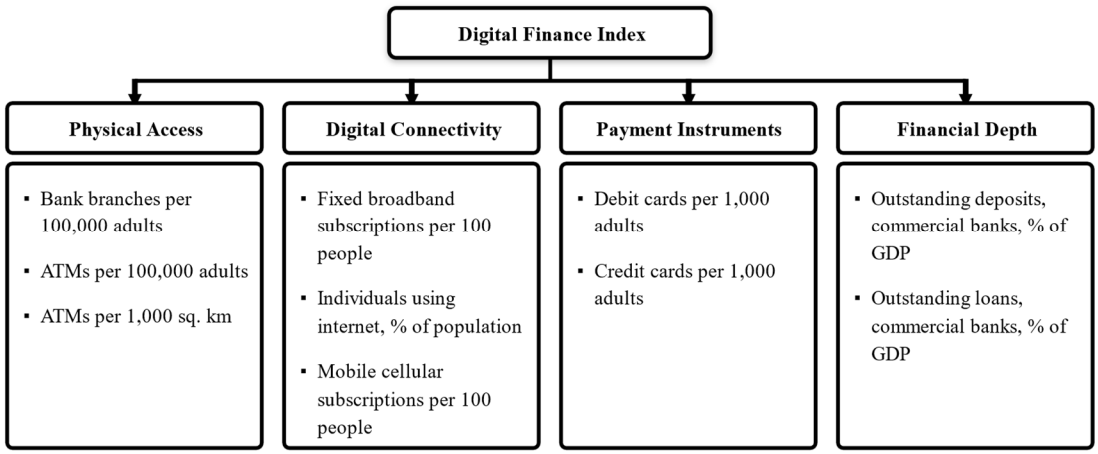


Figure 2: Conceptual Framework Designed before Developing the Index

Digital delivery may lead to lower search, travelling and transaction costs, and promote wider access to formal finance (Ozili, 2018). While these mechanisms provide a motivation for a possible relationship between digital finance and financial development, they don't equate the two. The baseline conditions of digital connectivity and electronic payment instruments, and the conventional financial-depth outcomes or contextual conditions, are deposits and loans. Therefore, it is problematic to add the latter to a predictor index, as well as to financial-development outcome, due to tautology and simultaneous determination. The non-overlapping dependent variables of the empirical tests or a core index (without the financial-depth dimension) should be reported.

Empirical evidence from different countries' contexts shows a positive relationship between digital financial inclusion and economic outcomes closely related to financial development. At the macro level, analyzing a cross-section of 100 countries, (Cao et al., 2026) conclude that digital finance can play a major role in enhancing development and reducing global inequality, especially in lower-income economies. Likewise, (Meniago, 2025) found that digital financial inclusion positively impacts economic development in 16 countries in the Southern African Development Community (SADC), in which institutional quality acts as a moderating factor. (Ramesh Hegde and Guruprasad, 2026) built a composite Digital Financial Inclusion Index for 30 Asian countries and found that digital access indicators like ATMs, mobile money agents, and internet access accounted for the bulk of the increase in the digital financial inclusion index, highlighting the positive relationship with the GDP per capita. However, (Liu et al., 2021; Ahmad et al., 2021) both concluded that the level of digital financial inclusion at the provincial level, as captured by the Peking University index, is a significant driver of economic growth in the Chinese context through various channels such as capital accumulation, technological innovation, and consumption upgrading.

The region's structural features lend significance to the findings for the developing and South Asian economies. South Asia has high levels of unbanked population, a huge gap between rural and urban access to finance, and a high number of mobile subscribers, which provides both demand and infrastructure for digital financial services (DFIs) (Barua and Chakraborty, 2026). In particular, (Farzam and Shinkre, 2026) looked at the effect of ICT on the digital finance–financial development nexus and concluded that the impact of digital finance on financial development is magnified in developing economies when other factors related to information infrastructure are better. The impact of digital finance on development outcomes could be contingent upon the level of financial sector maturity, as reported by (Ofori-Sasu et al., 2025) in his study of 54 African countries, which found an inverted U-shaped relationship between financial development and economic wealth. Collectively, this literature provides a strong theoretical and empirical basis to support the hypothesis that digital finance represents an important contributor to financial development and that quantifying digital finance's various aspects is necessary to understand the development trajectories in regions like South Asia.

