Open Banking Ecosystem : The Indian Perspective

Aarti Patki [1]
Vinod Sople [2]

Abstract

The financial services industry has globally witnessed rapid changes because of technological advances. Banks started sharing customer information with customer consent but under regulatory guidelines to meet the changing customer demands and market competition. This situation enabled the banking industry to open its IT infrastructures, leading to the following level of banking services: open banking (O.B.). Due to technological advancement, banks and fintech companies started partnering to create innovative financial products/services for meeting customer requirements. Indian banks, in line with their global counterparts, are also in the race. The leading banks like Federal Bank, Yes Bank, ICICI Bank, and RBL Bank have taken open banking ecosystem growth initiatives over the last few years. Many other Indian banks and NBFCs have taken steps to be a part of the O.B. ecosystem. They have made a lot of investments on the technology front and made changes in their organizational culture to meet the new challenges. This paper discussed the implementation status of open banking, APIs, customer data rights, the liability of banks, regulatory framework, and implementation capability of banks. It also covered the implementation journey and its success.

Keywords : **Open banking, application programming interfaces, data protection, fintech**

JEL Classification Codes : G20, G21, G24, O16, O43

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To stay competitive and achieve growth, banks adopt new technologies and services. They are all trying to transform into the next level of banking services by getting into the open banking (O.B.) system. It allows the banking customers to benefit from the banking system by giving them control over their data. The product and service options, which are not available to customers with other banking apps, 'open banking' can offer the concept of service personalization to customers, and they can have the choice to access multiple accounts from one place. The open banking system is already in force in developed countries and is accepted by customers. However, it is getting implemented in a quiet space in India since the last few years. The Indian government has taken initiatives toward open banking system development and issued regulatory guidelines accordingly. The research on this subject in the Indian context lacks a comprehensive understanding of its development; the pace of implementation, growth, and prospects in supplementing the overall banking system; and the benefits it will impart to all stakeholders. Hence, we have attempted to shed light on the above areas through primary and secondary research. This research study will help ascertain the open banking status in adoption and development,

[1] *Assistant Professor (Corresponding Author),* Narsee Monjee Institute of Management Studies, Plot No. 2, Next to Pethapada Metro Station, Sector 33, Kharghar, Navi Mumbai - 410 210, Maharashtra.
(Email : apatki@gmail.com ; aarti.patki@nmims.edu) ; ORCID iD : https://orcid.org/0000-0001-8400-6984
[2] *Visiting Faculty,* Narsee Monjee Institute of Management Studies, Plot No. 2, Next to Pethapada Metro Station , Sector 33, Kharghar, Navi Mumbai - 410 210, Maharashtra. (Email : sop56win@gmail.com)

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challenges, risks in implementation, and success factors in its execution. This survey research paper is based on interviews of banking executives associated with the 'open banking' system in their banks.

Open Banking

Definition

Gozman et al. (2018) stated that open banking is a collaborative model which serves the customers with better capabilities; banks share the customers' data with several third parties. In an open banking system, the customers have a choice to avail of the financial services from service providers available on the network by giving consent to their banks to share their data with a third party, which is authenticated by the bank (Deloitte, 2017). As per the Open Banking Working Group of the Euro Banking Association, open banking is a secure way to give financial service providers access to your financial information. It enables new ways of managing your money with the customer.

There are three essential requirements (Grace, 2019) that apply to securing any O.B. ecosystem architecture: consent for customer data sharing, onboarding for integrating customers (with KYC), and access to customer account data.

Open Banking APIs

Open banking, APIs (application programming interface), and banking as a service are not the same. API simply allows the sharing of information between the systems. In open banking, API provides access to the third party to the financial institution's customer data (with the customer's permission). However, banking as a service provides third-party access to bank functionality (Anderson, 2020).

What is API?

API (application programming interface) with its code allows access to a database of banks to share (customer) data securely and conveniently within and outside the organization. APIs are a set of functions and procedures on a technology platform for data sharing between the organizations (banks, third-party service providers, and customers). The server's access point(s) is governed by API with its code (Figure 1).

