Foundations of FinTech

Banking

Eshwar Venugopal

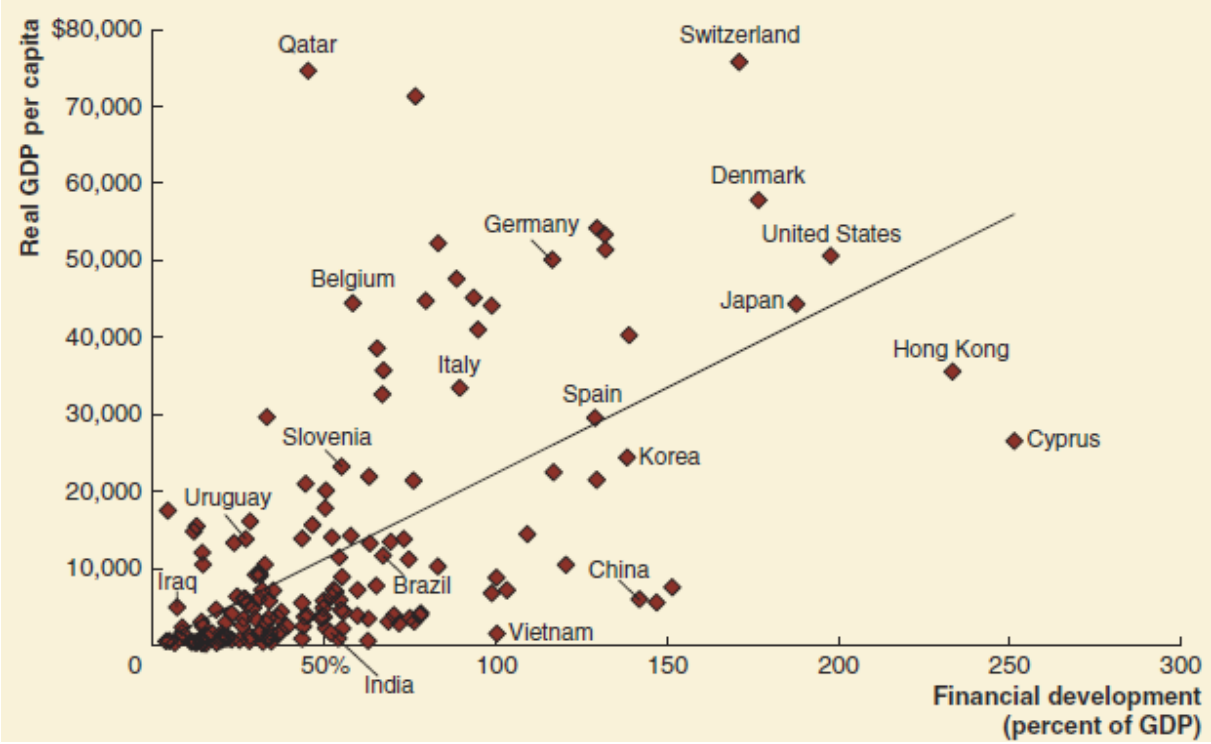
UCF

Why is banking important?

And by extension the financial system…

Why is banking important?

- Factors that determine a country's standard of living include:
  - The ability of businesses to accumulate physical capital
  - The ability of businesses to adopt the latest technology
  - The ability of the government to provide a legal framework that protects property rights and enforce contracts
- A strong financial system can be essential for robust economic growth required for a rising standard of living.
  - Countries with higher levels of financial development tend to have higher levels of real GDP per capita.
  - See the flow of funds: https://www.newyorkfed.org/research/blog/2019_LSE_Markets_Interactive_afonso



Source: World Bank Development Indicators

Imagine a World Without Banks

- This is not just an academic exercise; many former eastern-block nations faced this situation when they began to create financial markets and develop market-oriented banks and other financial institutions.

- If there were no banks…
  - Where would you go to borrow money?
  - What would you do with your savings?
  - Would you be able to borrow (save) as much as you need, when you need it, in a form that would be convenient for you?
  - What risks might you face as a saver (borrower)?

What economic function do banks serve?

Banks channel excess capital from people who are not using them to people who need capital.

- Banks play an important role in channeling funds (about $10 trillion annually) to finance investment opportunities.
  - See Table 2 on https://www.federalreserve.gov/releases/h8/current/
- They provide loans to businesses, finance college educations, and allow us to purchase homes with mortgages.
- They provide specialized financial services, which reduce risks and the cost of obtaining information about both savings and borrowing opportunities.

Banks intermediate!

What economic function do banks serve?

Bank intermediation addresses three fundamental issues: Information Asymmetry, Adverse selection & Moral Hazard

- All financial markets have a certain level of information asymmetry: a borrower knows more than the bank about his business and the effort he is willing to expend to repay the loan.
- Such a scenario will lead to "adverse selection".
  - If the lender is unable to distinguish between a good and bad deal, he is going to offer strict terms that only bad borrowers will agree to.
  - This is called the *lemons problem*. (George Akerlof received the 2001 Economics Nobel prize for this).
- How to reduce adverse selection?
  - Relationship banking allows bankers to collect private information about borrowers.
  - Securitization is the process of bundling loans into securities to be sold in the financial markets.
  - Securitization moved banks to an *originate-to-distribute* model and increased adverse selection issues.

What economic function do banks serve?

- Information asymmetry can also lead to "moral hazard" (i.e., principal-agent problem)
  - The borrower may take excessive risk using the lender's funds.
  - If the risk pays off, the borrower gets to keep the gain.
  - But if it fails, the lender losses his investment and the borrower has lost nothing.
- Public companies are required to disclose information and CEO salaries are tied to performance to overcome moral hazard issues.
- Unchecked adverse selection and moral hazard can lead to extreme credit rationing.