ATM density is one of the metrics most used as a proxy for the physical/digital access dimension of financial inclusion, either on its own as an independent variable or as one of the components of a composite PCA-based index. Several studies measure it as the number of

ATMs per 100,000 adults, either alone (Ansari et al., 2024;Meniago, 2025;Onyejiaku et al., 2026;Kumari and Giri, 2026;Konadu-Yiadom et al., 2025;Konadu-Yiadom et al., 2026) or alongside its land-based counterpart, ATMs per 1,000 square kilometers, within a single composite index (Cao et al., 2026;Tran Thi et al., 2025;Vuong et al., 2025;She et al., 2025). Similarly, (Nguyen Quoc et al., 2025) and (Ma et al., 2025) have several PCA-weighted indicators, including ATMs per 100,000 adults.(Nguyen Quoc et al., 2025) and (Ma et al., 2025) also have several PCA-weighted indicators, such as ATMs per 100,000 adults and ATMs per 1,000,000 adults, respectively. Several of the newer, based on PCA, indices make a deliberate effort to collapse ATM density with bank branches in the same basket, thereby treating ATMs as one of several digital and physical access indicators, while using "traditional" finance as the benchmark, against which the digital channels of finance (mobile money) are compared as in the earlier work of (Ugwuanyi et al., 2022) and (Ozili, 2018).

Bank branches constitute the foundational physical infrastructure of formal financial systems and remain a critical channel for financial service delivery, even in an era of increasing digitalisation. However, bank branch density can be used as a complement to ATM density in measuring the physical reach of the formal banking sector and is usually calculated as the number of banks per 100,000 adults or 1,000 square kilometers. In addition to the per-100,000-adults measure, commercial bank branches per 1,000 km² and per 100,000 adults appear in the composite digital finance indices of (Cao et al., 2026;Tran Thi et al., 2025;Vuong et al., 2025) and **(**She et al., 2025**)** and **(**Nguyen Quoc et al., 2025**;**Ma et al., 2025**)** use the per-100,000-adults measure alone. (Ofori-Sasu et al., 2025) instead uses branch density per 1,000 adults as one component of a larger financial-development composite index (along with the private- and domestic-credit ratios), while (Ugwuanyi et al., 2022) once again sees bank branches as the measure of "traditional finance" and compares it to the mobile money and other digital channels.

The expansion of fixed broadband and mobile lines has played a major role in economic development, in the improvement of access to the Internet internationally (Myovella et al., 2021). This impact has been more pronounced in Europe from the outset, as corroborated by several studies that demonstrate the economic gains that G-20 countries have gained from the development of fixed broadband and ICTs (Adejumo et al., 2020).

Empirical evidence from OECD countries also showed that fixed broadband was correlated with an increase in GDP per capita in 135 countries (Edquist et al., 2018;Habibi and Zabardast, 2020). Further, studies of the initial years of mobile subscribers' growth suggest that economic growth was strongly linked to the penetration of technology (Kurniawati, 2020;Nair et al., 2020). In Sub-Saharan Africa (SSA), the Middle East and North Africa (MENA), and Latin America and the Caribbean (LAAC), ICT has proven to have a significant impact on both the economic potential and performance of these regions by increasing the number of broadband and mobile subscriptions (Saba et al., 2024).

Financial access has also been gained via broadband and mobile subscriptions. In a study of 20 developing and developed countries, it was found that broadband was a significant driver of global economic growth (Appiah-Otoo et al., 2023). This has made a significant change in the economic development of the region, and the role of ICT technologies is now widely

acknowledged as an important driver in the current economic development. These are two different but complementary measures of connectivity infrastructure which are very relevant in the South Asian context where mobile has grown rapidly, and fixed broadband is unevenly deployed.