APIs are used for secure communication between banks and third parties' O.B. banking systems. It helps third-party developers to build services, apps, and websites for financial institutions. To incorporate the changes in an API, the versioning technique (Somani et al., 2002) is used in API design without any interruptions in customer applications. Across the world, there has been continuous growth in financial services APIs since 2005, indicating

Figure 1. ***API - Code that Governs Access Point***

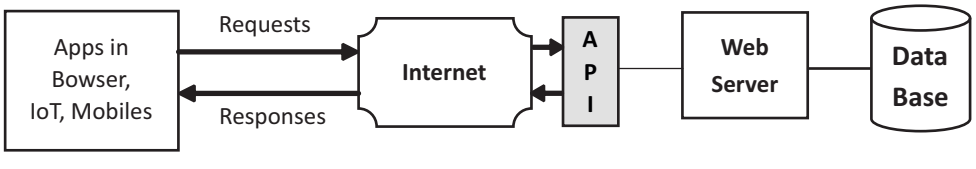
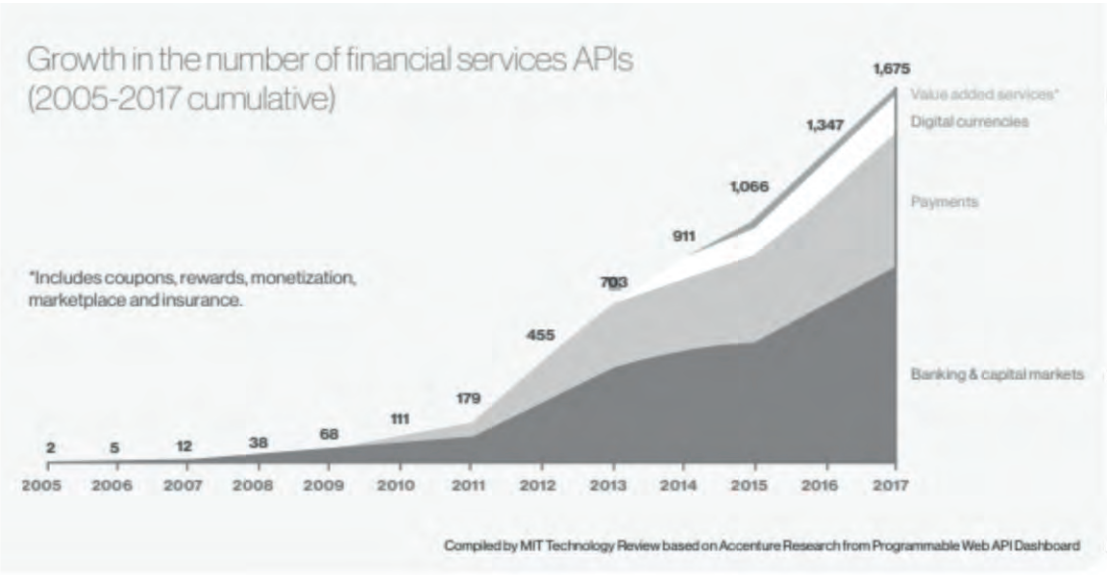


Figure 2. ***Growth in Number of Financial Services APIs (2005 – 2017, Cumulative)***



Source : Accenture (2018).

*The Brave New World of Open Banking, Accenture, 2018

the emergence of new generation banking operations leading to an open banking ecosystem. Accenture Research surveyed one hundred financial institutes in E.U., and the survey results published in *MIT Technology Review* indicated a growth of banking APIs from 170 in 2011 to 1,675 in 2017 (Figure 2).

BIAN (Banking Industry Architect Network)

Due to competitive and regulatory pressure, BIAN's solutions are acting as a reference model for banks and other companies to resolve the hiccups in their business functions. Infosys (India), as a technology company, is a part of BIAN and plays a significant role in advising Indian banks to shift to an ecosystem of open banking.

OBIE Standards

The Open Banking Implementation Entity (OBIE) was created by the U.K.'s Competition and Markets Authority to create software standards and industry guidelines that drive competition and innovation in U.K. retail banking. For O.B.'s implementation and success, OBIE published standards for API specification, security profiles, customer experience guidelines, operational guidelines, etc.

Open Banking Ecosystem

Indian banks and NBFCs offer open banking services and products from their core banking platform through API packages that cover payment collection, lending, and other banking services. Many NBFCs offer a set of open APIs under a partnership-based digital lending model in the forthcoming banking space. Thus, technology is at the forefront and pervasive in O.B. ecosystem banking layers (Table 1).

Table 1. ***Open Banking Layers***

Layer	Constituents			
Technology Layer	Core banking (application) platform handling customers' life cycle across asset products and liabilities.	API gateways players allow open banking partners to be accessed securely.	API integrators help develop APIs/gateways in making banks agile.	Payment networks
Third-Party Layer	Provide access of banks to fintech by working along with API stack players with multiple banks.	NBFC has licensed account aggregators to help bank customers get their financial status.		
Customer Layer	For retail customers' needs like savings, payments, lending & wealth, neobanks are emerging fast.	Neobanks built robust solutions for their identified segments for the needs of the SME customers.	In the digital retail space, SBI, DBS, and Kotak introduced Yono, Digibank, and Kotak811, respectively.	Business giants like Amazon, Google, and PayPal have their own UPI payment platforms.
Enabling Layers	KYC / AML / risk management players / credit bureau.	IndiaStack - APIs developed for governments and businesses to make use of the country's existing digital infrastructure.	Investors encouraged innovation through investing and helped accelerate the growth of O.B. & neo banking in India.	