What economic function do banks serve?

- Diversification: Help investors diversify their risk by pooling money and investing in numerous projects. This way, both the banks and investors are diversified. Pooling money also serves as a form of mutual community insurance and provides better bargaining power for the investors (a small lender has less power compared to a large one)
- Perform due diligence
- Provide payment systems: more than 95% of cash in the US is in the form of digital entries with banks
- Reduction in transaction costs through economies of scale and scope: It would be very difficult for us as individuals to setup up the infrastructure for payments. Since banks pool resources and share it across services, they are better equipped to run more than one line of product.

- *Which of the above economic functions can "crowd-financing" can solve?*

How do banks work?

- Banks operate by borrowing funds-usually by accepting deposits or by borrowing in the money markets.
- They then use those deposits and borrowed funds (liabilities of the bank) to make loans or to purchase securities (assets of the bank).
- This process is called **Asset Transformation**
- Banks tend to “borrow short and lend long” (in terms of maturity).

How do banks work?

- T-account Analysis:
  - —Deposit of $100 cash into First National Bank

First National Bank			
Assets		**Liabilities**	
Required reserves	+$10	Checkable deposits	+$100
Excess reserves	+$90		

How do banks work?

- $10 of the deposit must remain with the bank to meeting federal regulations.
- Bank is free to work with the $90
- The bank loans the $90 to a small business
- Employees of the small business turn around and deposit their paychecks in FNB…

How do banks work?

- June 2016 snapshot of the balance sheet for the entire U.S. commercial banking industry.
- Deposits - checking, savings, money market deposit accounts, and time certificates are the major source of funds.
- Most common uses of these funds are to make real estate and commercial and industrial loans.
- Individual banks' asset and liability composition may vary widely from the industry figures, because some institutions provide specialized or limited banking services.

Assets (uses of funds)			**Liabilities + Bank capital (sources of funds)**			
		(% of total assets)			**(% of total liabilities plus capital)**	
Reserves and other cash assets		10.6%	Deposits			74.8 %
Securities		22.0	Checkable deposits		12.1	
U.S. government	4.4		Non-transaction deposits		62.7	
Mortgage-backed securities (MBS)	12.5		Small-denomination time deposits (CDs less than $100,000) plus savings deposits	56.2		
State and local government and other securities	5.1					
Loans		58.8				
Commercial and industrial	12.3		Large-denomination time deposits (CDs greater than $100,000)	6.5		
Real estate (including mortgages)	29.1					
Consumer	9.7		Borrowings			8.2
Interbank	1.2		From banks in the U.S.		0.5	
Other loans	6.5		Other borrowings		7.7	
Trading assets		1.1	Other liabilities			4.3
Other assets		7.5	Bank capital (or shareholders' equity)			12.7

Source: Federal Reserve Statistical Release

Principles of Bank Management

Banks must manage their assets and liabilities. The banks have four primary concerns:

1. Liquidity management
2. Asset management
   - Managing credit risk
   - Managing interest-rate risk
3. Liability management
4. Managing capital adequacy

Principles of Bank Management

Scenario 1

Liquidity Management

Reserves requirement = 10%, Excess reserves = $10 million

Assets		Liabilities	
Reserves	$20 million	Deposits	$100 million
Loans	$80 million	Bank capital	$ 10 million
Securities	$10 million		

Principles of Bank Management

Deposit outflow of $10 million

Assets		Liabilities	
Reserves	$10 million	Deposits	$90 million
Loans	$80 million	Bank capital	$10 million
Securities	$10 million		

- With 10% reserve requirement, bank still has excess reserves of $1 million: no changes needed in balance sheet

Liquidity Management

Scenario 2

No excess reserves

Assets		Liabilities	
Reserves	$ 0	Deposits	$90 million
Loans	$90 million	Bank capital	$10 million
Securities	$10 million		

- With 10% reserve requirement, bank has $9 million reserve shortfall

Liquidity Management

1. Borrow from other banks or corporations

Assets		Liabilities	
Reserves	$ 9 million	Deposits	$90 million
Loans	$90 million	Borrowings from other banks or corporations	$ 9 million
Securities	$10 million	Bank capital	$10 million

2. Sell securities

Assets		Liabilities	
Reserves	$ 9 million	Deposits	$90 million
Loans	$90 million	Bank capital	$10 million
Securities	$ 1 million		

Liquidity Management

3. Borrow from Fed

Assets		Liabilities	
Reserves	$ 9 million	Deposits	$90 million
Loans	$90 million	Borrowings from the Fed	$ 9 million
Securities	$10 million	Bank capital	$10 million

4. Call in or sell off loans

Assets		Liabilities	
Reserves	$ 9 million	Deposits	$90 million
Loans	$81 million	Bank capital	$10 million
Securities	$10 million		

- Excess reserves are insurance against above 4 costs from deposit outflows

Asset Management

- Asset Management: the attempt to earn the highest possible return on assets while minimizing the risk.
  1. Get borrowers with low default risk, paying high interest rates
  2. Buy securities with high return, low risk
  3. Diversify
  4. Manage liquidity

Liability Management

- Liability Management: managing the source of funds, from deposits, to CDs, to other debt.
  1. No longer primarily depend on deposits
  2. When they see loan opportunities, they borrow or issue CDs to acquire funds
- Most banks manage this via the *asset-liability management (ALM) committees.*

Capital Adequacy Management

Bank capital is a cushion that prevents bank failure. For example, consider these two banks:

High Capital Bank

Assets		Liabilities	
Reserves	$10 million	Deposits	$90 million
Loans	$90 million	Bank capital	$10 million

Low Capital Bank

Assets		Liabilities	
Reserves	$10 million	Deposits	$96 million
Loans	$90 million	Bank capital	$ 4 million

Capital Adequacy Management

- What happens if these banks make loans or invest in securities (say, subprime mortgage loans, for example) that end up losing money?
- Let's assume both banks lose $5 million from bad loans.

