Critical Analysis of How Fintech is Shaping the Future of India

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Abstract

The rapid evolution of financial technology (Fintech) is transforming India's banking and financial landscape, driving financial inclusion and economic growth. This paper critically examines how innovations such as UPI, blockchain, digital wallets, and AI-powered solutions are revolutionizing traditional banking services. It explores the role of government initiatives like Digital India and Startup India in fostering fintech growth while addressing challenges such as cybersecurity threats and regulatory complexities. Furthermore, the paper highlights fintech's impact on financial literacy and accessibility, emphasizing its role in bridging the financial gap. The study concludes by assessing fintech's future trajectory in shaping India's digital economy.

CHAPTER 1: INTRODUCTION

Financial Technology, also referred to as FinTech, is the technology and innovation that seeks to compete with traditional financial methods when providing financial services, whereas, it is considered an emerging industry that uses technology to improve financial activities. An example of this technology can be referred to the use of smartphones in banking services or what is known as cellular banks, as well as investment services via mobile phones, and Cryptocurrencies, which aim to make financial services accessible to the general public, Financial technology companies consist of emerging projects financial intuitions, and well-established technology companies that aim to either enhance or replace the use of financial services provided by existing financial companies.[paper 1]

Fintech began as a back-end application in the institutions of finance and trade, but it has now expanded to include literacy of finance, education, investment, cryptocurrency, and retail banking. The Internet and mobile technologies are responsible for its tremendous rise as a combination of technological breakthroughs in business and personal finance. [paper 5]

Fintech in India

The Fintech sector in India has witnessed funding accounting for a 14% share of Global Funding. India ranks #2 on Deal Volume. The Fintech Market Opportunity is estimated to be 2.$ Tn by 2030. Indian fintechs were the 2nd most funded startup sector in India in 2022. Indian Fintech startups raised $5.65 Bn in 2022. The total number of unique institutional investors in Indian fintech almost doubled between 2021 and 2022, rising from 535 to 1019 respectively. [https://www.investindia.gov.in/sector/bfsi-fintech-financial-services]

The India Fintech Blockchain Market was valued at USD 0.35 billion in 2024 and is expected to reach USD 1.87 billion by 2030, rising at a CAGR (Compound annual growth rate) of 32.10%. The India fintech blockchain market is experiencing substantial growth, driven by the expanding adoption of blockchain technology across various financial services. As financial institutions and startups seek to enhance transaction transparency, security, and efficiency, blockchain offers a promising solution. In India, the rise in digital innovation has accelerated the deployment of blockchain in fintech applications. [https://www.fintechfutures.com/techwire/india-fintech-blockchain-report-2024-market-to-grow-by-over-1-5-billion-by-2030-regional-insights-competition-forecast-and-opportunities/]

Importance of Fintech in driving economic growth and financial inclusion

The Financial world is abuzz with digitisation and inclusion. Industry leaders are actively discussing how to drive deeper penetration of financial services across the country, personalise and simplify these services, and foster collaboration between governments, banks and fintech companies to create a more holistic ecosystem. While traditional banking systems have made services, fintech companies are emerging to address the evolving needs of various demographics.

These innovative digital platforms have democratised access to financial services and played a pivotal role in enhancing financial liberty, bridging the financial gap, and fostering economic equality in India. As per a report by the World Bank, nearly 190 million Indians do not have a bank account. According to the S&P Global Financial Literacy Survey, India takes the 73rd position among 144 countries, with a mere 24% financial literacy rate lower than the global average of 33%. This is where fintech and companies have proven to be fundamental catalysts of change, leveraging technology to educate the masses about financial concepts simply and engagingly. Armed with their innovation, technologies and customer-centric approach, Fintechs have been at the forefront of driving inclusion that narrows the financial gap between India and Bharat. They provide a range of financial services, from payments and remittances to lending and insurance, to the underserved segments of the population. For instance, digital broking apps offer easy-to-understand modules on investing, trading and personal finance, helping users make informed financial decisions. On the other hand, payment-tech platforms have revolutionised digital payments in India, enabling transactions even in remote areas with poor banking infrastructure. The fintech revolution isn't about amalgamating finance and technology and opening up bank accounts; it's about people. It's about the depth of connectivity and inclusion of people from all walks of life to have an equal claim to financial services. It's about ensuring full access to affordable and valuable financial services. When individuals have more savings, better access to credit, reduced income inequality and easy insurance options, economic equality becomes achievable.
[https://cfo.economictimes.indiatimes.com/blog/financial-inclusion-and-fintech-bridging-gaps-and-driving-economic-equality/109750294]

Historical Context of Fintech in India

India's fintech industry started to take off around the middle of the 2000s. During this time, online payment and banking services saw an exciting surge. As time passed, mobile wallets began to take shape, providing a practical and safe alternative to physical cash transactions.

Many people use e-wallets today to make purchases and pay bills. Indians have also enthusiastically embraced innovative solutions like UPi, the Bharat Bill Payment System, Buy Now Pay Later (BNPL), etc. Our analysis of payment patterns in India tells us that Indian households make 35% of their transactions digitally. However, things weren't always easy for early fintech startups. They overcame several obstacles, including gaining user trust and managing intricate laws. But these challenges also provided innovation opportunities, laying the groundwork for the fintech industry we have today. India's seamless shift to digital finance would not have been possible without the solid foundation of public digital infrastructure (such as the Aadhar and UPI). The supporting laws implemented by regulatory bodies like RBI, IRDAI and SEBI made this journey smoother. Government initiatives like Startup India, Digital India and E-RUPI have also worked well in fostering a digital culture in India. Similarly, granting licences to payment banks and implementing programs like Jan Dhan Yojana has also had a positive impact.

The evidence of this development can be seen in India's UPI transactions. In May 2023 alone, it reported monthly transactions of over 9 billion! [https://www.pluralonline.com/evolution-of-indian-fintech-past-present-and-the-future/]

Key milestones: UPI, digital wallets, blockchain integration

The influence of UPI on the FinTech sector is expected to grow, with several trends emerging due to increased adoption of digital payments, enhanced financial services, expansion of digital banking, and focus on security and privacy. As UPI continues to gain popularity, more users will shift to digital payment methods, driving the growth of cashless transactions. The integration of UPI with various financial services will lead to the development of innovative solutions, such as personalised financial management tools and advanced analytics. UPI's role in facilitating digital account management will likely lead to the expansion of digital banking services, with more institutions offering online account opening options and seamless digital experiences. With the rise of digital transactions, there will be an increased emphasis on security and privacy. UPI's continued development will include enhancements to protect user data and prevent fraud. UPI has fundamentally transformed the FinTech landscape, driving innovations and shaping trends in digital finance. By enabling seamless transactions and integration with various platforms, UPI has facilitated the rise of digital accounts and payments. Whether you're looking to open a PhonePe digital account online, a Google Pay account online, or an instant BharatPe account online, UPI offers a convenient and secure solution for managing your finances. Additionally, Paytm's zero balance account opening feature provides an accessible option for users seeking to start banking with minimal requirements. [https://digikhata.in/blog/future-of-fintech-innovations-and-trends-shaped-by-upi#:~:text=The%20influence%20of%20UPI%20on,the%20growth%20of%20cashless%20transactions.] Blockchain is another technology that has the potential to reshape the financial sector. It's a digital ledger that allows secure and immutable recording of transactions. Banks are embracing this technology to revolutionise money transfers and transaction records. Cryptocurrencies like Bitcoin are integral to this shift, presenting both opportunities and challenges in India. While they can offer better financial inclusion and faster cross-border transactions, there are concerns regarding the misuse of the technology. The government and financial service providers need to take a balanced approach to harness the potential of this technology without compromising on the security factor. [https://www.pluralonline.com/evolution-of-indian-fintech-past-present-and-the-future/]

How Fintech is transforming traditional banking and financial services?

Traditional banking models have typically followed a brick-and-mortar paradigm, with physical branches serving as critical touchpoints for consumer interactions. Traditional banking features in-person services, legacy systems and centralised decision-making via hierarchical hierarchies. In-person services include face-to-face transactions, account management, and advisory services, with a focus on personal interactions between consumers and bank employees. Legacy systems represent long-standing, often arduous banking processes. Traditional financial institutions' hierarchical organisational structures are characterised by centralised decision-making. Traditional banks encounter several challenges in adapting to modern technological advancements, primarily due to legacy systems that impede seamless integration with innovative technologies, resulting in slower uptake compared to agile Fintech competitors. Meeting the growing demand for digital banking services becomes increasingly challenging for traditional banks as customer expectations rise, fuelled by FinTech's ability to drive personalised and customised solutions. Moreover, intense competition from FinTech firms, which swiftly respond to market demands and drive innovation, further exacerbates the pressure on traditional banks to adapt quickly to changing customer needs. Regulatory constraints also pose barriers to innovation for traditional banks, as stringent compliance requirements may discourage risk-taking and experimentation. Additionally, traditional banks face hurdles in promoting financial inclusion, particularly in remote or underdeveloped areas, where physical branch presence is limited, and outreach strategies may be ineffective in reaching unbanked populations. Furthermore, the high operating costs associated with maintaining physical branches and outdated technologies diminish the cost-efficiency of traditional banking operations, making it challenging to compete with the more cost-effective Fintech alternatives. According to a World Bank study, governments can save as much as 75% by implementing electronic payment programs. These programs allow them to do away with expenses related to handling, shipping and distribution fees that come with cash-based payments, as well as the associated risks of theft and fraud.

