

## 5G Technology and Future of Banking

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### Abstract

*This study examines the effects of developments in communication technologies on the banking sector and banking services. In addition, it is envisioned how 5G technology will shape the future of the banking industry. As a result of the analysis, it has been observed that an important innovation and structural transformation period was lived in the banking sector with the use of 3G and before 2000, which we define as traditional banking era. It is concluded that with the expected wide use of 5G technology after year 2022, the banking sector is expected to enter a new and disruptive restructuring and service innovation.*

**Keywords:** Banking services, future of banking sector, 5G technology, financial innovations.

### 1. Introduction

This study intends to review telecommunication technologies starting 1970s (1G technology) through 2020s (5G technology) and analyze the expected effects of 5G technology on the future of banking sector. The study is conducted by having a comparative review of digital technology developments in the last 50 years.

The research design of this study covers the relationship between the advancements in telecommunication technologies and the future of banking sector. The following section compares the 1G-2G-3G-4G-5G technologies. The next section analyzes the effects of the technological changes on the banking sector from traditional banking era to digital banking. The following part specifically explains the innovative changes of 4G on the banking services. Later section tells the expected and destructive changes on banking sector through the extended use of 5G. The final section concludes the expected effects of 5G on the future of banking sector.

### 2. Background

Technological developments in mobile telecommunications have evolved immensely after the transition from analog technologies that were widely used in 1980s to digital technologies connecting to globe with wireless cellular technologies.

The first commercial automated mobile network is known as the first generation (1G). It was first implemented by the Nippon Telegraph and Telephone Company in Tokyo and spread throughout Japan in 1979. This system, which could not provide a service other than a bad sound quality (security problem, lack of connection between different operators, coverage limits, etc.), had a great development potential in technology although it was a very expensive system (limited number of users). (Woodland, L. 2021)

Described as the second generation, 2G emerged in Finland in 1991 and was named Global System for Mobile Communication (GSM). 2G, which increases the bandwidth by 7 times and allows multi-media communication (SMS and image) apart from just voice transmission, made it more widely available for users.

3G technology was first introduced in 2001 by the NTT company. 3G had a number of significant innovations. It emerged as a system that has 140 times increased bandwidth, has internet connection, can define single network protocol (switch among network providers), provides multi-media sharing, allows choosing different data packets, and can provide international roaming services. Streaming, video conferencing (Skype) and location-based services began to be provided with 3G enabling mobile phones to serve as small and simple computers, and gave a big rise to the smartphones (iPhone, Blackberry) market.

4G Long Term Evolution (LTE) was first introduced in Sweden in 2009. By increasing the bandwidth 200 times, 4G provided high quality data flow, and made it possible to use of smartphones as mobile computers. (Place, et al. 2014). It was implemented by Samsung and the speed record was broken in the test environment. In November 2016, Samsung announced that they had successfully completed a 5G prototype trial in collaboration with the China Mobile Research Institute (CMRI). With the transmission of high-size data with low latency, internet-of-things (IoT) became possible. While 5G acts as the skeleton to connect these devices, major breakthroughs are expected in the fields of smart home, autonomous vehicles, smart transportation, smart agriculture and smart cities. With the increase in data transmission speed, the necessary processor capacity for virtual reality and augmented reality applications will be provided by cloud technologies, thus this processing load will be removed from mobile devices. This service has already started to be offered to customers in the USA, Switzerland, China, Japan and South Korea is expected to spread to the whole world in the next a few years. (Samsung, 2016)

Table 1 summarizes the evolution of telecommunication technologies from the first generation (1G) to the fifth generation (5G) by comparing standards, technologies, hardware and services.