Capital Adequacy Management

- Impact of $5 million loan loss

High Capital Bank

Assets		Liabilities	
Reserves	$10 million	Deposits	$90 million
Loans	$85 million	Bank capital	$ 5 million

Low Capital Bank

Assets		Liabilities	
Reserves	$10 million	Deposits	$96 million
Loans	$85 million	Bank capital	−$ 1 million

- A bank maintains reserves to lessen the chance that it will become insolvent.

Capital Adequacy Management

Why don't banks want to hold a lot of capital?

- Higher is bank capital, lower is return on equity
  - *ROA* = Net Profits/Assets
  - *ROE* = Net Profits/Equity Capital
  - *EM* = Assets/Equity Capital
  - $ROE = ROA \times EM$
  - Capital $\uparrow$, *EM* $\downarrow$, *ROE* $\downarrow$
- Banks hold capital to meet capital requirements.
  - Read about Basel Committee on Bank Supervision: https://www.bis.org/bcbs/history.htm

Bank revenue streams and risks

- Banks earn money by charging interests and fees.
- They also trade in securities.
- We compensate banks for an array of **risks they take** (on our behalf?)
  - Credit risk: borrowers may default
  - Interest rate risk: maturity matching.
    - What has been happening with interest rates recently?
  - Trading risk: Banks trade in capital markets for their own accounts.
    - Do you see any concerns here?
  - Operational risk: Risks from normal operations (think about fraud, natural disasters, process failures, etc.)

Off-Balance-Sheet Activities

1. Loan sales (secondary loan participation)
2. Fee income from
   - Foreign exchange trades for customers
   - Servicing mortgage-backed securities
   - Guarantees of debt
   - Backup lines of credit
3. Trading Activities and Risk Management Techniques
   - Financial futures and options
   - Foreign exchange trading
   - Interest rate swaps