Government initiatives, like Digital India and Startup India, encourage Fintech innovation…
The cashless transaction system is achieving its growth day by day, as soon as the market becomes globalized and the development of the banking sector more and more people move from cash to a cashless system. The cashless system is not just a necessity but also a need of today's order. Over the past few years, efforts to drive financial inclusion in India have delivered mixed results. Access to bank accounts has increased dramatically, driven by a strong policy and regulatory push. However, the usage of these accounts and the uptake of formal financial services beyond savings accounts has remained exceptionally difficult. The amendments to the Banking Act demonstrate the Government, RBI and banking institutions' intent to ensure stable growth of the economy by ensuring a healthy BFSI. Building trust within the industry will be paramount to India's further growth.
[https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3485038]
The Government Schemes and policies along with Digital innovation are accelerating the growth and opportunities for MSMEs for inclusive economic growth and sustainability through Entrepreneurship for transforming MSMEs/SMEs both in rural areas and urban areas, the innovations are catalysts for social, and economic development with associations such as NITI Aayag, FICCI, CII, ONDC, OCEN, NDEAR, NPCI-peer to peer lending. PMMY, ASPIRE, the Pharmaceutical Technology Upgradation Assistance Scheme (PTUAS), CGSSD (Credit Guarantee Scheme for Subordinate Debt), and Self-reliant India fund for equity infusion through Fund of Funds (FoF). Skill India, Startup India, Make in India, FDI norms, Ease doing Business (EodB), Fintech Digital Lending, Udyam, CLCS (credit linked capital subsidy for technology up-graduation), Mudra, Coir Board, Khadi and Village Commission, Khadi e-market portal for the vocal to local, E-marketplace (GeM), THe new Logistics Policy, and zero defect and zero effect revision of MSME Classification, PMEGP, Atma-Nirbhar Bharat Abhiyan (ANBA) packages for the

MSME/SME sector to contribute extensive employment opportunities, industrial production, exports contributing to GDP, SHGs programmes under the startup village Entrepreneurship Programme (SVEP), PMKVY, National Skill India Mission GST exemption for SHG with support of NABARD, SIDBI, the backbone for MSMEs in financing Green sectors like renewable energy Industries, Health Products, Agriculture and electric vehicles (EVs), Technology Centers (TCs) in policy framework promotes the sustainable Development Goals(SDGs), Atma Nirbhar MSMEs and to achieve 5 trillion dollar economy. [https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4400246]

1.1 Major Technologies Transforming Financial Services

Blockchain:

Financial service providers find blockchain technology useful to enhance authenticity, security, and risk management. Several institutions are adopting blockchain in trade and finance systems to build smart contracts between participants, improve efficiency and transparency, and open up newer revenue opportunities. Blockchain's unique recording capabilities make the existing clearing and settlement process redundant. Banks and other financial entities are adopting blockchain-enabled IDs to identify people. Better results come from organisations' capacity to foresee emerging trends in financial blockchain applications and develop blockchain functionality. The transfer of asset ownership and addressing the maintenance of a precise financial ledger. Measurement, communication, and analysis of financial information are three significant areas to be focussed on by accounting professionals. Blockchain clarifies asset ownership and the existence of obligations for accountants, and it has the potential to improve productivity. This paper identifies and studies relevant articles related to blockchain for finance. This paper focuses on Blockchain technology and its importance for financial services. Further takes up various tools, strategies, and featured services in Blockchain-based financial services.
[https://www.sciencedirect.com/science/article/pii/S2772485922000606]

The modern trends of digitalization have completely transformed and reshaped business practices, whole businesses, and even many industries. Blockchain technology is believed to be the latest advancement in industries such as the financial sector, where trust is of prime significance. Blockchain technology is a decentralized and coded security system which provides the capability for new digital services and platforms to be created through this emerging technology. This research presents a systematic review of scholarly articles on blockchain technology in the financial sector. We commenced by considering 227 articles and subsequently filtered this list down to 87 articles. From this, we present a classification framework that has three dimensions: blockchain-enabled financial benefits, challenges, and functionality. This research identifies implications for future research and practice within the blockchain paradigm.
[https://www.sciencedirect.com/science/article/abs/pii/S0268401219310928]

Artificial Intelligence (AI) and Machine Learning (ML)

The banking industry's adoption of artificial intelligence (AI) has drastically changed how financial services are delivered and perceived by consumers. Recent literature highlights the growing importance of AI in enhancing customer interactions, optimizing operational efficiencies, and improving service quality. As banks strive to remain competitive in a rapidly evolving digital landscape, understanding customer usage, preferences, and perceptions towards AI becomes paramount. AI in banking is the use of artificial intelligence technology in the financial sector to improve operations, and client experiences,

and drive innovation. Our study uses a varied sample of 152 respondents to investigate customer preferences and opinions of AI in banking. Aged 26 to 35, the majority of respondents were male (66.4%), with women making up 33.6% of the sample. 60.5% of the workforce had a master's degree, and 59.9% were employed in the private sector. Of those with incomes, 48% made between INR 51,000 and INR 1,00,000. The fact that 78.9% of them had private bank accounts was an important discovery. 48.7% of respondents utilised AI-powered banking services on rare occasions, while 33.6% used them regularly for basic activities such as balance enquiries. The study's Cronbach's Alpha scores demonstrated great consistency in assessing AI's function in customer service and fraud detection. Respondents praised AI for speedier customer service and personalised banking, although many preferred human interventions in areas such as fraud detection (88%) and loan services (85%). AI's involvement in risk management and fraud detection was well supported, with significant t-test findings and large confidence intervals.
[https://bpasjournals.com/library-science/index.php/journal/article/view/2000]

Cloud Computing:

Blockchain-based and AI fintech can mitigate financing pressure on corporations and shape corporate investment efficiency (Sun & Zhang, 2023), and the inhibitory consequences of fintech on corporate investment are noticeable with increasing agency conflict. Sustainable Bitcoin, fintech, and AI stock investments can influence environmentally friendly assets such as green bonds about clean energy (Abakah et al., 2023) in terms of distributional and directional predictability. Fintech shapes the firm development internal and external environment and may diminish the enterprise debt default risk (He et al., 2023) by mitigating corporate financing constraints. Fintech development can considerably decrease the corporate debt default risk (He et al., 2023) for high-tech companies having a small volume of investment opportunities, shaping banking operations, financial data, risk, and performance. Firm digitalization can diminish bank loan prices and mitigate fintech policy effects (Chen et al., 2023) in curtailing loan prices.
[https://bibliotekanauki.pl/articles/19901187.pdf]

As the financial technology (Fintech) sector continues to evolve, the adoption of cloud-based solutions integrated with Microservices and DevOps methodologies has become increasingly prevalent. This paper examines the dual benefits of cost efficiency and compliance challenges, scale resources on-demand, optimize operational costs, and enhance service delivery, making it an attractive option for businesses aiming to remain competitive in a rapidly changing landscape. Microservices architecture further contributes to cost efficiency by enabling organizations to develop, deploy, and scale individual services independently. This modular approach not only accelerates the deployment of new features but also reduces downtime and resource waste. Additionally, DevOps practices promote a culture of collaboration and automation, streamlining development processes and improving deployment frequency. This synergy between Microservices and DevOps facilitates rapid innovation and responsiveness to market demands, ultimately leading to improved financial performance. However, the transition to cloud-based solutions also presents compliance challenges, particularly in the highly regulated Fintech industry. Organizations must navigate a complex landscape of regulations, such as data protection laws and financial compliance requirements, which can vary significantly across jurisdictions.