Source : The Digital Fifth (2020).

The Indian Scenario

The open banking model adopted in India is based on a hybrid approach (Table 2), wherein both the market and government have active roles in the development of the O.B. ecosystem; however, the O.B. initiative in the U.K. is regulations driven, while in the U.S., it is market-driven. In India, the Unified Payment Interface (UPI) was launched in 2016, allowing an individual to access his/her bank accounts to make transactions with any other bank from registered apps on his/her mobile phone. Due to such initiatives, the BFSI (banking, financial services, and insurance) sector is developing into an API-based collaborative model. Further, API aggregators, along with new generation neo banks and digital banks, are creating new business models in the finance sector. Recently, ICICI Bank, one of the leading Indian banks in the private sector, has released a developer portal that consists of over 250 APIs and has joined the bandwagon of the open banking system.

Table 2. ***Indian Snapshot of O.B.***

Indian Scenario	Key Initiatives	Key Drivers
• The hybrid: Both market and regulators drive the hybrid model	• Rollout of NBFC-AA • Constitution of the public credit registry	• India-stack and other govt. initiatives, GST, GeM • Fintech collaborations
• UPI introduced led to the emergence of O.B.	• Data protection bill	• Govt push - Digitization program
• Several new API initiatives by banks		

The concept of open banking is endorsed and accepted by Indian regulators in two stages. It started with a payment system (Unified Payments Interface-UPI) followed by sharing of financial data with a third party (account aggregators NBFC-AA as notified by master directives issued by the Reserve Bank of India (RBI)). The motive behind these initiatives is exploring the usage of accessed customer data to benefit both customers and banks. The RBI's directives enabled RBI to control many financial data flows and regulate entities that deal with financial data. This was beyond its original mandate of regulating banking on data sharing.

In India, Personal Data Protection Bill, 2018 was introduced by the Ministry of Electronics and Information Technology (https://www.meity.gov.in) to support the growth in the finance sector. RBI has kept in mind that 'financial data' is 'sensitive personal data.' In 2016, RBI issued guidelines for NBFC - AA to get prior permission from its customers before using/transferring their data to any authorized entity. It is very clear from these directives that the banks are only the custodian of customers' data, not the owners.

Traditionally, in India, banks have developed financial products and services based on their previous experience and internal discussions, that is, inside-out view. However, O.B. has affected the traditional approach of bankers by adopting an outside-in view to develop products in collaboration with technology partners (fintech) on a revenue-sharing basis to meet the customers' changing needs. O.B. gives new perspectives to the banking process, making it efficient and customer friendly.

UPI, introduced in 2016, supports open banking in India, and it is fundamentally changing the retail banking payment system, wherein banking data is shared through APIs with third parties.

The Global Landscape

The open banking initiative started with introducing PSD2 - Payment Services Directive - (PwC, 2017) in European Union (E.U.). The European Commission (Directorate General Internal Market) regulates the payment services and service providers based on the guidelines. The above guidelines aim to harmonize the customers' rights to protect them and obligations for payment providers and users. It opened the gates for open banking across Europe and the U.K. However, instead of the regulatory route, it followed a market-driven system. They allowed U.S. banks to open their customer data to third-party. Similar trends are observed in Canada too. On the other hand, many other financial services markets worldwide are looking toward the success of O.B. initiatives in the E.U. banking space as a role model. Starling Bank in the U.K. has gained a first-mover advantage in the open banking space by opening banking APIs through a hackathon.

In India, among those efforts, the introduction of the UPI (unified payment interface) is making a way to streamline payments across channels and promote cashless payments post the 'demonetization' era (December 2017).

Table 3. *Global Open Banking Developments*

Areas	Developments
Australia	• The government is aggressively pushing for the O.B. ecosystem.
	• Central Australian banks like ANZ, NAB Commonwealth, and Westpac have to make banking data available to consumers on all products by 2020.
China	• O.B. ecosystems on the digital platform are emerging with data-sharing capabilities.
	• Examples are WeChat and AliPay.
East Africa	• An emerging trend of new underwriting models is based on access to alternative data sources on PSD2 guidelines.
	• Examples M-Shamwari, Tala, and Branch.