- **All these activities involve risk and potential conflicts**

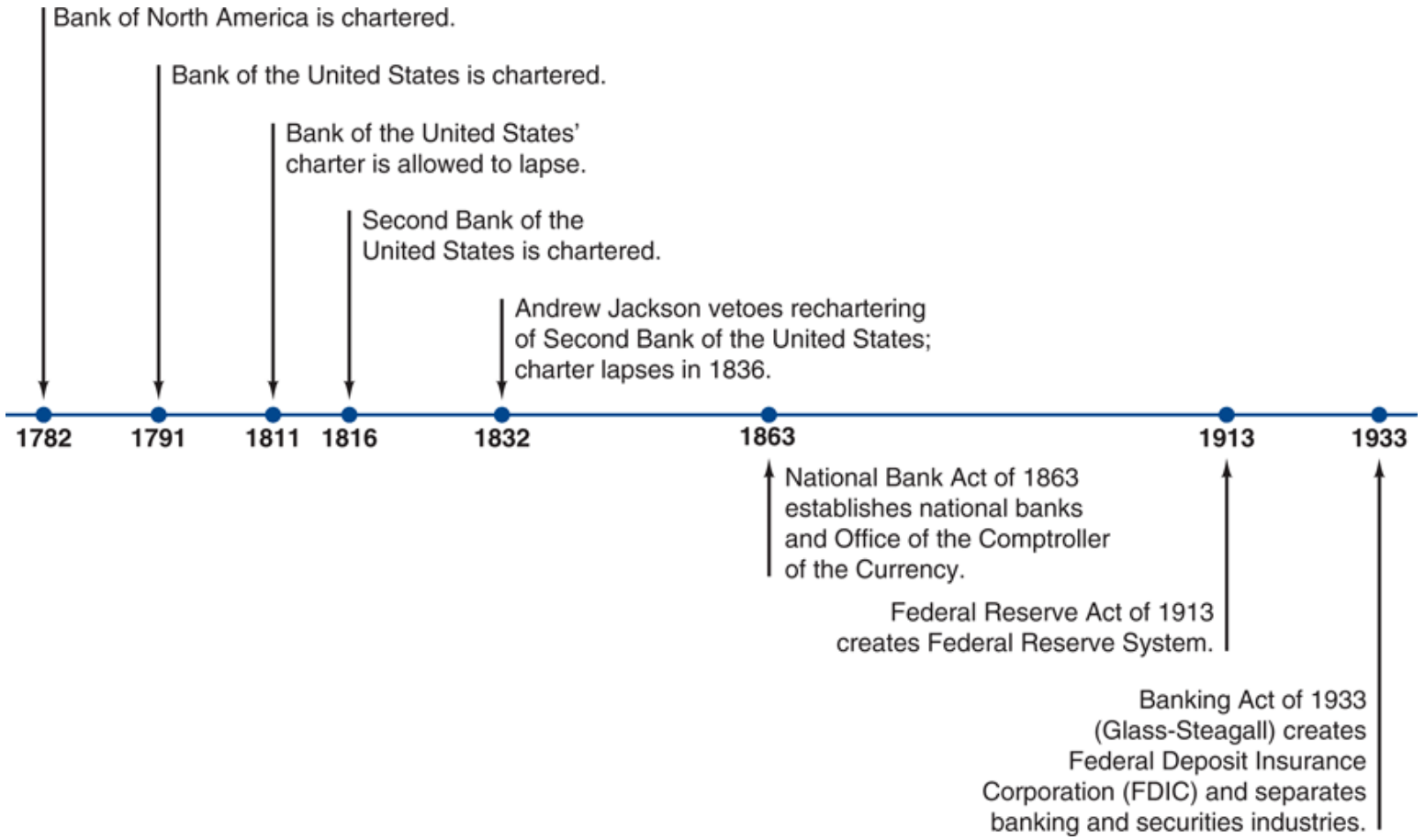
Banking: abridged history

Banking: abridged history

- Unlike other countries, banking in the US has a relatively shorter history
  - Florence had more than 100 banks by the end of 14th century (Medici banking empire)
- Medici's expansion was facilitated by invention of double-entry bookkeeping by Franciscan Friar Luca Paciolli
- In the U.S., about 6,200 commercial banks are serving businesses and consumers' needs. This puts the U.S. in a class by itself.
- In most other developed nations, only a handful of banks dominate the landscape.

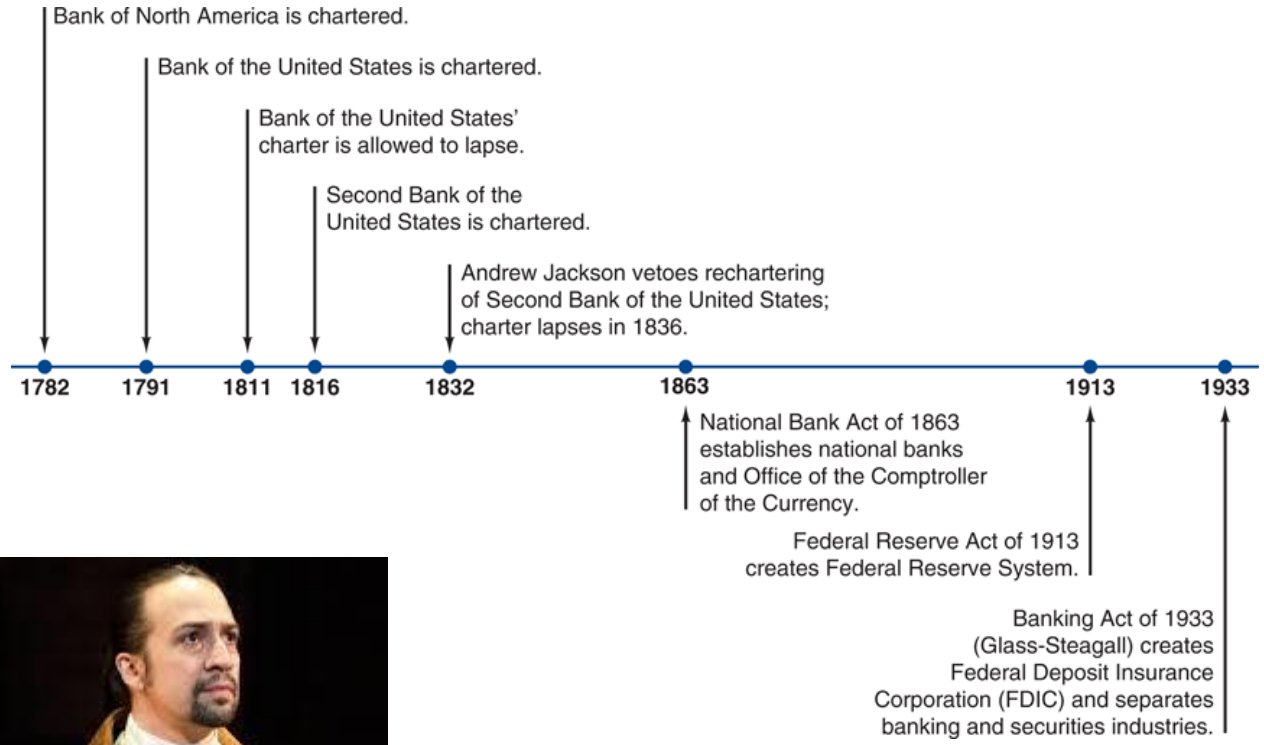
Banking: abridged history

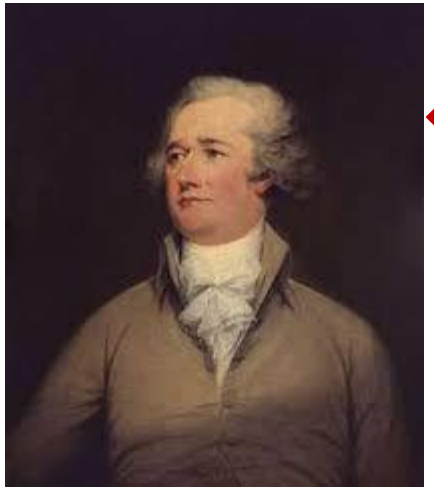
Figure 19.1 Timeline of the Early History of Commercial Banking in the United States



Banking: abridged history

- First central bank - “First Bank of the United States” was chartered for a term of 20 years on Feb 25, 1791, by the congress.
- It was championed by the first Secretary of Treasury - Alexander Hamilton.