[https://www.researchgate.net/profile/Muhammad-Ilyas-179/publication/384985435_Cost_Efficiency_and_Compliance_Challenges_in_Cloud-Based_Fintech_Solutions_with_Microservices_and_DevOps_Integration/links/6710c5c309ba2d0c76057e81/Cost-Efficiency-and-Compliance-Challenges-in-Cloud-Based-Fintech-Solutions-with-Microservices-and-DevOps-Integration.pdf]

Big Data and Analytics:

Nowadays, everything around us produces Big Data (BD). The digital process and the social media exchange provide it, while the communication and sensor systems transmit it. The development of smartphones and mobile devices increased the amount of it. Thus, multiple sources provide BD at an alarming velocity, volume and variety. Due to this, it is necessary to adopt optimal processing power, analytic capabilities and skills, to extract meaningful value from them. BD has rapidly moved to be a mainstream activity in organisations, changing the way people within organisations work together. The culture in which business and IT leaders have to join forces to achieve value from all data is changing. Tapping into large-scale, fast-moving and complex streams of data sets has the potential to transform the way organisations make their decisions. On the other hand, increasing demand for insights requires a new approach to defining tools and practices. In the current competitive business and industrial environment, top management has to be fully knowledgeable about new thinking, techniques and developments in the field.
[https://www.emerald.com/insight/content/doi/10.1108/ijqrm-01-2019-294/full/html]

Operational risks are increasingly prevalent and complex to manage in organisations, culminating in substantial financial and non-financial costs. Given the inefficiencies and biases of traditional manual, static and qualitative risk management practices, research has progressed to using data analytics to objectively and dynamically manage risks. However, the variety of operational risks, techniques and objectives researched is not well mapped across industries. This paper thoroughly reviews the emerging research area applying data analytics to operational risk management (ORM) within financial services (FS) and energy and natural resources (ENR). A systematic literature search resulted in 2,538 publications, from which detailed bibliometric and content analyses were performed on 191 studies of relevance. The literature is classified using a novel multi-layered framework, informing critical analyses of the analytics techniques and data employed. Five core themes emerge, relevant to practitioners, researchers, educators and students across any sector: risk identification, causal factors, risk quantification, risk prediction and risk decision-making. Generally, ENR studies focus on identifying causal factors and predicting specific incidents, whereas FS applications are more mature in surrounding risk quantification. To conclude, the comprehensive review reveals areas where further research is needed to advance ORM within and beyond FS and ENR, in pursuit of improved decision-making.
[https://www.tandfonline.com/doi/full/10.1080/01605682.2022.2041373#abstract]

Robotic Press Automation:

Robotic Process Automation (RPA) is a new wave of the future technologies. Robotic Process Automation is one of the most advanced technologies in the areas of computer science, electronics and communications, mechanical engineering and information technology. It is a combination of both hardware and software, networking and automation for doing very simple things. In this light, the research manuscript investigated the secondary data - which is available in Google, academic and

research databases. The investigation went on for a total of 6 months, i.e., from 1-1-2018 to 30-6-2018. Very few empirical articles, white papers, blogs were found in RPA and came across to compose this research manuscript. This study is exploratory because of the contemporary phenomenon. The keywords used in searching the database were Robotic Process Automation, RPA, Robots, Artificial Intelligence, and Blue Prism. The study finally discovered that Robots and Robotic Process Automation technologies are becoming compulsory as a part of doing business operations in organizations across the globe. Robotic Process Automation can bring immediate value to the core business processes including employee payroll, employee status changes, new hire recruitment and onboarding, accounts receivable and payable, invoice processing, inventory management, report creation, software installations, data migration, and vendor onboarding etc. to name a few applications.
[https://www.scielo.br/j/jistm/a/m7cqFWJPsWSk8ZnWRN6fR5m/]

Importance of Cybersecurity in Fintech:

What is the role of cybersecurity in protecting financial data and transactions?

With the rapid growth in the technological environment nowadays, many organizations, whether large or small, have full reliance on the use of information systems in their daily operations, which creates a need for the organization to take into consideration effective strategies regarding information security to protect the institution's sensitive and valuable databases from being stolen or attacked by cybercriminals. The global banking system has faced significant changes within the last few years in terms of processes, transactions, and operations, which are influenced by technology and its innovations in recent trends. However, there are specific concerns within systemic operations and information technology innovation. Banks depend on third-party systems to offer several digital services. Thus they depend on systems that are out of their control. This has raised the awareness of hackers and criminals of technological threats and weaknesses that would allow them to hack banking systems and steal valuable information and funds. Cyber threats and attacks are challenging due to the rapid change in technologies. Banks should take into consideration cyber-attacks to protect their clients; the study will provide a base for future studies in terms of threats and strategies against cyber-attacks and examine protection strategies implemented by banks, and awareness that banks and clients are familiar with in terms of cyber threats and security. Cybersecurity is a process designed to defend computers, servers, networks, and digital data from unauthorized access and destruction or attack in cyberspace. Organizations must be concerned about the safeguarding of their financial data, intellectual properties, and their reputation as a crucial part of their business strategy. The goals of businesses and governments in their use of the cybersecurity component are not only to protect their confidential information but also to ensure the availability of the information and maintain its integrity.
[https://www.researchgate.net/profile/Adel-Al-Alawi/publication/337086201_The_Significance_of_Cybersecurity_System_in_Helping_Managing_Risk_in_Banking_and_Financial_Sector/links/5f288580299bf134049ebe88/The-Significance-of-Cybersecurity-System-in-Helping-Managing-Risk-in-Banking-and-Financial-Sector.pdf]

Growing cyber threats: phishing, ransomware, identity theft and financial fraud.

The accounting industry has transformed due to the rapid advancements in technology. This has led to the digitization and automation of financial processes. However with his digital revolution comes challenges and risks, particularly in protecting financial information. As accounting data increasingly exists, the importance of robust cybersecurity measures cannot be understated. Data breaches can have consequences, such as significant financial loss penalties from regulatory bodies and damage to the trust of customers. On the other hand, ransomware attacks can severely disrupt accounting operations and cause disruptions in service delivery and financial transactions. Insider threats, though not as frequently discussed, can pose risks when employees unintentionally or deliberately mishandle or disclose sensitive financial information. Accounting organizations must adopt cybersecurity practices to mitigate these risks. This article examines strategies and best practices that strengthen data protection. It highlights the importance of implementing access controls, encryption techniques, and network monitoring systems to detect and prevent unauthorized access. Additionally, it emphasises the need for employee awareness and training programs to cultivate a security-conscious culture within accounting firms. Accounting professionals and organizations can fortify their defences by studying real-life case studies and implementing recommended cybersecurity measures. Reduce the chances of cyber-attacks. This article aims to raise awareness about the importance of cybersecurity in the accounting sector while equipping professionals with insights and recommendations for effectively safeguarding sensitive financial information. The increasing digitalization of accounting processes necessitates a focus on cybersecurity.

Impact of cyberattacks on financial stability, consumer trust, and regulatory scrutiny.

Cyber risk, defined as the risk of loss from dependence on computer systems and digital technologies, has grown in the financial system. Cyber events, especially cyberattacks, are among the top risks cited in financial stability surveys in the United States and globally.[2] Similar to other financial vulnerabilities, cyber risk presents both micro and macroprudential concerns However, while substantial technical attention has been paid to cyber resilience, measuring the ramifications of cyber risk for the financial system is at an early stage. This article proposes a way to assess the vulnerability of the financial system to cyber risk. The approach aligns with the existing Federal Reserve financial stability framework, focusing on how a cyber shock could be amplified by the financial system and on how to monitor the vulnerabilities that lead to that amplification. The banking industry has always been vulnerable to cyberattacks. In recent years, Pakistan’s banking sector experienced the most intense cyberattack in its over 70-year history. Due to these attacks, a large number of debit card accounts of major banks were negotiated. This study aims to examine the impact of cyberattack awareness and customers’ commitment levels after these cyberattacks. Design/methodology/approach The study integrated the commitment–trust theory framework for the relationship between trust and commitment to the usage of online banking services. The partial least square structural equation modelling is being used to explore the relationship between customer trust, which is an outcome of continuous usage, and customer perception of affirmative cybersecurity measures in the bank. Findings revealed that customer trust in online banking is positively associated with customer commitment, but customers’ cyber attack awareness negatively impacts customer trust and commitment to online banking. Practical implications The study highlights the importance of proactive communication, transparency and robust incident response that helps organisations establish themselves as trustworthy entities while prioritising customer information and transaction protection. Originality/value The authors report on how cyberattacks on the banking sector influence the trust and commitment of the customers in the sector. The variable of cyberattack awareness used in this study is novel in online banking literature.