Europe	• O.B. initiatives based on PSD2 give more control to customers over personal banking data.
	• N26 and Fidor (Digital banks) and Klama (digital lenders) are changing the banking landscape.
Japan	• Japan revised its Banking Act based on PSD2.
	• Assign targets to financial institutions to develop APIs that partners can use.
Southeast Asia	• Witnessed growth in fintech, API, and data sharing.
	• For example, mobile wallet growth in India after demonetization.
	• Fintech governance by the Monetary Authority of Singapore.
	• O.B. related initiatives by governments in China, India, and Singapore.
	• These initiatives are linked to KYC and customer authentication.
United States	• No directives on O.B. by U.S. regulators.
	• Several industry bodies have issued guidelines and lists of OB-APIs' development.
	The data-sharing contracts between large banks with individual partners are getting into force.
	• Wells Fargo's partnership with Xero and Finicity. Chase's partnership with Intuit is an example.

Source : PwC (2018).

Table 3 shows the O.B. ecosystem in different stages of development in various jurisdictions, with three primary forces in its evolution – regulation, competition, and consumer demand.

In E.U. markets, open banking regulations prompted companies to think about the data they capture in the business process, but they do not own the same. This will witness a paradigm shift in the future for banks treating issues of data storage, ownership, and using customer data they have captured. Concisely, O.B. will allow bank customers to have clarity of their data on porting, moving, and controlling the access by a third party.

Approaches to the O.B. Ecosystem

Different (Remolina, 2019) approaches to O.B. are used in different jurisdictions. The first one is the market development approach. For example, the Singapore Government supports banks' voluntary initiatives for the O.B. ecosystem as the guidelines. These guidelines are published by the Monetary Authority of Singapore (MAS) and the Association of Banks in Singapore on non-binding API guidelines for financial institutions, fintech, and entities to develop APIs. The second one is the compulsory approach adopted in the U.K. and European Union. It is not just a directive, but it is also considered a genuine approach to improving customer satisfaction when it comes to banking through innovative products and services. Governments are encouraging competition in the banking space in various jurisdictions through O.B. The third is the SandBox approach, wherein government allows financial institutions and fintech (PwC, 2016) to experiment with innovative financial products and services. The 'Mojaloop Foundation' (https://mojaloop.io) designed an open-source software to advance financial inclusion to provide a reference model to support and further develop the O.B. ecosystem.

Literature Review

The sub-prime crisis in 2008 was the starting point for the E.U. to initiate regulatory reforms in the finance sector to address the faults in the financial institutions (Liikanen, 2012). In the new regulatory context, E.U. banks framed new business policies and economic structures to comply with new regulations (Ayadi et al., 2012).

Due to technological advancements brought in by fintech companies in the finance sector, the old and large

banking models are getting disrupted. In addition, with the use of blockchain technology and big data, large network base firms such as Amazon and Facebook will be seen utilizing the cloud-based platform. This will result in a large amount of financial inclusion (Wewege et al., 2020). Grace (2019) discussed the adoption of open banking in Canada, wherein it is stated that there will be disruption in the industry and financial services. The policymakers have an essential role to play here as there will be a human and technological collaboration and more transparency and ease of use. A similar concept on open innovation is discussed, and the broader usage of open innovation will lead to more innovative products and strategies and the survival of banks. Though there would be monetary constraints looking at the benefits and effectiveness, the early adoption is beneficial for customers and the banks (Schueffel & Vadana, 2015). Another research study highlighted the role of retail banks and fintech. Retail banks need to become customers' banks by adopting a trans-disciplinary approach. The banks would not be merely deposit-taking institutions but would offer a bundle of services as there is digital transformation (Omarini, 2015).

One of the research projects discussed the regulatory challenges faced by the adoption of open banking. As the data is the new oil, a new kind of industry has been created due to datafication. Financial institutions are starting new businesses and collaborating to face the challenges. Open banking is one of those new disruptions based on the application program interface, which enables the third parties to develop financial products and services around a financial institution that exposes its data and/or its infrastructure (Remolina, 2019). In open banking, the customer is the deciding party for giving access to their information which is already with the bank with a third party. These third-party providers work on application-based interfaces, which is another digital transformation. Thus, by adopting O.B., banks' monopoly is broken, and the customer can have an advantage and choice of various financial products and services (Koeppl & Kronick, 2020).

The three major features of the O.B. system are that the bank is the custodian of customer data and not the owner, the customers' banking data is under the control of the customer, and prior consent of the customer is required to access and share customer data with relevant third-party financial service providers (Hamilton, 2019). In the open banking system (Gozman et al., 2018), access to the banking system and customer data cannot be accessed by any third party at its discretion. However, access controls will be there in the system by the bank to preserve the security and privacy of customer data and contractual information (Kim et al., 2016). In the open banking system, the customers, for their requirements, can securely share their data with other third parties and banks for comparing services. Gozman et al. (2018) stated that the customers could manage their accounts without using their bank with the O.B. system.