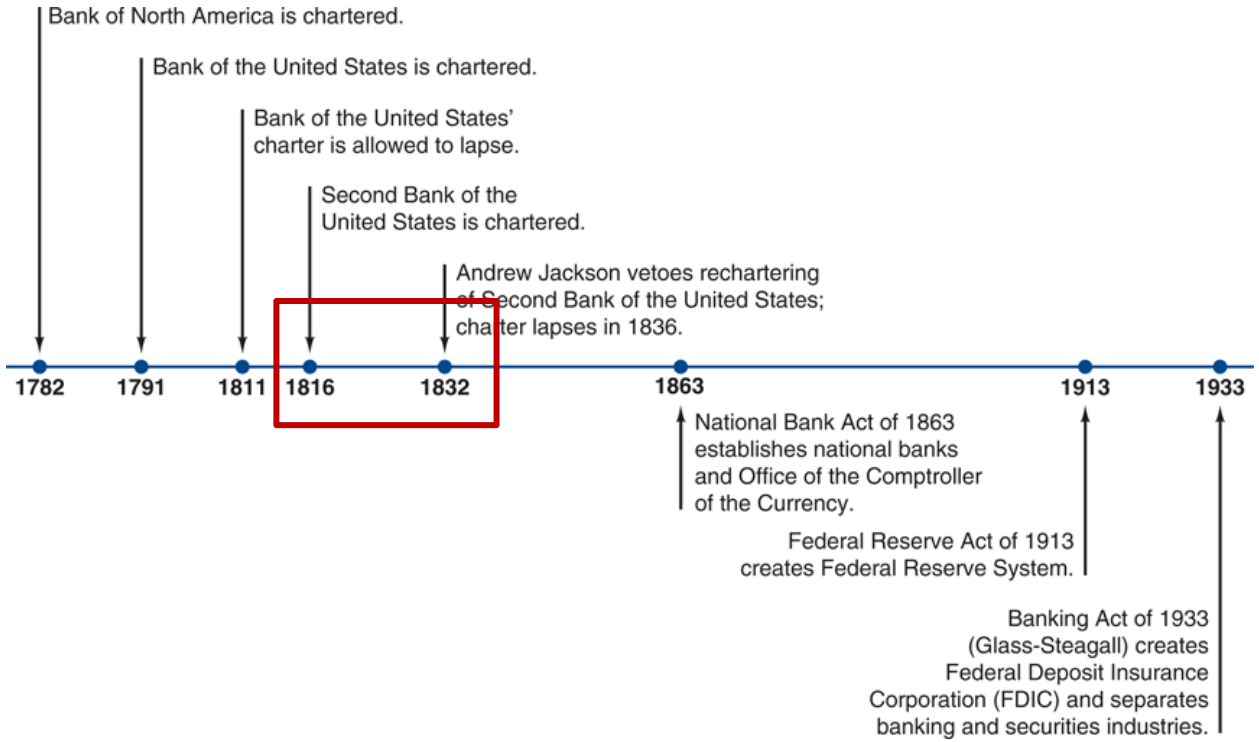


This guy

NOT this guy

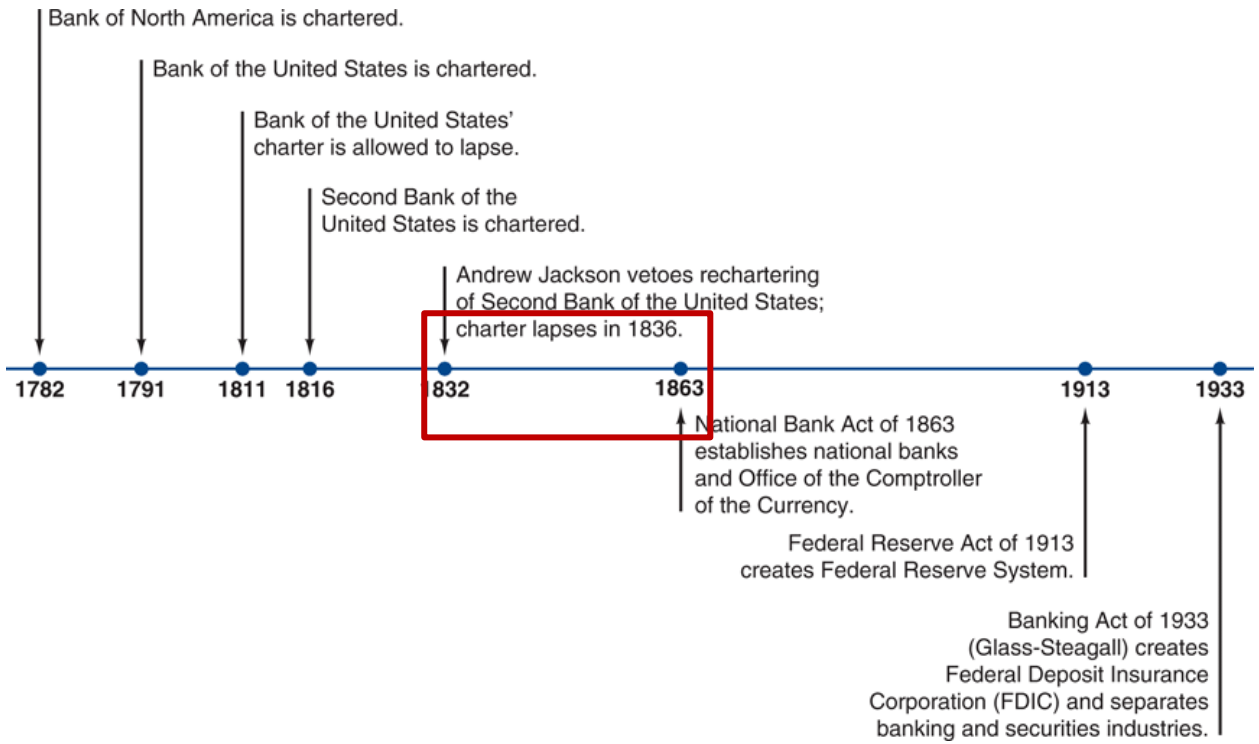
Banking: abridged history

- Banks issued their own notes: piece of paper that promised value, convertible for gold or silver on demand
- The second central bank was established in 1816 and operated till 1832.