[https://www.federalreserve.gov/econres/notes/feds-notes/implications-of-cyber-risk-for-financial-stability-20220512.html]

1.3 Cyber Attack 3 Countermeasures in Fintech

Encryption and Data Privacy:

In the dynamic world of financial technology, securing financial data is a key priority. Increasing digital connectivity, and adoption of cloud-based services require complex measures to protect the integrity, privacy and availability of sensitive information. Encryption techniques are emerging as a key tool to achieve these goals by converting plaintext into ciphertext, protected from unauthorised access and probability violations. This review paper examines the various encryption techniques required to secure financial information in fintech applications. The main methods described include symmetric encryption and asymmetric and hybrid encryption techniques. Additionally, the function of end-to-end encryption (E2EE) is discussed in terms of protecting data privacy while it is being sent, which is essential for safeguarding sensitive financial activities such as mobile banking and digital payments. With its sophisticated method of permitting calculations on encrypted data without the need for decryption, homomorphic encryption shows promise for facilitating safe data analysis in Fintech settings while preserving data confidentiality. Symmetric encryption is a basic encryption technique in which the same key is used to encrypt and decrypt data. This approach ensures efficiency in processing large amounts of data while maintaining privacy. The concept revolves around sharing a private key between sender and receiver, providing secure communication without the need for complex key management algorithms. Common symmetric encryption algorithms include Advanced Encryption Standard (AES) and Data Encryption Standard (DES). AES is widely accepted in fintech applications due to its effective security features and high performance in encrypting sensitive financial information. [12] [13]. AES works in basic sizes of 128, 192, or 256 bits and provides different security properties depending on the selected key length. Despite its effectiveness, symmetric encryption faces significant classification and implementation challenges. Protecting the confidentiality of the shared key is of utmost importance, as any compromise may result in the unauthorized decryption of the blocked password. Fundamental changes and secure storage methods are important practices to mitigate these risks in fintech environments. Asymmetric encryption, also known as public-key encryption, differs from symmetric encryption, it uses a Key pair, a public key for encryption and a private key for decryption. This two-key system provides secure communication between the parties without the need to first exchange a shared private key. The public key is widely distributed and can be shared freely, while the private key is secret and known only to the recipient. Hybrid encryption combines the strengths of symmetric and asymmetric encryption methods to achieve improved security and performance in data protection. Hybrid encryption uses asymmetric encryption to effectively exchange a randomly generated symmetric key, which is then used to encrypt more data using a symmetric encryption algorithm such as AES. This method uses high-performance symmetric encryption to process large amounts of data, and the secure key exchange and delivery capabilities of asymmetric encryption. Hybrid encryption is particularly useful in situations that require secure, file transfer communication and other secure, and encrypted data storage in cloud environments.

Multi-factor Authentication:

Implementing Multi-Factor Authentication (MFA) has become increasingly imperative in the realm of cybersecurity as organizations face escalating threats to their digital assets. This paper explores the significance of MFA as a proactive measure to enhance security by requiring users to provide multiple forms of authentication before gaining access to sensitive systems and data. Through a comprehensive

analysis of MFA implementation strategies, technological considerations, and benefits, this paper elucidates the role of MFA in mitigating common attack vectors such as password theft, phishing, and brute force attacks. By examining real-world case studies and industry best practices, it highlights the effectiveness of MFA in bolstering security posture and reducing the risk of unauthorized access. Moreover, the paper discusses the challenges and considerations associated with MFA adoption, including user experience, scalability, and compatibility with existing systems. Overall, it underscores the importance of MFA as a fundamental security control in safeguarding against evolving cyber threats and recommends proactive measures for successful implementation.
http://ijmlrcai.com/index.php/Journal/article/download/13/13
Multi-factor authentication (MFA) is a multi-step account login process that requires users to enter more information than just a password. For example, along with the password, users might be asked to enter a code sent to their email, answer a secret question, or scan a fingerprint. A second form of authentication can help prevent unauthorized account access if a system password has been compromised. Digital security is critical in today's world because both businesses and users store sensitive information online. Everyone interacts with applications, services, and data that are stored on the internet using online accounts. A breach, or misuse, of this online information could have serious real-world consequences, such as financial theft, business disruption, and loss of privacy. While passwords protect digital assets, they are simply not enough. Expert cybercriminals try to actively find passwords. By discovering one password, access can potentially be gained to multiple accounts for which you might have reused the password. Multi-factor authentication acts as an additional layer of security to prevent unauthorized users from accessing these accounts, even when the password has been stolen. Businesses use multi-factor authentication to validate user identities and provide quick and convenient access to authorized users.

Regulatory Compliance:
Compliance is a broad topic, and it is often hard to define as its operational boundaries can be varied. The term follows a philosophical tradition involving the belief that people lack self-governance. Ability and consequently, it is necessary to establish a robust governing authority. Today, there is not a generally accepted definition, even though many scholars and professionals typically refer to compliance as a method for ensuring that specific norms and rules are met. For example, according to Wright, “compliance in the true sense of the word entails a legal requirement or a standard for context.” Other authors pointed out that adhering to laws and regulations is a way of mitigating potential risks to society and encouraging ethical behaviour
Regulations within the financial sector vary greatly based on the financial service. According to Mohammed(1970), some of these regulations focus only on investment products, while others deal with credit and liquidity functions. However, since the financial industry is highly dependent on information technology, cybersecurity has now become one of the most significant components of financial regulatory compliance. The Sarbanes-Oxley (SOX) act of 2002 places, for instance, emphasis on this concept that requires organizations to be accountable for the security, accuracy, and reliability of all information systems that they use when reporting financial information. However, despite the regulatory compliance in the financial sector, there is an increasing need for new or updated measures to address new cybersecurity threats. For example, Hornbuckle discussed how standards, ike the Payment Card Industry Data Security Standard (PCI DSS), are not sufficient to protect companies from cybersecurity

events, such as the Target store breach. The increasing need to address these issues in financial service has led to the rise of the "Fintech" phenomenon, which is described in the literature as "the use of technology to deliver financial solutions (Douglas, 2016, p. 17; Jenik & Lauer, 2017)." As Fintech becomes more and more advanced, it is necessary to address more cybersecurity demands to ensure that companies continue to deliver secure services.
[https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3569902] The main characteristic of this system is its staticity because it is based on the assumption that it is possible to capture and monitor the status compliance with regulations at any level of this hierarchy in an accurate way. However, the current realistic framework of global regulatory compliance is non-hierarchical and views compliance as a dynamic process changing over time. The current global system involves many actors other than single states, including intergovernmental organizations, private organizations, and individuals. All of these "non-traditional actors" interact in complex ways that go beyond agreements and legislation; they alter the balance in the existing regulatory schemes, thus playing a key role in how organizations and individuals interpret, implement, and comply with regulations. Consequently, the lines between international, national, and local compliance measures are fading, and mandatory compliance, although often necessary, is increasingly being perceived as a burden in this context.
[https://cams.mit.edu/wp-content/uploads/Compliance_cyber_Marotta.pdf]

Behavioural Analytics:

Behavioural analytics has emerged as a powerful approach to enhance fraud detection in the fintech sector. Traditional fraud detection methods primarily rely on transactional data and rule-based systems, often overlooking the valuable insights derived from analyzing user behaviour patterns (Pourhabibi et al.,2020). In addition, behavioural analytics complements transaction-based fraud detection by considering the contextual information surrounding user interactions and transactional activities (Jurgovsky et al., 2018). At the heart of behavioural analytics is the understanding of user behaviour patterns. Users exhibit consistent behaviour patterns during their interactions with fintech platforms, and these patterns can provide valuable clues about their typical activities (Claessens et al., 2018). For example, users may have regular login times, preferred transaction amounts, and specific transaction frequencies. Behavioural analytics seeks to establish a baseline of normal behaviour for each user by analyzing historical data. Any deviations from this baseline can be indicative of suspicious activities that warrant further investigation.

A subset of behavioural analytics is behavioural biometrics, which focuses on unique behavioural patterns as a means of user identification and authentication. Behavioural biometrics measures biologically inherent traits such as keystroke dynamics, mouse movement patterns, and touch gestures on mobile devices. These patterns are individualistic and difficult for fraudsters to mimic, providing an additional layer of security for user authentication. By leveraging behavioural biometrics, financial institutions can enhance user authentication processes and prevent unauthorized access to user accounts.

Threat intelligence Platform:

Financial institutions serve as the backbone of modern economics, providing a range of services from savings and loans to investment opportunities. Their role is so integral that any disruption in their operations can have a cascading effect on various sectors, affecting not just businesses but also the daily lives of average citizens. The stability of these institutions is therefore of paramount importance, and any form of vulnerability can have far-reaching implications. For instance, during economic downturns, the failure of a single major bank can trigger a domino effect that jeopardizes the financial stability of other banks and, by extension, the economy as a whole. This interconnectedness makes the financial sector highly susceptible to systemic risk which can be exacerbated by external shocks such as natural disasters, geopolitical tensions, or significant policy changes.

The financial sector faces an array of cyber threats that are both diverse and increasingly sophisticated. These threats emanate from a variety of sources, including state-sponsored hackers aiming to compromise national security, as well as individual actors motivated by financial gain.

The methods employed in these cyber-attacks can range from phishing schemes to more advanced techniques like ransomware and distributed denial of service (DDoS) attacks. Some malicious actors focus on immediate financial gain, targeting customer accounts or manipulating transitions. Others may have more insidious goals, such as causing systemic disruptions that can lead to widespread chaos. For instance, an attack on a major financial exchange could not only halt trading but also undermine confidence in the financial system at large.

Blockchain-based security

The emerging blockchain technology helps in the decentralization of transactions, where every participant network verifies and validates the transaction making it immutable. With the rapid expansion of the technology, transactional data which is stored and validated is also increasing. The blockchain technology came into prominence largely due to bitcoin and the security aspects of the technology. This technology is comparatively fast, secure and efficient. This paper discusses the generalized overview, different algorithms to reach consensus, system workflows and various security aspects of handling, transacting and storing data. This paper also throws light Smart Contracts and their applications.