The regulatory-driven open banking system in the E.U. (PwC, 2017, 2018) has made it compulsory for banks to share customer data with third-party financial service providers. Customer data sharing is done through application programming interfaces (APIs) only with relevant and authorized third-party providers and after getting the customers' consent to share their data with the banks (Sparks, 2018).

With pre-occupation and fear in the mind of losing business to innovators (fintech) in the banking space, the primary focus of the E.U. banks was on technological up-gradation/adoption using new technologies in their financial services offerings to customers (Omarini, 2018b) to make their traditional banking operations more competitive and sustainable, which prompted digital transformation and O.B. ecosystem development in E.U. According to Dhar and Stein (2017), with the digital banking platforms, customers' expectations of banking services and how they do their banking are changing due to the transformed role of financial intermediaries. Wewege et al. (2020) stated that with the digitalized banking transitions, there are marked changes and progress seen in banking infrastructure capabilities for stability, connectivity, data sharing, cybersecurity, and standardization of APIs.

Fintech companies in banking services have also gone into mobile technologies, big data, and superior analytics to design services/products for general and customized applications in the banking space

(Blake & Vanham, 2016). The collaboration of banks with external partners will help banks develop new technologies, acquire new skills, and gain access to technical expertise and knowledge (Schueffel & Vadana, 2015).

Due to disruptive technology used by fintech companies, the banking institutions require integrated innovation capabilities, dedicated innovation teams backed by talent acquisition/retention, learning and development, and training mechanisms to adopt the new technologies and innovation practices (Salampasis & Mention, 2018). In the E.U., due to regulatory push coupled with the presence of fintech companies, banks are pulling third parties, having innovative service packages, to offer innovative financial services/products to the banking customers within the framework of O.B. guidelines (Omarini, 2018a).

According to Juengerkes (2016), in Europe, fintech and banks have taken collaborative efforts at different stages of banking product and service development. This collaboration will close the gap between the services of traditional banks and customers' changing demands. As per KPMG's (2017) study, four factors contribute to the growth of fintech. The first one is technological evolution; the second one is changing customers' expectations; the third one is funding and capital adequacy; and the fourth one is regulatory support. Open banking raises essential questions of ownership and control of data that cannot be answered by recourse to property law concepts but are best addressed by legislation – data protection law (Evans,2018). For O.B.'s success, three priorities (Koeppl & Kronick, 2020) need to be addressed. Establish through legislation explicit control of data for financial customers; ensure standards for safe access and safe data storage; and the third is to build a digital I.D. system that allows customers and businesses to control access to their data.

Due to demonetization, a massive change was observed in the monetary system in India. This was due to the Indian economy moving toward digital payments — from card payments to mobile app-based payments. The technological impact has been the highest in the last decade (Kotishwar, 2018; Shukla, 2017).

Banks' importance of collaboration and early adoption of new technologies would be beneficial for them to be competitive. There are operational and regulatory challenges, but the customer is the center. Since most banking processes are data-driven, the strategic partnership approach would be the new role the banks should adopt (Hari Krishna & Arun Kumar, 2020). The traditional market structures of the banks are undergoing a paradigm shift with the increased competition and changing market structure. Banks now adopt the neo-industrial organization approach (Chandanani et al., 2017 ; Rekha et al., 2020).

Research on efficiency and productivity was investigated concerning Indian private and public sector banks, wherein the private sector banks were found to be more productive than public sector banks (Kumar & Kar, 2021). The technological outsourcing by the commercial banks can be understood based on the factors: Construct skill, cost savings, technical benefits, and strategic advantage (Mohapatra, 2015). The importance of blockchain technology in the banking domain was discussed by Kotishwar (2020).

Due to emulating global changes, the Indian banking sector has witnessed unprecedented change. The paradigm shift from cards to APIs will have advantages for customers. This will help customers select the third parties with whom they will be sharing financial information, which was earlier accessible to only banks. Customers will have a wide range of financial products and services to choose from. Banks will face tough competition, and a more collaborative and strategic approach to working in an ecosystem consisting of banks, customers, fintechs, and TPP must be adopted. India has slowly and steadily moved from cash to cashless transactions and from card to mobile app-based payments. Looking at the opportunities, leading Indian banks have taken initiatives to develop the O.B. ecosystem. In the absence of any prior study, this study covers the dimensions of the O.B. ecosystem surrounding drivers, enablers, and benefits in the current Indian context.

Research Design

Research Questions

(1) Is the banking ecosystem in India geared up for O.B.?

(2) What are Indian regulatory reforms for O.B. ecosystem development?