Banking: abridged history

- From 1832 to 1864 state governments took over supervision of banks
  - States lacked the know-how to supervise
  - Supervisor had to inspect banks to make sure that they had enough capital
  - Sheer number of bank notes in circulation (more than 10,000 types of notes were under circulation) made supervision intractable
  - Counterfeiting was rampant
- By early 1860s, bank failures and runs were common, and people were left with worthless paper money that was not backed by anyone



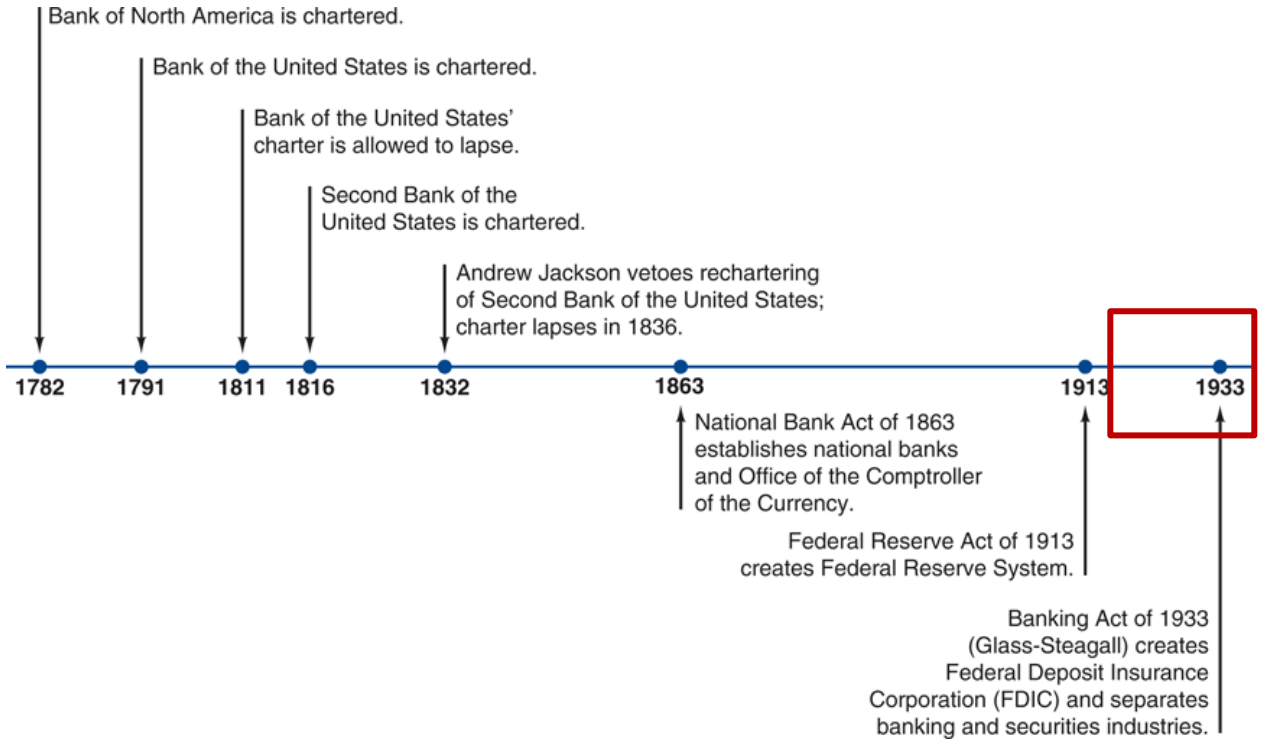
Banking: abridged history

- Congress passed the National Currency Act in 1863 and revised the National Bank Act in 1864, which led to the creation of Office of Comptroller of the Currency (OCC) under the Treasury.
  - OCC was responsible for organizing and supervising the new banking system
  - From 1865 a new national currency was established
    - National banks bought U.S. government securities and deposited them with the OCC for national bank notes.
    - This was then lent to borrowers and depositors
    - If a bank failed, the securities in the bank's account were sold and the people were reimbursed.
  - Early bank notes had extensive artwork to combat counterfeiting

  - Take a look at https://www.uscurrency.gov/history and http://numismatics.org/a-history-of-american-currency/

Banking: abridged history

- 1929 depression led to the demise of more than 1000 banks in the US and bank-runs were an epidemic.
- In June 1933, Federal Deposit Insurance Corporation (FDIC) was established, and accounts were insured up to $2,500.
  - What is the insured amount now?
  - Was 100K from 1980 to 2008, Now 250K.



Banking: abridged history

- From 1960s banks have adopted technology at a rate higher than any other industry!
- In 1999, Glass-Steagall was repealed (originally was passed in 1933).
  - Commercial banks now engaged again in securities activities.

Banking: abridged history

- Regulatory responsibilities of OCC have been ever increasing because of new technology usage by banks.
- The history had one other significant outcome: Multiple Regulatory Agencies
  1. Federal Reserve
  2. FDIC
  3. Office of the Comptroller of the Currency
  4. State Banking Authorities

Banking: (Financial) Innovation

Financial Innovation

- Innovation is the result of search for profits. A change in the financial environment will stimulate a search for new products and ideas that are likely to increase the bottom line.
  - E.g., Shadow Banking system is increasingly replacing bank lending via marketplaces

- There are three types of changes we can examine:
  - Response to Changes in Demand Conditions
  - Response to Changes in Supply Conditions
  - Avoidance of Existing Regulation

Financial Innovation

- Response to Changes in Demand Conditions
  - A major change is the large increase in interest-rate risk starting in the 1960s.
  - Adjustable-Rate Mortgages are an example of the reply to interest-rate volatility.
  - Banks also started using derivates to hedge risk, and intermediaries (like the CBOT) started developing extensive interest rate products.