Internet access serves as a direct enabler of online and digital financial services, determining the proportion of a population that can engage with web-based banking platforms, digital wallets, e-commerce payment gateways, and government-to-person (G2P) digital transfer programmes (Farzam and Shinkre, 2026). Although internet use is the most frequently cited usage/availability indicator in the digital finance indices reviewed, it is a near-necessary condition for most other indicators of digital finance. It makes a standalone component or PCA-weighted component in the indices constructed by (Khera et al., 2022;Idrees et al., 2024;Kamenga Mapurita and Mayoukou, 2024;Elouaourti and Ibourk, 2024;Cao et al., 2026;Zhong et al., 2025;Ramesh Hegde and Guruprasad, 2026;Nguyen Quoc et al., 2025;Vuong et al., 2025) and (Kumari and Giri, 2026). After isolating internet usage as one of two separate "digital finance technology" channels (in addition to mobile phone subscriptions), (Antwi and Kong, 2023) discover that, unlike mobile subscriptions, internet usage is positively and significantly related to banking-sector stability at all quantiles of the distribution. (Farzam and Shinkre, 2026) take the analysis a step further by creating a measure they label ‘Internet Usage’ within a larger ‘ICT' construct they hypothesize can be used to explain financial-sector development, and (Liu et al., 2021) construct a distinct ‘Internet Development Index' using 12 infrastructure and penetration indicators, with the use of this threshold variable conditioning the strength of the link between digital financial inclusion and economic growth.

Debit and credit cards are among the most widely used electronic payment instruments globally and serve as indicators of the extent to which a population has transitioned from cash-based to digitally mediated financial transactions (Akeju et al., 2024).Debit card penetration reflects the proportion of the banked population that actively uses electronic channels for point-of-sale transactions and cash withdrawals, while credit card penetration additionally captures access to formal consumer credit through digital channels. Card ownership and indicators of card usage reflect a more transaction-specific aspect of digital finance than measures of internet or mobile. Debit cards per 1,000 adults is also a PCA input in both (She et al., 2025) and (Islam et al., 2026); the latter has also added credit cards per 1,000 adults as a separate indicator. (Cao et al., 2026) and (Ma et al., 2025), on the other hand, assess the same underlying construct as the percentage of the adult population with a debit card. At the individual level, (Azmeh et al., 2026) consider mobile-banking adoption in Palestine to depend on the use of ATM cards, as well as on the use of credit cards, treating these as two binary variables of financial usage which acknowledges that the concepts of card ownership and card usage are distinct even if country-level indices often blur the boundaries between them.

Outstanding commercial-bank deposits and loans as percentages of GDP measure the size of formal financial intermediation, which is a commonly used indicator of financial development, not an actual measure of digital transactions. The only justification for their inclusion is for the purpose of showing what capacity the banking system can offer for delivering digitally enabled products (Tran Thi et al., 2025;Vuong et al., 2025;Nguyen Quoc

et al., 2025). This is a contextualized rationale that is indirect; it is not an indicator of digital uptake. The preferred reporting format therefore separates out a more fundamental three-dimensional index of the digital enablers from an expanded four-dimensional index of the ecosystem. If financial development is the dependent variable, deposits and loans should not be included in both the index and the outcome definition, and the core index should be the main specification.

Research has shifted from specific indicators to composite indicators that include multiple dimensions of financial inclusion and digital finance. (Khera et al., 2022) and (Idrees et al., 2024) provide an analysis of cross-country digital financial inclusion, while (Kamenga Mapurita and Mayoukou, 2024) do so in an African context, and Peking University's index focuses on the Chinese context, with detailed within-country applications made available by (Liu et al., 2021). These can vary in terms of their construct definition, information sources, geographic portability and actual usage or prerequisites. The present framework goes beyond mere use of PCA (which previous studies used) with a defined and publicly facing four-dimensional framework for eight countries in South Asia, as well as a clear treatment of the conventional banking-depth measures.