Blockchain offers an innovative approach to storing information, executing transactions, performing functions, and establishing trust in an open environment. Many consider blockchain as a technology breakthrough for cryptography and cybersecurity, with use cases ranging from globally deployed cryptocurrency systems like Bitcoin, to smart contracts, smart grids over the Internet of Things, and so forth. Although blockchain has received growing interests in both academia and industry in recent years, the security and privacy of blockchains continue to be at the centre of the debate when deploying blockchain in different applications. This article presents a comprehensive overview of the security and privacy of blockchain. To facilitate the discussion, we first introduce the notion of blockchains and its utility in the context of Bitcoin-like online transactions.

1.4 Fintech Variables Impacting Cybersecurity

In recent years, a new generation of financial technology startups supporting financial institutions and providers of digital solutions has emerged, resulting in a reversal of financial market conditions around the world by leveraging technology innovations in finance. In light of this rapid development, it is necessary to adopt methods that guarantee the utilization of the financial technology revolution for the benefit of society and the economy, considering consumer protection and the financial system.

The field of finance has evolved thanks to technological developments throughout the ages. However, over the past decade, technology-based innovations in finance have enhanced consumer access to many services in the areas of payments, lending, insurance, savings, and investment; This is within their reach, with an unprecedented pace and scope , But it raises a lot of privacy concerns and whether dealing in technology reveals customer data and is at risk, and will related technologies be used in machine learning and artificial intelligence in risk management in banking (Kareem et al., 2020), Where it is possible and in an unintended or unexpected way or without the knowledge that the customer may fall into the trap of fraud so we see that the process of increasing adoption of cloud computing is assigned to companies that have sufficient experience to deal with modern technology with financial institutions and provide financial services electronically and have the potential to counter cyber-attack The most important thing is that the new world is not only full of opportunities, but also fraught with a set of risks known and unknown risks on several levels, starting with individuals , We notice recently the growth of non-bank internet lenders, it has become possible to obtain credit anywhere and anytime, and therefore comes the role of industry watchers in organizing this business, as this system becomes very stressful and it is required to protect consumers.

Data Volume:

Mobile Penetration:

Mobile cloud computing (MCC) is defined as a computing model that consists of mobile and cloud computing services via the Internet. MCC represents the integration and convergence of these two technologies into a single seamless model. Although this integration has immense advantages, it has also exacerbated security and complexity, including those of MCC applications. These applications run portable devices and harness the power and availability of cloud services to complete tasks such as accelerated cloud processing power and unlimited storage. MCC applications use cloud services by offloading mobile application tasks to the cloud based on a set of conditions and criteria related to the respective mobile device states, running tasks and cloud status. Thus, MCC applications are unique and complex, and testing them is difficult because of the various execution paths and locations of each process, which represent different offloading implementations. Each test case for a MCC application needs to be generated and executed with respect to the device state to cover all possible process flows. Therefore, the number of generated test cases is substantially increased.

Mobile cloud computing (MCC) enables mobile devices to exploit seamless cloud services via offloading and has numerous advantages and increased security and complexity. Penetration testing of mobile applications has become more complex and expensive due to several parameters, such as the platform, device heterogeneity, context event types, and offloading. Numerous studies have been published in the MCC domain, whereas few studies have addressed the common issues and challenges of MCC testing. However, current studies do not address MCC and penetration testing. Therefore, revisiting MCC and penetration testing domains is essential to overcoming the inherent complexity and reducing costs. Motivated by the importance of revisiting these domains, this paper pursues two objectives: to provide a comprehensive systematic literature review (SLR) of the MCC, security and penetration testing domains and to establish the requirements for penetration testing of MCC applications. This paper has systematically reviewed previous penetration testing models and techniques based on the requirements in Kitchenham's SLR guidelines. The SLR outcome has indicated the following deficiencies: the offloading parameter is disregarded; studies that address mobile, cloud, and web vulnerabilities are lacking; and a MCC application penetration testing model has not been addressed by current studies. In particular, offloading and mobile state management are two new and vital requirements that have not been addressed to reveal hidden security vulnerabilities, facilitate mutual trust, and enable developers to build more secure MCC applications. Beneficial review results that can contribute to future research are presented. [https://ieeexplore.ieee.org/abstract/document/8917986]

1.5 Compatibility to Adopt New Technological Advancements

Regulatory Landscape:

Emerging as a breakthrough idea with the ability to revolutionise several sectors by improving security, openness, and efficiency is block chain technology. Without middlemen, this distributed ledger system is decentralised and lets transparent and safe transactions. Startups, noted for their speed and creative ability, are well suited to use blockchain technology to navigate the complex regulatory landscape surrounding cryptocurrencies and initial coin offerings. Additionally, issues related to data privacy and intellectual property rights can also pose significant obstacles for startups looking to implement block chain solutions. As such, startups must carefully consider these legal challenges and work closely with legal experts to ensure compliance with regulations. By addressing these issues proactively, startups can maximise the benefits of block chain technology while minimising potential legal risks. India's regulatory framework is still in development and characterised by uncertainty and a lack of comprehensive rules. India's evolving regulatory landscape for blockchain technology presents challenges and opportunities for industry stakeholders. Clear and comprehensive regulations will be essential to provide the necessary guidance and support for block chain innovation to flourish in the country. As the government works towards establishing a clear regulatory framework, industry players must stay informed and adapt to changes to navigate the evolving landscape effectively. Collaboration between regulators, industry experts, and stakeholders will be crucial in shaping policies that balance innovation and consumer protection in the block chain space. This collaboration will help ensure that regulations are not overly restrictive, allowing for innovation to thrive while also protecting consumers. By working together, industry stakeholders can help shape a regulatory environment that fosters growth and investment in block chain technology. The collaborative effort will also help build truth in open dialogue and sharing knowledge, industry players can address potential challenges and mitigate risks more effectively. Ultimately, a cooperative approach to regulation will benefit both businesses and consumers, creating a more sustainable and resilient ecosystem for block chain technology to flourish.

One of the main regulatory obstacles block chin entrepreneurs have is following data privacy rules. The immutable character of block chain runs counter to data protection rules such as the General Data Protection Regulations in Europe, which gives people the right to erasure. Startups find great legal uncertainty resulting from this clash, which makes developing compliant block chain products challenging. In order to address this issue, regulators may need to work closely with block chain entrepreneurs to find the solutions that balance innovation with data privacy requirements. Additionally, ongoing dialogue and collaboration between industry stakeholders and regulatory bodies will be crucial in navigating these complex legal challenges and fostering a supportive environment for block chain development. By establishing clear guidelines and standards effectively. This collaboration will ultimately benefit both parties by promoting innovation while ensuring ultimately driving adoption of block chain technology. As the technology continues to evolve, it is essential for all parties involved to work together towards a common goal of balancing innovation with data privacy protection.

Furthermore, difficult are anti-money laundering rules. The pseudonymous character of block chain technology helps illegal activity to flourish, which drives authorities to enforce strict AML rules on block chain companies. [https://bpasjournals.com/library-science/index.php/journal/article/view/2054]

Public and Private Collaborations:

The advent of financial technology, or FinTech, has caused an enormous shift in the financial sector in recent years. FinTech innovations, which cover a wide range of technological developments, revolutionize traditional financial services. Examples of these include peer-to-peer lending platforms, mobile payment solutions, block chain-based crypto currencies, and robo-advisors. Along with streamlining procedures, improving accessibility, and cutting expenses, these technologies have democratized financial services and given people and companies all around the world more influence. Any technological advancement intended to improve or automate financial services and procedures is referred to as a FinTech innovation. This includes, but is not limited to, contactless payment technologies, digital wallets, mobile payment apps, and payment systems, which have revolutionized the ease and effectiveness of how people and businesses interact. By removing the need for traditional financial middlemen and bringing borrowers and investors directly together, peer-to-peer lending platforms, crowd funding websites, and online marketplace lenders have completely changed the borrowing lending scene. Block chain technology, which powers crypto currencies like Ethereum and Bitcoin, provides safe and decentralized networks for transactions, upending established payment methods and opening the door for new kinds of digital assets and smart contracts. The provision of automated, low-cost investment advice and portfolio management services by algorithm-based investment platforms has democratized access to wealth management and financial planning. In the insurance industry, technological advancements include usage-based insurance models, digital insurance platforms, and AI-powered underwriting boost productivity, cut expenses, and enhance client satisfaction. FinTech technologies provide major regulatory concerns in addition to their tremendous potential to change the financial sector. Because FinTech is so dynamic and disruptive, we need regulatory frameworks that can effectively protect consumers, uphold financial stability, and encourage innovation. The purpose of regulatory frameworks is to safeguard consumers against fraudulent activities, unfair practices, and systemic risks related to FinTech products and services.