Financial Innovation

- Response to Changes in Supply Conditions
  - A major change is the improvement in information technology that
    1. lowered the cost of processing financial transactions, making it profitable for financial institutions to create new financial products and services
    2. made it easier for investors to acquire information, thereby making it easier for firms to issue securities

Financial Innovation: Bank Credit and Debit Cards

- Many store credit cards existed long before WWII.
- Improved technology in the late 1960s reduced transaction costs making nationwide credit card programs profitable.
- The success of credit cards led to the development of debit cards for direct access to checkable funds.

Financial Innovation: Electronic Banking

- Automatic Teller Machines (ATMs) were the first innovation on this front. Today, over 250,000 ATMs service the U.S. alone.
- Automated Banking Machines combine ATMs, the internet, and telephone technology to provide “complete” service.
- Virtual banks now exist where access is only possible via the internet.
    - E.g., DigiBank will be discussed later

Financial Innovation: Electronic Payments

- Computer systems and the internet has made electronic payments of bills a cost-effective method over paper checks or money.
- Yet, U.S. is still far behind some European countries in the use of this technology.
- U.S. writes close to 100 billion checks. In Europe, however, two-thirds of transactions are electronic.
- America's continued use of paper is costly.
  - Finexio, an Orlando based B2B payments FinTech startup is attempting to alter this
  - https://www.youtube.com/watch?v=SRceYxQEQf4
- E-money is a by-product of e-payments

Financial Innovation: New markets/products

Junk Bonds

- Prior to 1980, debt was never issued with a 'junk' rating. The only junk debt were bonds that fell from investment grade.
- Michael Milken of Drexel Burnham assisted firms in issuing original-issue junk debt and almost single-handedly created the junk bond market.

Commercial Paper Market

- *Commercial paper* refers to unsecured debt issued by corporations with a short original maturity ($1+ trillion market by the end of 2012).

Securitization

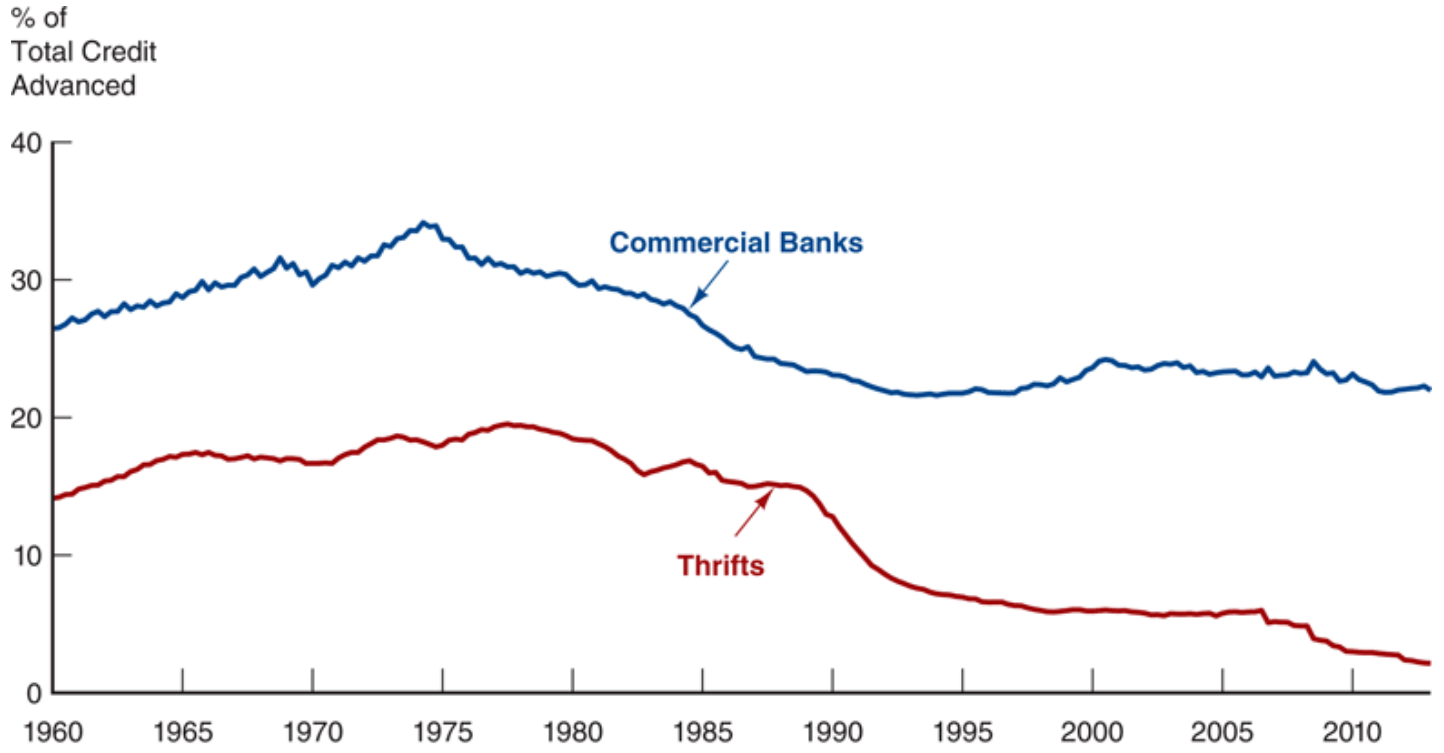
- *Securitization* refers to the transformation of illiquid assets into marketable capital market instruments.
- Today, almost any type of private debt can be securitized. This includes home mortgages, credit card debt, student loans, car loans, etc.