In addition to PCA, other studies have explored different weighting approaches to limit the subjectivity in indicator selection, such as entropy weighting (She et al., 2025); min-max normalization with coefficient-of-variation weighting (Ramesh Hegde and Guruprasad, 2026); and geometric-mean aggregation over a large indicator set (in one study 33 indicators across three dimensions) (Ye et al., 2026).

Another group of literature uses an existing institutional index, rather than creating a new one. The Digital (Inclusive) Financial Inclusion Index created by the Digital Finance Research Centre of Peking University and Ant Group has been the most widely used measure of digital finance in China-based studies to date, as the main independent variable in research on economic growth (Liu et al., 2021;Ahmad et al., 2021), welfare (Li and Peng, 2023), household financial health (Zhu et al., 2026), rural labor allocation (Ye, Chen, & Xu, 2026), manufacturing upgrading (Cheng et al., 2026), and household fertility and bargaining power (Han et al., 2023;Lan et al., 2024).

Most of these indicators, whether created by the international community or by individual institutions, are based on the same few world databases. (Ozili, 2025) develops a number of channel-specific indices (DFI, DFID, ADFI and a composite FIND index) directly from the IMF's Financial Access Survey and World Bank data, while the World Bank's Global Findex Database provides the raw survey indicators used to build nearly all of the indices referenced above account ownership, digital payments, and mobile money up taken.

There is no single index that captures all aspects of digital finance in all countries and in all periods. Rankings and interpretations can change due to differences in data coverage and how indicators represent connectivity, account ownership, payments/banking depth. It is therefore important to evaluate the proposed DFI at the dimension and composite level and not as a stand-alone indicator of the activity of digital transactions.

Four interrelated limitations lead to the necessity of the present research. First, the existing indicators of digital finance and financial inclusion differ in different terms of understanding, selection of indicators and approaches to measurements, making it impossible to conduct the analysis of different studies in different countries. Second, while some studies analyzed the influence of fintech on financial development, there are almost no studies that investigated this relationship using an integrated Digital Finance Index that was created for South Asian country. For example, (Aduba, 2023) analyzed the influence of fintech utilization on financial development in developing and emerging economies and found a positive correlation. However, the provided study did not use a kind of Digital Finance Index, which includes Digital Connectivity, Physical Access, Payment Instruments and Financial Depth.

Third, the presently conducted research has not studied this four-dimensional ten-indicator index in a uniform approach covering eight South Asian countries within the period from 2004 to 2024. Fourth, it is important to highlight the requirement of assessing the statistical validity, reliability and sensitivity of the above-mentioned indicators to develop a composite index using PCA.

In this context, the study suggests a new digital finance indicator based on four components and ten indicators that can be used to efficiently assess digital finance situation in South Asia. The purpose of the research is also to evaluate the correlation of digital finance index with financial development, which in the context of this study is assumed to be the dependent variable. The reason is that outstanding deposits and loans are widely accepted measures of financial development and are present in the digital finance index, therefore, the analysis has to take into consideration the issue of potential commonality between the measures of different constructs by introducing a different measure of the dependent variable and testing a different index that does not take into consideration financial depth in the design of the new construct.

A thorough review of the literature was carried out to gain an understanding of previous indices and the methodologies used to create them. The digital divide (Bruno et al., 2023), poverty (Siddhisena and Jayathilaka, 2006), energy efficiency (Dolge et al., 2020), and digitalisation to measure its impact on the labor force (Androniceanu et al., 2020) as well as sub-indices on ICT to measure effects on economic growth (Kurniawati, 2021). In addition to individual researchers, a number of well-known institutions have also achieved successful results in creating comprehensive indexes in the field of innovation, mobile connectivity and network readiness (Index, 2023).

The same phenomenon is seen in digital finance itself when the academic interest in a construct reaches a certain level, global institutions step in to establish standards for it. The World Bank's Global Findex Database, compiled by has become the definitive and up-to-date international indicator on financial inclusion and digital payments, covering approximately 125,000 adults in 123 different economies. On this basis, the IMF has developed its own composite index for 52 emerging and developing economies, while more recent studies have added even larger samples of 68 countries, which are comparable in income level (Idrees et al., 2024).