(3) Do Indian banks share customer banking data (with their consent) in a secure manner with authorized third-party developers via open APIs?

Objectives

This research aims at studying :

(1) The open banking ecosystem in India: Status in adoption and development.

(2) Challenges and risks in implementation.

(3) Success factors for O.B. implementation.

Research Methodology

Primary Data

Data were collected through a structured questionnaire administered during personal interviews with executives (25 numbers) of the leading Indian banks (Private banks: Axis Bank, Federal Bank, HDFC Bank, ICICI Bank, Kotak Mahindra, DCB, and RBL; public sector bank: SBI; foreign bank: HSBC), fintech companies, and management consultants in banking services.

Secondary Data

Secondary data were collected from management research journals, published research papers, and news bulletins and reports from Deloitte, McKenzie, PwC, etc.

Analysis and Results

India's first open banking initiative is the Unified Payment Interface (UPI) to facilitate an instant interbank payment transfer. UPI was introduced on April 11, 2016, by the National Payments Corporation of India. The following Indian banks (Table 4) are at the forefront of taking the open banking ecosystem initiatives. Almost every bank in India has implemented an open banking platform, and the following are the pioneers in the Indian banking Industry to launch 'application programming interface' (API) banking services in large numbers for multiple applications.

The open banking ecosystem is entirely based on the technology platform. The respondents believe that the following are the challenges in the technology space for successfully implementing the O.B. system :

Table 4. ***Open Banking Initiatives in India***

Bank	Initiatives	APIs in Ecosystem (With Source)
Yes Bank	The first Indian bank to launch API, allowing integration with corporate clients' ERP systems. At the same time, the regulation in Asia supports API but lacks strict regimes and guidelines, causing hindrances in the growth trend.	50 Odd APIs with @100 participating partners. (https://www.finextra.com/newsarticle/34748/yes-bank-launches-sandbox-housing-50-bank-apis)
RBL Bank	The bank introduced a digital services platform for customer uses, backed by APIs for e-KYC, PAN verification, currency rates, and credit score. It is one shop solution API.	Over 600 APIs, partnerships with several fintechs and service providers. (https://ir.rblbank.com/pdfs/financial-highlights/rbl-bank-ar-19-20.pdf)
DCB Bank	DCB Bank launched its API on a pilot basis to be used by customers, fintech companies, and associates.	The bank currently has more than 20 startups, fintech, and API developers on the O.B. platform as partners. (https://www.moneycontrol.com/news/business/companies/dcb-bank-launches-open-banking-for-next-generation-banking-solutions-3591261.html)
Kotak Bank	The bank, in November 2018, launched its API platform for lending and payment products.	Kotak Bank has gone live with more than 30 partners in the lending and payments segment in the open banking initiative, and over 40 developers are presently going through the integration process. (https://www.kotak.com/content/dam/Kotak/about-us/media-press-releases/2018/open-banking-platform-21112018.pdf)
Federal Bank	The O.B. platform allows all core banking processes seamlessly. Banks through APIs offer innovative financial solutions leading to the integration of various banking services. APIs are consumed by fintech on the O.B. platform to provide innovative financial products/services.	Over 139 APIs under a development plan allow entities to address various businesses. (https://developer.federalbank.co.in/fedbnkdev/dev/product)
ICICI Bank	ICICI Bank, on January 14, 2020, launched an API banking portal.	A diverse range of nearly 250 APIs across financial and non-financial categories. (https://cio.economictimes.indiatimes.com/news/enterprise-services-and-applications/icici-bank-launches-api-banking-portal-with-nearly-250-apis/73247625)
HDFC Bank	Via API gateway, HDFC Bank delivers the bank's internal services to external partners like corporates, fintech, aggregators, and startups.	Over 100 + partners (https://openbanking.hdfcbank.com/admin/app/api-catalog) (https://yourstory.com/2019/12/ringside-view-indias-largest-api-banking-hdfc) https://ibsintelligence.com/ibsi-news/4-top-indian-private-banks-apis-enabling-innovations-in-open-banking/)
Axis Bank	Axis Bank has gone live as a Financial Information Provider (FIP) on the landmark Account Aggregator (A.A.) framework of the Reserve Bank of India. Account Aggregator is a digital platform that allows for easy sharing and consumption of customers' financial data from various regulated entities with the customers' consent.	Axis Bank is a pioneer in adopting the Unified Payments Interface (UPI) using API. (https://apiportal.axisbank.com/portal/product/all)

SBI	The bank has adopted new-age digital banking services and introduced retail digital banks (YONO), which is at par with fintech.	SBI has an initiative on the API developer's platform. The bank developed an indigenous, unique PCI-DSS platform for payment modes facilitating seamless e-commerce transactions through the bank's payment aggregator and payment gateway. (https://developerzone.sb.ob.globalbank.sbi/) (https://www.sbi.co.in/web/corporate-governance/annual-report)

↳ ***Legacy Integration***. As against the traditional banking system, O.B. demands a flexible and robust design with 24/7 data availability.