**Table 1: Advancements in Telecommunication Technologies**

Features	1G	2G	3G	4G	5G
Evolution	1970	1980	1990	2000	2016
Deployment	1979	1991	2001	2010	2019
Data Bandwidth	1.9 kbps	14.4 kbps	2 Mbps	200 Mbps	100 - 200 Gbps
Standards	AMPS	TDMA, CDMA, GSM, GPRS, EDGE, 1xRTT	WCDMA, CDMA-2000	LTA, WiMAX	Not defined yet
Technology	Analog Cellular Technology	Digital Cellular Technology	Broadband, CDMA, IP technology	Undefined IP and seamless combination of broadband. LAN/WAN/PAN/WLAN	Undefined IP and seamless combination of broadband. LAN/WAN/PAN/WLAN
Service	Mobile Telephone (voice only)	Digital Voice, SMS, Data	Integrated high quality audio, video and data	Dynamic information access, wearable devices	Dynamic information access, wearable devices with AI capabilities
Multiplexing	FDMA	TDMA, CDMA	CDMA	CDMA	CDMA
Type of	Circuit	Circuit and Packet	Packet	Packet	Packet
Core Network	PSTN	PSTN	Packet Network	Internet	Internet
Handsoff	Horizontal	Horizontal	Horizontal	Horizontal and Vertical	Horizontal and Vertical

Source: <https://www.Verizon.Com/About/Our-Company/5g/Difference-Between-3g-4g-5g>, Hussain, et al. (2016), Mukhopadhyay, et al. (2016). <https://flipshope.com/blog/1g-vs-2g-vs-3g-vs-4g-vs-5g-comparison-differences/>

AMPS is Advanced Mobile Phone System, TDMA is Time-Division Multiple Access, CDMA is Code-Division Multiple Access, GSM is Global System for Mobile, GPRS is General Packet Radio Service, EDGE is Enhanced Data Rates for GSM Evolution, WCDMA is Wideband Code Division Multiple Access, LTA is Line Turnaround, WiMAX is Worldwide Interoperability for Microwave Access, IP is Internet Protocol, LAN is Local Area Network, WLAN is Wireless Local Area Network, FDMA is Frequency Division Multiple Access, PSTN is Public Switched Telephone Network.

5G is an indispensable part of digital technology ecosystem where the components are all interdependent to each other. This digital ecosystem is expected to shape and transform all industries by providing huge computing power, internet of things, blockchain, 5G networks, artificial intelligence, cloud computing and big data. Enhancements of 5G technology may be summarized as follows: (see Table 2)

**Ultra-reliable ultra-low latency rates** are critical especially for industrial IoT (B. Bertenyi, 2021) with ultra-low latency rates (less than 10 milliseconds).

**Time-sensitive networking (TSN) and time-sensitive communication (TSC)** support simultaneous communication through multiple channels with high reliability and availability. (Kang, 2021)

**Advanced and improved machine learning (ML) and artificial intelligence (AI)** enable advancements in vertical industries where communication between devices and machine-to-machine learning is critical (massive IoT).

**Private networks** help to create superior reliability by higher authentication standards and neutral host models for fully isolated networks enabling authorized users to log on to.

**Faster download speed** provides more coverage and higher quality internet service compared to Wi-Fi system.

**Device enhancements** increases user experience, extensive connectivity through a number of devices with improvements in battery lives.

**Table 2: Enhancements of 5G**

Enhancements of 5G	Explanation
Ultra-Reliable Ultra-Low Latency Rates	<ul style="list-style-type: none"> <li>✓ critical especially for Industrial IoT</li> <li>✓ ultra-low latency rates that are less than 10 milliseconds</li> </ul>
Time-Sensitive Networking (TSN) and Time-Sensitive Communication (TSC)	<ul style="list-style-type: none"> <li>✓ supports simultaneous communication through multiple channels with high reliability and availability.</li> </ul>
Massive Internet of Things (IoT)	<ul style="list-style-type: none"> <li>✓ advanced and improved machine learning and artificial intelligence tools enable advancements in "Vertical Industries" where communication between devices and machine-to-machine learning is critical.</li> </ul>
Private Networks	<ul style="list-style-type: none"> <li>✓ higher authentication standards and neutral host models</li> <li>✓ superior reliability and fully isolated networks enable only authorized users to log in</li> </ul>
Faster Download Speeds	<ul style="list-style-type: none"> <li>✓ more coverage than Wi-Fi providing higher-quality internet service</li> </ul>
Device Enhancements	<ul style="list-style-type: none"> <li>✓ improvements in device battery life capacity increases user experience</li> <li>✓ extensive connectivity and number of devices on 5G ecosystem</li> </ul>

Source: Kang, et al, (2021), Dahlman, et al, (2019), Cisco (2021), <https://www.cisco.com/c/en/us/solutions/what-is-5g/what-are-5g-speeds.html#~:benefits-of-5g-technology>

### 3. Developments on Banking Sector

The rapid changes in the field of telecommunication have led to rapid changes in the organizational and service structure in the banking sector. The most innovative of these changes for the banking sector was seen after 2000 when 3G technology began to be widely used and 4G technology became widespread after 2010. With the expectation that 5G technology will be widespread in the world as of 2022, there will be disruptive changes in the banking sector.