By ensuring transparency, fairness, and efficiency in the financial markets, these regulations foster confidence and trust among market participants. Regulatory supervision reduces the risks that FinTech operations provide to the stability of the financial system, including cyber attacks, malfunctions in business operations, and possible disruptions to established financial institutions. Clear, definite regulations encourage responsible innovation while adhering to regulatory standards, giving FinTech startups and established players a competitive edge. Fostering a strong and viable FinTech sector requires striking a careful balance between innovation and consumer safety. While inadequate rules may expose consumers to risks and vulnerabilities, excessive regulatory burdens may discourage innovation and hinder market competition. Regulations must change to keep up with the rapidly evolving FinTech landscape. This requires finding a balance between safeguarding consumers and encouraging innovation by adjusting regulations to the unique risks posed by fintech activity. This keeps regulatory burdens proportionate to potential risks and prevents startups and small businesses from facing unjustified barriers to entry. Regulatory sandboxes offer FinTech companies safe spaces to try new goods and services while being closely monitored by regulators. This way, regulators can evaluate risks and create the right regulations without impeding innovation. The creation of knowledgeable and practical regulatory frameworks that meet the interests of all stakeholders while encouraging innovation and competition is made easier by cooperation between regulators, industry stakeholders, academicians, and consumer advocates. It is imperative that regulatory frameworks possess flexibility and agility, enabling them to promptly address new threats, technological breakthroughs, and market trends. [https://bssspublications.com/PublishedPaper/Publish_618.pdf]

Infrastructure and Digital Literacy:

The growth of mobile payment systems is staggering, indicating that it is a rapidly expanding industry of significant importance to consumers. Non-financial institutions are now offering these services, which are gaining popularity due to their ease of use and absence of complex add-ons. Users are only required to enter their login information, PIN number, or biometric authentication, making the process effortless . An essential initial stride towards fully unlocking the boundless potential of this sector entails the timely embracement of FinTech payment services. Ultimately, the continued use of these services by consumers will determine their long-term success. Despite the extensive digitization of the banking system, mobile payment services have not been widely adopted due to various regulatory and marketability challenges . However, the popularity of online shopping and the widespread availability of mobile devices has contributed to the rapid growth of the digital mobile payment industry in recent years. The mobile payment industry is experiencing a remarkable surge, with tremendous potential for growth. According to a study conducted by 2020, the global mobile payment market initially projected to reach a value of USD 1.48 trillion in 2019, is expected to soar to an astonishing USD 12.06 trillion by 2027, exhibiting a remarkable compounded annual growth rate of 30.1% from 2020 to 2027.

FinTech, a type of technology that enhances access to financial services, has the potential to revolutionize how people manage their finances. By making financial services more transparent, cheaper, and more accessible, FinTech is particularly beneficial to individuals with limited time for financial management. The landscape of financial technology has undergone a sweeping transformation due to the integration of pivotal technologies, including but not limited to internet technology, big data, artificial intelligence, distributed technology, and security technology leveraging biometric authentication. This confluence of powerful tools has ushered in a new era of sophistication, enabling businesses to operate with unprecedented efficiency and security while empowering individuals to make informed financial choices with ease and confidence. These technologies have brought about significant changes in the conventional financial sector development model . Consumers can now easily access financial services through Internet technologies. Big data enables better risk evaluation and fraud detection. Artificial intelligence allows for accurate forecasts and automated financial operations. Security technology has improved the security of financial transactions, and distributed technology provides a decentralized and secure means of exchanging value. Overall, these developments have improved the efficiency, accessibility, and security of financial services. Banks are also adopting FinTech to tap into its commercial value. In the second quarter of 2019, FinTech saw a significant investment of USD 8.3 billion, representing a 24% increase from the first quarter. FinTech's widespread adoption creates a more diversified financial landscape, providing access to innovative financial services to people. The adoption of FinTech services by customers may be hindered by their concerns over security and privacy. Although there are many affordable financial service platforms and user-friendly features available, consumers are hesitant to trust FinTech companies with their personal and financial

information due to the risk of unauthorized access or misuse). McKinsey and Company has reported that these concerns pose a significant obstacle to the further growth of FinTech services. As such, it is essential for FinTech companies to address these concerns by implementing robust security and privacy measures to ensure the protection of their customer's sensitive information.
[https://www.mdpi.com/2227-7099/11/12/286]

Need for Fintech professionals:
Information technology (IT) and information system (IS) professionals constitute one of the largest cadres of knowledge workers (Downey et al. 2008). A number of studies have been conducted to examine the requisite skills and knowledge for IT and IS personnel. With time going by, one of the greatest difficulties confronting IT/IS Professional is adapting to rapid change, which will alter the importance of particular skills for IT professionals and therefore necessitate that frequent updates be performed (Gallivan 2004). More and more researchers think that thriving in such a dynamic environment requires competency in a number of skills, including both the technical and non-technical skills. In addition, some studies have attempted to explain the effects of skills deficiency on job performance. It has been demonstrated that the deficiency in both technical and organizational skills results in lower job performance and that the negative effect of organizational skill deficiency on job performance is severer. There is another stream of research focused on the career paths and the turnover of IT professionals. For example, Joseph et al found that careers of the IT workforce are more diverse than the traditional view of a dual IT career path (technical versus managerial). Joseph et al. (2015) examined how relative pay gap is related to job mobility for male and female IT professionals. Although prior studies provide important insights into the change of the required skills for the related professionals in the IS field, they suffer from an important limitation.

These studies obtained their samples by conducting surveys or extracting the information of job ads from newspapers, or interviewing employees with small sample sizes. Such limitation prevents them from investigating more accurate and abundant characteristics of professionals' skills in large datasets. Fortunately, the advent and exponential growth of social media websites (LinkedIn, Facebook, etc.) have prompted the development of novel approaches to enhance our understanding of the attributes of IT professionals. For example, Ge et al. (2016) explored how the mobility of engineers and scientists depends on their human capital utilizing LinkedIn profiles. Collectively, previous studies outline a critical role of technical and organizational skills for IT professionals. However, nearly no study focuses on investigating the characteristics of skills required for FinTech professionals. Due to the dynamic nature of the IS field and the emergence of FinTech buzz, keeping up with new trends is critical for the related professionals. This suggests a need to evaluate the critical required skills or the previous work experiences for new FinTech workers. Thus, we aim to develop an understanding of the specific characteristics of skills required for FinTech professionals by extracting useful information from Singapore LinkedIn profile data. In this way, we can gain a tremendous size of sample and explore the FinTech jobs-skills fit of financial and information technology professionals.

Education and Training:
The Skill India Digital platform stands as a testament to the transformative power of digital infrastructure in revolutionizing the skilling landscape. Through its remote learning approach and a comprehensive array of services, it not only empowers individuals from diverse backgrounds but also

aligns with the broader goal of creating a knowledge-based economy. We examine its impact on employment opportunities, industry linkages, digital skills training, remote learning, and the issuance of digitally verifiable credentials. The digital technologies envisaged in the transformation of Amrit Kaal include a focus on digital talent development with a focus on new-age courses like coding, AI, robotics, mechatronics, IOT, 3D printing, and drones etc., via the establishment of 30 Skill India International centers and a unified Skill India digital platform is also proposed to enhance skilling development of widespread digital infrastructure and innovation and enhancing electronics manufacturing. The Skill India Digital platform envisions revolutionizing the skilling landscape in India by providing accessible and affordable digital skills training. It aims to bridge the gap between job seekers and employers by offering industry- relevant knowledge and practical skills, thus ensuring that individuals are equipped with the latest knowledge and skills required by employers. The platform's remote learning approach eliminates geographical limitations, allowing individuals from rural areas or smaller towns to gain valuable digital skills. It also offers flexibility, enabling learners to progress at their own pace and convenience, furthermore, the platform aims to aggregate skill initiatives of all government stakeholders, build linkages of skilling with counseling, career guidance, job openings, credit, and social security, thus creating a comprehensive digital platform for skill development. Portal has been launched as a one-stop platform that integrates skilling, education, employment, and entrepreneurship ecosystems to provide a life-long array of services targeting a wide range of stakeholders including Learners, Sector Skill Councils, Knowledge Providers, Content Partners, Training Partners, Skill Centers, Trainers, Assessors, Assessment Agencies, Awarding Bodies and Financial Institutions. The platform recognizes that only some can access traditional educational institutions or afford expensive training, and therefore provides a solution by leveraging technology to bring learning directly to individuals.
[https://ieeexplore.ieee.org/abstract/document/10286715]

The role of startups and Corporates:

The growth and concentration of startups in cities around the world, in what the Economist has referred to as 'a Cambrian moment', has led to a resurgence in popularity for the entrepreneurial ecosystems (EE) and accelerator literatures. Thus far, the EE literature has focused on identifying the core characteristics of such systems and the actors involved, typically seeing EEs as singular entities that can be recognised based on shared characteristics. While many EEs have been identified around the world, the literature has said little about sectoral variations across these ecosystems. Sectoral variations are an increasingly pertinent issue; as EEs grow and develop, they often adopt certain specialisms, and industry literature often identifies them by these specialisms. For instance, Boston has a world-leading EE that focuses on life-sciences and robotics, while London specialises in FinTech (Financial Technology); the types of actors, processes and opportunities involved in these EEs are likely to differ significantly, affecting the locational tendencies and performance of different startups.