↳ ***Technology Infrastructure.*** The right technology infrastructure should be in place to handle anticipated data volumes.

↳ ***API Management Tools***. The banks should choose an automated API management platform to build efficiency and ensure strategic alignment across various stakeholders.

↳ ***Developer Technology***. The developer portals are the new channel ; so banks need to focus on critical features of developers.

↳ ***Security Concerns***. Customer authentication (SCA) in O.B. is a crucial requirement for security.

↳ ***Data Management***. In O.B., banks promote data-driven interactions across the ecosystem as the recipient of new customer data. Hence, banks need to evolve suitable strategies for external data consumption and usage in line with data privacy regulations of the land.

Most respondents confirmed the following benefits of implementing an open banking system :

↳ ***Enhanced Customer Experience***. O.B. will empower customers to choose the best financial provider to suit their needs.

↳ ***Enhanced Operational Efficiencies.*** OB-API enhances banks' existing operational capabilities through analytics and helps them to capture new emerging opportunities.

↳ ***New Revenue Streams***. Banks with fintech can offer innovative financial services/products to their existing customers. They can give them a broader option in their service/product portfolios and drive customer engagement and satisfaction with operational costs.

↳ ***Increased Agility.*** The system built on flexible platforms around APIs will help banks deploy O.B. more quickly to manage continuous changes in the market and customer expectations with lower operational cost, and with the most negligible impact on its core banking capability.

↳ ***Accelerate Financial Inclusion.*** The open banking program can increase banking activity by providing access to transaction data and enabling low-value payments.

↳ ***Access to Additional Customer Data.*** With an open banking platform, Indian banks will build trust with customers as safe and secure data holders. Hence, customers will not hesitate to allow banks to access their other financial data.

- With the traditional core banking platform, most Indian banks handle the complete life cycle of customers across liabilities and asset products. However, due to market requirements and regulatory push, Indian banking is transitioning to API powered platform to get into an O.B. space.

- Indian API gateways segment has a limited set of international players allowing more scope for a flexible Indian player to create an impact.

- API integration is critical to O.B.'s strategy. To make O.B.'s operations more agile, API Integrators should attain a level of expertise in services offered in O.B.

- RBI with 'ispirit' has developed draft guidelines on some APIs for banks & financial institutions to follow under the new NBFC Account Aggregator master direction. Banks and the regulator are the most significant change agents in this ecosystem. It is similar to Iwoca (U.K.), which Indian banks can use for getting authorized bank statements and account information from potential SME customers.

- In India, fintech can focus on customer engagement & interaction while banks are providing real-time back-end support using APIs. Open banking enables competition and cooperation among traditional banks and fintech.

- Most bank executives have expectations from O.B. standards on reduction in overdraft fees, customer service improvement, and tighter control on data leading to enhanced financial inclusions, which, however, requires a more significant role to be played by the regulator.

Conclusion

(1) ***Growth.*** A mix of regulatory mandate coupled with the fintech revolution and market-competition approach is making the 'Open Banking' ecosystem grow in Indian banks that proactively embrace the tenets of 'Open Banking' and capitalize on the opportunities to enable them to gain significant first-mover advantage.

(2) ***Technology.*** With the growth in trade and commerce, India is looking for faster, better, more innovative banking to gear up to meet the global standards. India is progressively approaching this futuristic model of open banking.

(3) ***Regulation.*** Three things are essential to a bank, i.e., data protection, data confidentiality, and customer trust retention. For controlling new vulnerable emerging new technologies, open banking in India will require appropriate controls within the system for cyber security. Indian Data Protection Law 2020 is in the process of enactment.

(4) ***Banking Environment.*** For the growth of the O.B. ecosystem, many changes are required in technology development, adoption, implementation, infrastructure, and customer readiness. The rapid adoption of new systems is demonstrated by Indian banks using mobile banking and online payment systems through UPI.

(5) ***Collaborative Approach.*** Open banking relies extensively on applying Programming Interfaces (API) to share customer data securely. The Indian banks, toward their journey to an open banking environment, are making a significant shift in banking structures to make way for a collaborative ecosystem of financial service providers.

(6) ***RBI Move.*** Consequent to rapid growth in fintech innovations and their interface with the banking sector during the last few years, the Reserve Bank of India developed and introduced in 2019 the 'Regulatory Sandbox' framework to accelerate the growth of the Indian O.B. ecosystem.