In accordance with the purpose of this study, the near history of banking services is divided under three sub periods. The first period covers the years before 2000 and is named traditional banking era. The later period is defined as 3G-4G banking era and covers a period of 2000-2022. The last period is called 5G banking era for a period of 2022 and thereafter. (see Table 3)

Before year 2000, the banking sector may be located in the traditional banking era where the banks are people focused, organizations rely on human capital for operations and sales, working hours are limited for banking services, transaction fees are high. These make banking operations expensive and out-of-reach for many people. The most important innovations in this era are credit cards and ATMs (Akın, F. 2020).

The 3G-4G period, on the other hand, can be defined as a period in which important structural transformations are experienced in the banking sector. While a significant part of banking transactions is carried out with digital systems instead of personnel, the servicing hours has started to be defined as 7X24, that is beyond the daily working hours.

While cyber security came to the fore, the most innovative products in this period are digital accounts, IBAN, cryptocurrencies and mobile banking. As seen in Table 4, this era brought mobile banking, digital payments, more branches and availability enabling more customers to have access to banking system. As the use of mobile banking increased, the need of holding cash for making payments critically decreased. Mobile banking proved to be convenient, accessible, and secure, especially during Covid-19 pandemic where the adoption of mobile banking applications significantly increased (Schindler, 2021).

While the preparation for the 5G era still continues, the expected changes in the banking sector are the Gait analysis based on biometric data, digital wallet, wearables-VR-voice-based banking transactions, remote-VR branches and robot personnel services.

**Table 3: Comparison of Developments in Banking Features**

Features	Traditional Banking Era (Before 2000)	3G-4G Banking Era (2000 - 2022)	5G Banking Era (2022 - Onwards)
<b>Principle Services</b>	Treasury Management Retail & SME Banking Trust / Wealth Management Mortgage Insurance Saving Accounts	Mobile Banking Digital Payment SWAPs Near Field Comm. Tech (NFC) Personal Investments Customer Experience	Chatbots Remote Service Centers Data Protection Video Communication Digital Wallets App Programing Interface (API) Mng
<b>Availability</b>	Working Hours (09.00-17.00)	Extended Working Hours 7 days - 24 hours for Online Banking	Nonstop banking hours
<b>Transactions/ Products</b>	Accounts Checks Loans Savings/Retirement Plans Paying Bills Risk Management	Online Payments (Bills, etc..) Electronic Fund Transfer (EFT) Personal Finance Personel Loans Insurance Wealth Management Risk & Compliance	One-touch Payment Hands-Free Transactions (by speech to text) On-the-go Bill Payment (by wearables) Single-level Authentication (Touch-ID)
<b>Organization</b>	Banking Personnel Oriented	Branch (Sales & Marketing) Mobile (Product Management) Oriented	ITC Personnel & Robot Oriented
<b>Fraud Detection</b>	Personal ID Cards	PIN Codes SMS Mobile Phone Pairing Facial Recognition	Gait Analysis (biometric recognition)
<b>New Products</b>	ATMs ATM Cards Credit Cards	Mobile Branch International Bank Account Number (IBAN) Digital Accounts Customer Services Dept. Cryptocurrency	Digital Deposit Apps Advanced ATMs Photo Bill Payment Apps Virtual Meetings Smart Scanners (Credit Card, Cheques) Instant Settlements (Blockchain)
<b>Bank Revenue Streams</b>	High Transaction Fees New Account Fees	Credit Card Fees Transaction Fees ATM Fees Money Transfer Fees	Smart Personal Wealth Management Robo Advisors Data Processing Personal Policy Recommendations

Source: statrys.com, Tian, et al. (2019)