This paper focuses on FinTech EEs. FinTech as a 'concept delineates processes and practices at the interface of finance and digital/online information and communication technologies (ICT) which might radically transform or 'disrupt' the nature, or at least the practice, of finance as commonly understood'. As one of the most notable startup subsectors, FinTech has attracted an increasing share of all global venture capital, peaking with 17% in 2018 . FinTech is considered one of the more 'mature' subsectors, having risen significantly in popularity since the global financial crisis (GFC) shocked the traditional finance sector in 2008, and is closely linked to other notable subsectors like Cybersecurity and the rapidly growing Blockchain subsector. FinTech EEs are now a globally widespread phenomena, with a recent industry report identifying 45 FinTech EEs, and sorting them into categories of 'Top 20′ and 'Ecosystems to watch' . The effects of this growth are felt acutely in the traditional finance sector that it is drastically restructuring, with the rise of online 'challenger banks', alternative payments solutions, robo-investing, and cryptocurrencies, amongst others. This relationship with the traditional finance sector is a significant departure from that of startups typically, in that they look to banks and other large financial firms (LFFs) not just for funding in the traditional sense, but as competitors or partners in an industry they are attempting to disrupt. Consequently, this is a significant subsector that operates with fundamental differences to other startup subsectors, and which offers an ideal opportunity to explore sectoral variations in EEs. [https://www.sciencedirect.com/science/article/pii/S0016718521001093]

CHAPTER 2:

Cybersecurity Threats:

Cyber threats encompass a diverse range of malicious activities aimed at disrupting, damaging, or gaining unauthorized access to computer systems, networks, and data. These threats can arise from various sources, including individual hackers, organized crime syndicates, state-sponsored actors, and even insider threats. One prevalent type of cyber threat is malware, which includes harmful software like viruses, worms, trojan horses, and ransomware. Ransomware, in particular, has surged in recent years, with attackers encrypting victims' data and demanding payment for decryption keys. Another significant threat is phishing, a social engineering tactic that deceives individuals into revealing sensitive information such as login credentials or financial details. Phishing attacks have become increasingly sophisticated, often using domain spoofing to impersonate legitimate entities.

The impacts of these cyber threats can be devastating, leading to financial losses, operational disruptions, and long-lasting damage to reputations. According to a 2023 report, global cybercrime costs could reach $10.5 trillion annually by 2025, highlighting the severe economic implications of these threats. To mitigate such risks, organizations must adopt comprehensive cybersecurity strategies. Regular security audits are essential for identifying vulnerabilities while employee training on cybersecurity best practices can significantly reduce the risk of phishing and other social engineering attacks (KnowBe4, 2023). Furthermore, having a clear and tested incident response plan can help minimize damage during a cyber incident (CISA, 2023). As cyber threats continue to evolve, a proactive approach to cybersecurity is crucial for safeguarding digital environments.

Cybersecurity strategies are essential frameworks designed to protect an organization's information systems and data from increasingly sophisticated cyber threats. As cyberattacks become more prevalent, organizations must adopt proactive measures that not only defend against potential breaches but also ensure rapid recovery in the event of an incident. A crucial component of effective cybersecurity is conducting thorough risk assessments, which allow organizations to identify vulnerabilities and prioritize their mitigation efforts based on the potential impact on operations (Mason & Williams 2023). Another key element is a layered security approach, often referred to as defense in depth, which integrates multiple security measures across the IT environment. This includes firewalls, intrusion detection systems, and data encryption, providing comprehensive protection against diverse attack vectors.
[https://airjournal.org/ijafrm/wp-content/uploads/sites/63/2024/11/IJAFRM-5216-30.pdf]

Regulatory Uncertainty:

India's e-commerce future looks promising thanks to rapid tech advancements and shifting consumer behavior. It examines how consumer preferences are evolving due to increased smartphone and internet adoption, pivotal factors driving e-commerce growth. It provides crucial insights for e-commerce businesses, policymakers, and investors looking for lucrative prospects. Understanding this rapidly evolving market empowers stakeholders to make informed decisions and contribute to India’s thriving e-commerce ecosystem. Resulting in all this growth with new trends there is one significant trend which is growing use of mobile commerce. With the widespread availability of smartphones and their convenience, more customers are choosing to shop through mobile apps or websites. Statista predicts that mobile devices will account for 72.9% of e-commerce sales in India. Despite all this growth the industry faces hurdles, notably infrastructure and logistics challenges due to India’s vast geography. Payment systems and security concerns also persist. Building trust and ensuring secure transitions are vital. Understanding consumer preferences is key. Pricing, convenience, product variety, and personalised experiences drive purchasing decisions. Adapting products and marketing to meet these expectations is crucial.

In recent years, global e-commerce has boomed, and India is no exception. Factors like increased internet access, smartphone usage, and government support have fueled India’s e-commerce growth. However,despite its potential, the industry faces significant obstacles.

1. **Limited Internet Access**: Low internet adoption rates in India, particularly in rural areas, restrict the customer base for online retailers
2. **Digital Literacy Gap**: Many Indians lack the computer literacy required for successful online shopping, hindering the growth of e-commerce
3. **Infrastructure and Logistics:** India's logistical and infrastructural challenges, including last-mile delivery issues, lead to delays and increased costs for online retailers.
4. **Payment and Security Concerns**: Concerns about fraud and data breaches deter Indian consumers from providing sensitive financial information online.
5. **Regulatory Complexity**: The complex legal and regulatory framework surrounding e-commerce, including taxation and foreign investment rules, adds operational complexity.
6. **Intense Competition**: The highly competitive e-commerce market in India requires businesses to differentiate themselves, offer competitive pricing, and deliver superior customer experiences
7. **Supply Chain Management**: Efficient supply chain management, including inventory control and quality management, is crucial for e-commerce success in India (Agarwal and Dixit, 2017). Indian e-commerce businesses face these challenges, but strategic planning, collaboration, and technological advancements can help them overcome these obstacles and tap into the market's enormous potential for economic growth and development.
   [https://journal.formosapublisher.org/index.php/fjst/article/view/6152]

Digital Divide:

The digital divide is the gap between those who have access to internet, technology, and digital literacy training and those who do not. Just as the globalization of technology and digital society reshaped the world, the digital divide added a new dimension to the persisting global socioeconomic divide. Addressing the digital divide has become a global concern due to the significant role that technological progress and techno-consumption play in the global political economy. Bridging the digital divide is beneficial for businesses because the marketplace is online, and, in this case, having more online customers is profitable. There are three levels of analysis of the policy and managerial implications of the digital divide.At the individual level, the “digital divide” refers to a lack of access to IT due to technological, sociological, and economic disadvantages. The gap exists between individuals who have access to IT as an integral part of their lives and those who do not. Access to technology also varies across geographical areas. For instance, rural areas have poor access to the Internet. Social group or class, The digital divide between higher and lower castes is a socio-technical issue that highlights how higher castes tend to be more affluent and digitally advanced than lower castes. The class or socioeconomic gap is vast in Indian society; therefore, the digital divide is a kind of extension of the prevailing divide. The digital divide in India cannot be analyzed as a single issue. Considering that pre-existing socioeconomic divides is also important, India is characterized by various socioeconomic divides, such as caste stratification, the rural-urban divide, capability inequality, and class disparity. Dalits are considered to be the lowest stratum of caste groups in India, whose social and economic position is much worse than that of any other population in India. India's rural areas are still highly under-resourced and poorly managed compared to its urban areas, which are much more developed and technologically advanced.