Recommendations

(1) ***Governance Structure.*** Indian banks need to have a robust governance structure, conforming to the highest standard following a very structured approach towards API-OB. Indian banks need to evolve robust protocols, safeguards, and security (Prasad, 2019) to facilitate transactions using open banking APIs, which have been increasing in the last few years.

(2) ***Join an Established Ecosystem.*** With tech giants (fintech) emerging as a force to reckon with in the payments space, it makes sense for banks to be part of an ecosystem. Banks may also be required to join other ecosystems, such as the unified payments interface in India.

(3) ***Build Own Ecosystem.*** The open banking ecosystem is enabled by key players who perform tasks such as data validation and analytics and provide infrastructure. Several leading banks abroad have taken the initiative to build their open banking ecosystems. To name a few, seven banks in Singapore came together to create PayNow, a money transfer facility that only needs a mobile number or National Registration Identity Card (NRIC), and HSBC has its 'Connections Hub,' a social network that business customers can use to connect with other HSBC customers worldwide.

(4) ***Security Challenges and Risks.*** Apart from the benefits of an open banking system, it has challenges and risks (Table 5). The Indian banks should consider the following inherent security challenges and threats in implementing the O.B. system.

Backer (2019) stated that the other challenges in O.B. that warrant some attention are: trust building, user protection through testing, fraud-fighting, innovation through collaboration, and technology regulators.

Table 5. ***O.B. Ecosystem: Challenges and Risks***

Security Challenges	• Data transfer vulnerabilities in the APIs for back-end system communication
	• Data linkages at various node/endpoints
	• Fake certifications for security layers
	• Weak protocols for data validation
	• API is designed with flaws in business logic
Risk and Liability	• Loss of customer data and risk for customers
	• Third-party management liability
	• Trust (relationship with 3rd parties)
Low Standardization	• No standards across the industry on service definition, authentication, authorization
	• No clarity on data specifications and APIs
Operationalizing API	• API operationalization at a prolonged speed
	• Work duplication in multiple areas in an enterprise
	• Issues of scalability and performance of APIs
	• Issue of integration with existing applications
Testing	• Scale efficiency and security test scenarios

Source : Infosys (2018).

Implications

There are three primary forces in the O.B. ecosystem evolution in other jurisdictions around the world. These are — regulation, competition, and consumer demand — pushing banks to digitize and develop APIs. In India, the leading banks like Yes Bank, ICICI Bank, HDFC Bank, Federal Bank, DCB, RBL, and SBI are at the forefront of taking the open banking ecosystem initiatives. Each one has multiple APIs to interface between customers and third-party service providers for various banking operations in the O.B. ecosystem. RBI, with iSpirit, has developed draft guidelines on APIs for banks & financial institutions. Three things are essential to a bank, that is, data protection, data confidentiality, and customer trust retention. India's Data Protection Bill 2020, which is under process, will be the answer to this new paradigm toward cyber security. Researchers can use this study to understand the developments in open banking worldwide and initiatives taken by leading banks in India.

Limitations of the Study and the Way Forward

The study is limited to the Indian banking ecosystem. Only leading Indian banks that have initiated the implementation of open banking and have achieved some landmarks in the process were considered samples for conducting the interviews. The banks that are still in the traditional banking system and are not immediately thinking of going in for this next level of banking (open banking) were excluded from the primary research study.

Future research would include the study of those banks which are new to open banking and are still in the adoption phase. The study on leading banks can be further extended to understand the cost vis-à-vis benefit of open banking. Consumer behavior and acceptance of open banking can also be a part of future research. In addition to that, future research on open banking will be on developing an innovative banking model for the free movement of money so that banks may not hold any deposits, and it will validate that banking is necessary and not the banks.

Authors' Contribution

Dr. Vinod Sople conceived the idea and developed a research design to undertake primary and secondary research studies. Aarti Patki extracted information from research papers published in reputed journals available on various databases. Dr. Vinod Sople verified the research design and supervised the study. Both authors conducted the interviews with bank executives and wrote the paper.

Conflict of Interest

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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About the Authors

Aarti Patki is currently associated with Narsee Monjee Institute of Management Studies (Navi Mumbai) as Assistant Professor (Finance). She is a Fellow member of the Institute of Chartered Accountants of India and M.Com from Mumbai University. She is pursuing a Ph.D. in supply chain finance.

Dr. Vinod Sople is presently associated as a Visiting Faculty with NMIMS (Navi Mumbai). His area of interest is supply chain and logistics management, intellectual property rights, and digital marketing. He worked with the industry for 25 years and academics for 20 years.