**Table 4: 3G-4G Technology and Enhancements in Banking Services**

Services	Actions
<b>Accounting Information</b>	1. Mini-statements and checking of account history
	2. Alerts on account activity or passing of set thresholds
	3. Monitoring of term deposits
	4. Access to loan statements
	5. Access to card statements
	6. Mutual funds / equity statements
	7. Insurance policy management
<b>Transactions</b>	1. Funds transfers between the customer's linked accounts
	2. Bill payments and third-party fund transfers
	3. Check Remote Deposit
<b>Investments</b>	1. Portfolio management services
	2. Real-time stock
<b>Support</b>	1. Status of requests for credit, including mortgage approval, and insurance coverage
	2. Check (cheque) book and card requests
	3. Exchange of data messages and email, including complaint submission and tracking
	4. ATM Location
	5. Loan Application
<b>Content Services</b>	1. General information such as finance related news
	2. Loyalty-related services

Source: Adapted from Turkish Banking Association (TBA) reports

#### 4. 5G and Future of Banking

5G banking featuring video communication, data protection and digital wallets are expected to create a permanent shift for banking customers and their habits. Globally, bank customers have been adopting to digital apps as their primary

touchpoint for their banks and this transformation will expectedly change the structure of bank branches as well as financial services industry.

As the coverage and 5G enabled device usage increase, some of its effects on banking and financial services are projected as below (Khrisna, 2017; Tian, 2019);

- Extended reality - help customers understand banking transactions, visualize paper statements so they can easily understand, and manipulate and simulate what-if scenarios.
- Embedded high-quality video and interaction services - help conduct regulated activities such as financial advice and secured lending in-app replacing lengthy face-to-face interactions.
- Sensors in homes, vehicles and offices - create highly personalized and real-time insurance offerings.
- Branch remodeling - connect existing in-branch devices such as ATMs, Kiosks, and CCTV cameras.

Banks will soon have a much richer understanding of footfall, services being delivered, the utilization and design of spaces and adherence to security and safety protocols.

Developed and supported with 5G technology and complementary digital ecosystem improvements, potential expected impacts of 5G on financial services can be summarized as below;

- ✓ Accelerated mobile commerce growth
- ✓ Shopping while watching a video, in-video commerce
- ✓ AR/VR enabled shopping experience, commerce growth
- ✓ Better and more timely geo-targeted offers
- ✓ Highly personalized customer experience, digital customer engagement
- ✓ Time-sensitive banking applications
- ✓ Improved fraud prevention
- ✓ Enhanced mobile POS transactions and utilization
- ✓ Wider financial system inclusion in emerging markets

5G will introduce higher bandwidths and ultra-low latency that will enable mobile commerce to have faster transactions, users to have seamless video experiences that will help customer connect with their “bankers” anywhere and improved AR/VR integration into financial and monetary transactions including wireless electronic check deposits, retail banking and mobile commerce.

Banking and financial services sector is called as among the top five industries that will be affected by 5G adoption and will have a good sectoral contribution to GDP growth in the next 5 years. According to Statista, by use of 5G, sectoral contribution to US GDP next 10 years may be more than 1.2 trillion USD.

## 5. Conclusion

3G and 4G brought a lot of changes for banking and financial services industries. The use of alternative and digital channels significantly increased as customers adopted to technological developments and internet coverage. Traditional banking distinctions such as low interest rates, high loaning capacity, proximity and capital structure became secondary values as regulatory bodies set new industry standards and technological innovations enabled new value added services. 5G is expected to carry the banking industry to another level where automation and machine-to-machine communication act as a game changer. Low-latency rates will bring a superior speed to recognition, identification, evaluation, approvals/rejections and banking transactions. High digital security will decrease the risk of fraud, automate regular processes such as loan evaluation and credit tracking. Bank branches will be forced to change the form, employment and organizational structure. Robots will extensively be used for automated divisions. Traditional tellers will be replaced with information technology officials.

Paperless operations will replace the traditional paperwork, and transactions will be monitored digitally leaving digital trace marks. Cash usage will be minimized, and the use of digital tokens, credit cards and cryptocurrencies will escalate. New players will emerge as financial services operators are compatible with FinTech developments. Banking regulations will change including digital transactions and video-based interviews for loan officers. “The Bankers” will be replaced mostly with artificial intelligence and smart machinery. In summary, 5G is expected to connect everything faster, more secure and more reliable.

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