The economic situations of individuals and social groups are based on their occupations. In any society, people maintain two kinds of economic bases: job/work and skills. India has a serious issue with work opportunities due to a lack of skills or poor technical skills. In contemporary society, static skills are no longer relevant; individuals need to continuously upskill themselves to survive in the competitive market. Unfortunately, the low attainment of education is a problem, resulting in a limited number of technically skilled laborers. Therefore, digitalization may not be able to bring about significant changes in the working conditions and overall economy of manual workers (India Skills Report, 2021).India's employment trend is largely informal, with a large percentage of the workforce engaged in informal jobs. This informal workforce in India encompasses individuals working in private enterprises, daily wage laborers, domestic helpers, and manual laborers in the formal sector who work without any socioeconomic security or benefits. The total population employed in India is 461.52 million, of which 415.23 million have informal jobs. Of the total number of people employed, 90% of men and 92% of women are informally employed. The education of workers in the informal sector is low. Educational attainment is also low among domestic laborers, street vendors, sweepers, and manual construction workers. Of these workers, over 60% of women and 35% of men had dropped out of primary school.
[https://www.frontiersin.org/journals/sociology/articles/10.3389/fsoc.2023.1145221/full]

Scalability and Interoperability:
Fintech innovations have significantly transformed the landscape of financial modeling, particularly in predictive analytics. Predictive financial modeling relies on sophisticated algorithms and vast datasets to forecast future financial outcomes, trends, and risks. Traditionally, financial institutions used statistical models and historical data to make such predictions. However, with fintech technologies like artificial intelligence (AI), machine learning (ML), and blockchain, the accuracy, efficiency, and scope of predictive modeling have greatly expanded. These technologies enable deeper insights into financial markets and enhance decision-making processes across various sectors, from banking and investment to

insurance and risk management. ML, a subset of AI, furthers predictive modeling by allowing models to learn and improve over time. ML algorithms can continuously refine predictions based on new data, making them highly adaptable in dynamic financial environments (Cao, Yang, & Yu, 2021). For instance, ML models can predict stock prices, credit risks, and market trends with increasing accuracy as they are exposed to more data. This ability to "learn" from data makes ML indispensable for developing predictive financial models that respond to rapidly changing market conditions Blockchain technology is also critical in fintech's contribution to predictive financial modeling. By providing a decentralized, transparent, and immutable ledger, blockchain ensures the integrity of financial data. In predictive modeling, the accuracy and reliability of data are paramount, and blockchain's ability to securely store and verify data without the risk of tampering enhances the credibility of the models. Additionally, blockchain can facilitate secure data sharing between institutions, fostering collaboration and improving the quality of predictions. Advanced data analytics tools, another cornerstone of fintech innovation, enable financial institutions to process and interpret large datasets in real time. These tools utilize big data analytics to extract insights from unstructured data, such as social media trends, economic indicators, and consumer behaviors. By incorporating these insights into predictive models, fintech solutions allow for more holistic and nuanced financial forecasts.

In financial analytics, fintech innovations have enabled the development of tools that can analyze vast amounts of data from various sources and produce actionable insights in real time. This is particularly valuable for risk management, where institutions must assess potential risks quickly and take preemptive actions. AI-driven analytics can identify patterns of fraudulent behavior or detect anomalies in financial transactions, providing early warnings and reducing exposure to financial risks. Forecasting has also seen substantial improvements with the integration of fintech. Traditional financial forecasting methods were often based on historical data and linear models, which struggled to account for the complexities and volatility of modern financial markets. In contrast, fintech-driven predictive models can process real-time data and adjust their forecasts based on current market conditions. This has led to more accurate and timely predictions, enabling institutions to capitalize on market opportunities and mitigate risks more effectively. Olorunyomi, Okeke, Ejike, & Adeleke, P. No.2357-2370 Page 2359 Computer Science & IT Research Journal, Volume 5, Issue 10, October 2024 Decision-making in financial institutions has become more data-centric due to fintech innovations. Predictive models powered by AI and ML provide decision-makers with more comprehensive insights into market dynamics, allowing them to make informed choices about investments, lending, and asset management. Additionally, fintech innovations have introduced automation into decision-making processes, where AI algorithms can autonomously execute trades or adjust portfolios based on predefined criteria. This level of automation increases efficiency and reduces human error in critical financial decisions.

[https://www.researchgate.net/profile/Adams-Adeleke-2/publication/385137525_Using_Fintech_innovations_for_predictive_financial_modeling_in_multi-_cloud_environments/links/6718073403591754c15e372/Using-Fintech-innovations-for-predictive-financial-modeling-in-multi-cloud-environments.pdf]

Chapter 3 RESULT
KEY LEARNING:

To address the growing risk of cybersecurity threats, organizations adopt a multi-layered defense strategy Ongoing monitoring and employee education A cybersecurity plan should advanced includes robust firewalls, intrusion detection systems, advanced threat detection tools that proactively identify and mitigate risks Security audits are performed regularly, Vulnerability assessments are also essential to ensure systems remain protected against ongoing threats. Organizations should also invest in employee training programs to increase awareness of phishing and social engineering techniques. Additionally, having a well-defined incident management plan allows for faster recovery and less damage from cyber incidents. Collaborating with cybersecurity experts and complying with regulatory guidelines such as the General Data Protection Regulation (GDPR) or ISO standards strengthens security By maintaining a proactive posture and fostering a cyber-friendly culture security awareness has improved, companies can protect their digital ecosystems from the increasing number of cyberattacks

For the challenges faced by India's e-commerce sector, innovative solutions rooted in technological advancements and strategic collaboration are essential. Addressing infrastructure gaps requires investment in last-mile logistics networks and the integration of emerging technologies like drones and automated delivery systems. Expanding digital literacy through community outreach programs and affordable internet access initiatives can bridge the digital divide, enabling more consumers to engage with e-commerce platforms. To tackle payment security concerns, e-commerce companies must adopt end-to-end encryption, secure payment gateways, and user-friendly interfaces that build trust among customers. Streamlining regulatory frameworks and fostering public-private partnerships can create a more conducive environment for e-commerce growth. Additionally, leveraging data analytics and AI can enable businesses to understand consumer preferences better, personalize offerings, and optimize supply chain management. By implementing these solutions, India’s e-commerce industry can overcome its challenges and unlock its vast potential for economic development.

In my paper titled "Critical Analysis of How Fintech is Shaping the Future of India", I examine the transformational effects of financial technology on the Indian economy and financial system. I explore how innovations such as UPI, blockchain and digital wallets have revolutionized banking and financial transactions, making them more accessible and inclusive. I explore how fintech addresses financial literacy challenges and promotes financial equity, especially for underserved populations. I also highlight the importance of government initiatives like Digital India and Startup India to promote fintech growth, and also discuss challenges such as cybersecurity threats, complex regulations and the need for entrepreneurs who are skilled in this rapidly growing industry. I also examine how emerging technologies, including AI, big data and cloud computing, are reshaping traditional financial services. My paper highlights how fintech is not only disrupting traditional banking but also creating a dynamic ecosystem that drives India’s economic future.

Chapter 4 Conclusion and Discussion

In the rapidly evolving landscape of financial services, Financial Technology (Fintech) has emerged as a transformative force, reshaping the future of banking services. This review paper provides a comprehensive analysis of the role of Fintech in revolutionizing traditional banking practices, exploring its impact on customer experiences, financial inclusion, regulatory frameworks, and the overall trajectory of the banking industry. The review begins by tracing the historical evolution of Fintech and its intersection with traditional banking.

It delves into the disruptive technologies driving Fintech innovation, including blockchain, artificial intelligence, and mobile applications, and their transformative effects on the efficiency, accessibility, and scope of banking services.It explores how Fintech has democratized financial services, enabling broader access to banking solutions and fostering financial inclusion, particularly in underserved populations. The regulatory landscape is a critical focus of this review, examining how authorities are adapting to the dynamic nature of Fintech. The paper concludes by forecasting the future trajectory of banking services in the era of Fintech dominance. It discusses the potential impact on job roles, business models, and the overall stability of the financial system, emphasizing the imperative for continuous adaptation and collaboration in this dynamic ecosystem. [https://www.researchgate.net/profile/Hari-Prasad-Josyula/publication/378902248_THE_ROLE_OF_FINTECH_IN_SHAPING_THE_FUTURE_OF_BANKING_SERVICES/links/65f0b406286738732d3ac008/THE-ROLE-OF-FINTECH-IN-SHAPING-THE-FUTURE-OF-BANKING-SERVICES.pdf]

The traditionally cash-driven Indian economy has responded well to the fintech opportunity, primarily triggered by a surge in e-commerce, and smartphone penetration. The transaction value for the Indian fintech sector is estimated to be approximately USD 33 billion in 2016 and is forecasted to reach USD 73 billion in 2020 growing at a five-year CAGR of 22 percent. India’s growth wave may still not be of the scale when viewed against its global counterparts, but it is stacked well, largely due to a strong talent pipeline of easy-to-hire and inexpensive tech workforce. [https://assets.kpmg.com/content/dam/kpmg/pdf/2016/06/FinTech-new.pdf] One of the primary growth drivers in the Indian fintech market is the widespread adoption of digital payments. The government’s push of financial inclusion through initiatives like Unified Payments interface (UPI) has led to a surge in digital transactions. Fintech companies are capitalizing on this trend by offering innovative payments solutions that cater to the diverse needs of consumers and businesses alike. From mobile wallets to peer-to-peer payment platforms, fintech firms are revolutionizing the way transactions are conducted in India, driving financial inclusion and boosting economic growth. [https://www.persistencemarketresearch.com/market-research/india-fintech-market.asp#:~:text=India%20Fintech%20Market%20Outlook,by%20the%20end%20of%202031.]

The RBI of Reserve Bank of India has adopted a range of strategies to strengthen the banking system. These include introducing differentiated banking licenses, simplifying norms related to KYC, and promoting mobile banking. MFIs play a crucial role in offering credits to low-income households and small businesses. The government should encourage the growth of MFIs by providing them with access to funding at lower costs and promoting partnerships between micro-finance institutions and banks.

CHAPTER 5: REFERENCES

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