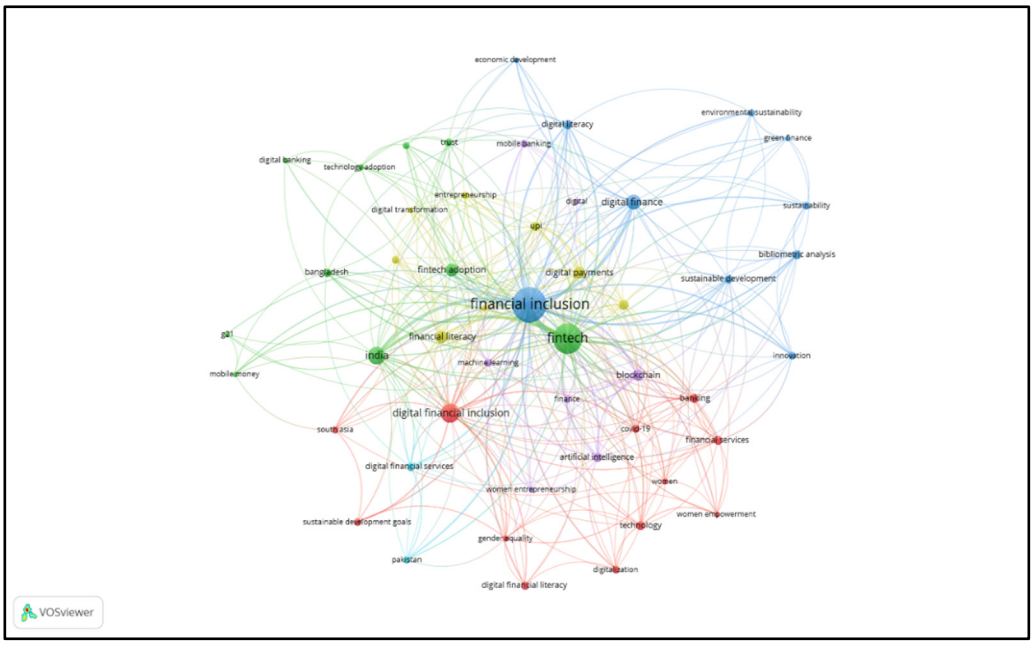


Figure 3: Network Visualization of the Authors' Keyword Co-Occurrence Network

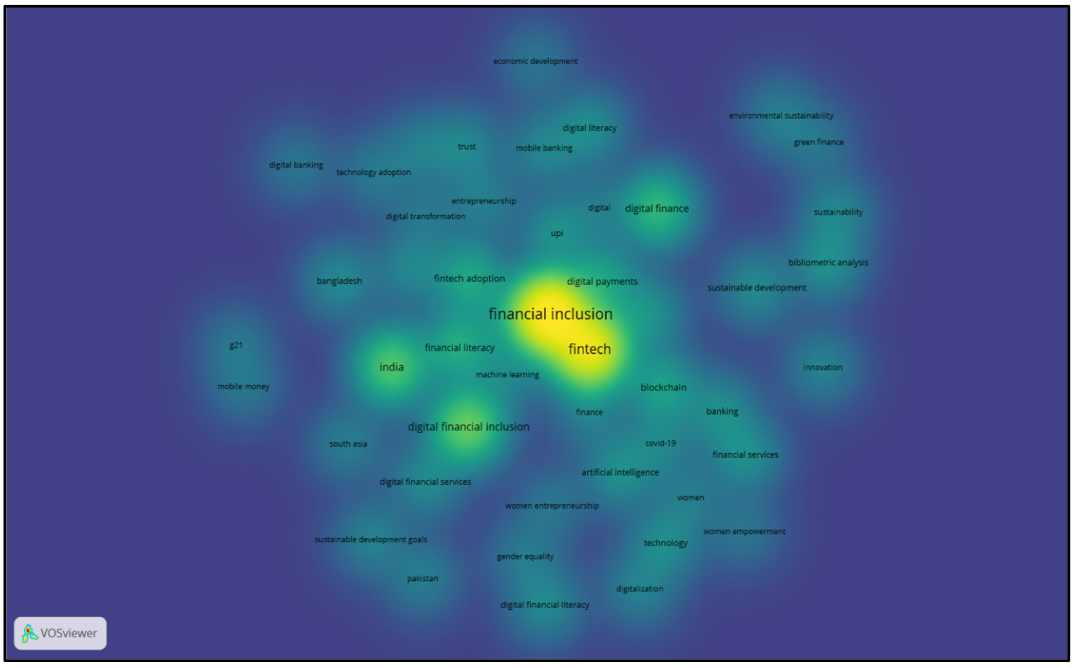


Figure 4: Cluster Density Visualization Shows the Keywords that Each Cluster's Authors Discussed Between 2018 and 2026.

The value of such widely adopted indices is not in any one number, but in the value of standardization In allowing for comparison across countries, In facilitating tracking of progress over time on a like-for-like basis; In providing credibility with the audience of policy makers and investors who are already familiar with using the World Intellectual Property Organization, Huawei, and Portulans indices as benchmarks in other areas; and In providing a common point

of comparison against which to validate region or country specific indices It is this blend of experimentation with methodology and institutional standardization that drives the index-construction approach taken in this study.

Figure 3 shows the conceptual network of keywords used in the literature studied and how they are related to each other in terms of digital financial inclusion (DFI), economic growth, PCA, and mobile money (MOB). The inclusion of these keywords indicates that specific themes have been studied in great depth, however, the synergy of composite index construction, digital infrastructure and South Asian economies is not as dense. This is further complemented by a visualisation of the most frequent keywords.

Figure 4**,** which sheds light on the fact that existing research groups generally focus on a limited number of proxy variables (mobile money, digital payments and FinTech), with comparatively less focus on indicators of formal financial depth and/or broadband infrastructure, or on card-based payments.

The literature advocates for a multidimensional approach to the enabling conditions of digital finance, but it also suggests a conceptual differentiation between digital services and traditional banking development. In this context, the article presents ten indicators pertaining to four dimensions within a framework that allows for comparisons within South Asia but does not assert that the ten all measure digitalization in a straightforward way. For the purposes of future interpretation of results, the three-dimensional core score should be stated together with the four-dimensional expanded score, and the effectiveness of the conventional finance depth has to be checked rather than accepted provided.

3. Methods

The following procedure is a proposed empirical protocol and is not a report of completed estimation. Create datasets by country and by year using sourced, consistent data. Check for omissions, changes in definitions and coverage. Standardize units, identify extremes and normalize variables, using a common period for reference. Acknowledge correlation structure. Report components and accounted variance, as well as the way scores are summarized. Recalculate using equal weights, excluding countries, using different missing data assumptions. Wherever possible, publish a dataset, code and methodology behind decisions. Calculate both a three-dimensional score (Connectivity, Physical Access, Payment Instruments) and a four-dimensional expanded ecosystem score with the reference to Financial Depth; compare their correlations and stability of rankings.

4. Conclusions and Implications

A four-dimensional framework is useful for policymakers to determine whether barriers are present in connectivity, physical reach, electronic payment mechanisms or the performance of traditional banking. Individual scores from the four dimensions are more helpful than looking at a single composite score as mentioned above. However, the suggested indicators capture only some of the preconditions and features of the financial systems, so they do not refer to actual data on mobile money transfers made, their amounts or the quality and affordability of services. With the introduction of the financial depth dimension, the authors create the overlaps

with the traditional measures of financial development. Moreover, the paper does not offer any panel data, PCA loadings, validity tests, or estimated coefficients, so it would be impossible to make claims related to actual country ranking and changes taking place over the period of 2004-2024. In the future, researchers should check the validity of the results obtained and look for direct indicators of digital use. The paper makes an important contribution in the field of region-based index development but does not provide any evidence.

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