Financial Innovation: Avoidance of Existing Regulations

- Regulations Behind Financial Innovation
  - Reserve requirements
    - Tax on deposits = $I \times r^D$
  - Deposit-rate ceilings (Reg Q)
    - As $i \uparrow$, loophole mine to escape reserve requirement tax and deposit-rate ceilings
- Money Market Mutual Funds (MMMFs): allow investors similar access to their funds as a bank savings accounts but offered higher rates.
  - Created by Bruce Bent and Henry Brown in 1970; but took off in 1978
  - MMMFs is a $2.6+ trillion market.
- Sweep Accounts: Funds are "swept" out of checking accounts nightly and invested at overnight rates.
  - Since they are no longer checkable deposits, reserve requirement taxes are avoided.

Financial Innovation and the Decline in Traditional Banking

- Asset transformation affected by financial innovation.
- The importance of commercial banks as a source of funds to nonfinancial borrowers has shrunk dramatically.



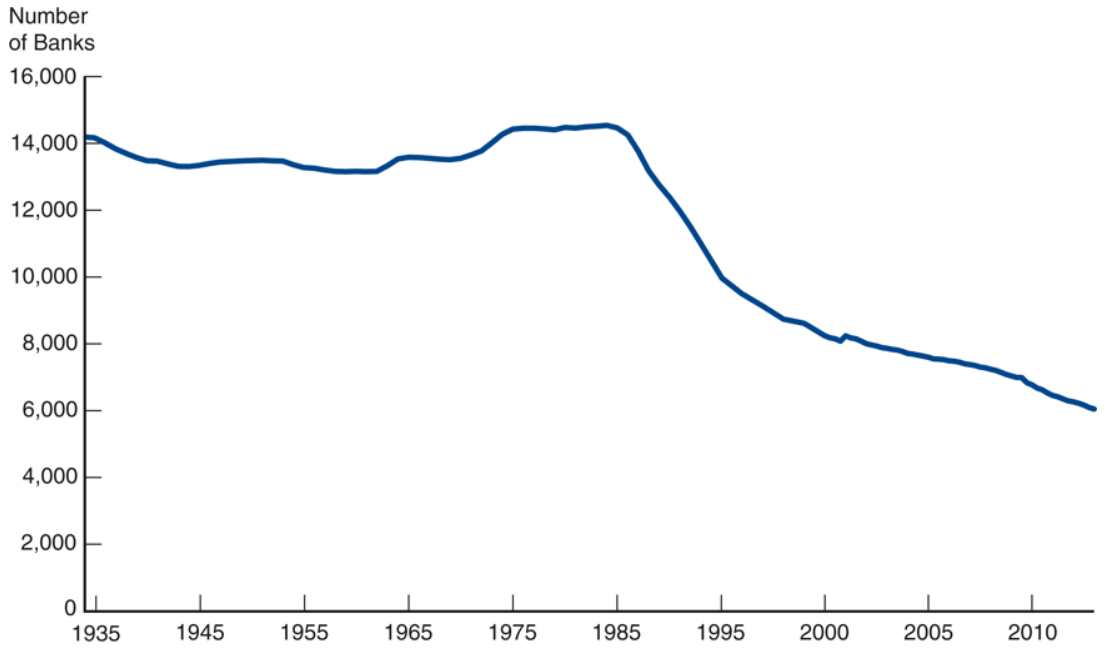
Source: Federal Reserve Flow of Funds Accounts; *Federal Reserve Bulletin.*

Financial Innovation and the Decline in Traditional Banking

- Decline in Cost Advantages in Acquiring Funds (Liabilities)
  - In late 1960s interest rates increased as inflation soared. Disintermediation ensued.
    1. Deposit rate ceilings and regulation Q
    2. Money market mutual funds
- Checkable deposits fell from 60% of bank liabilities to only 5%.
- Decline in Income Advantages on Uses of Funds (Assets)
    1. Easier to use securities markets to raise funds: commercial paper, junk bonds, securitization
    2. Finance companies more important because easier for them to raise funds

Bank Consolidation and Number of Banks

- Economies of scale
  - Increased with the web and computer technology
  - Scope economies also present in using data for pricing, new products, etc.
  - Has led to the birth of **large, complex banking organizations (LCBOs)**



Source: www2.fdic.gov/qbp/qbpSelect.asp?menuitem=STAT.

Figure 19.3 *Number of Insured Commercial Banks in the United States, 1934–2013*

Bank Consolidation and Nationwide Banking

- Cons
  - Fear of decline of small banks and small business lending
  - Rush to consolidation may increase risk taking
- Pros
  - Community banks will survive
  - Increase competition and efficiency
  - Increased diversification of bank loan portfolios lessens likelihood of failures

E-Finance: Information Technology and Bank Consolidation

- Information technology is particularly relevant for the credit card industry. Today, over 60% of the credit card debt is held by the five biggest banks (only 40% in 1995).
- Custody for securities has risen, from 40% as a percent of assets in 1990 to 90% today.
- Smaller banks just contract with larger banks, further leading to consolidation.

Banking: Products and Services

Commercial Banks, S&Ls and Credit Unions

- Credit Unions: Member-owned, not-for-profit organization to deliver services to its members.
  - There are still around 6000 credit unions worth $1 trillion in the US
  - Addition & Fairwinds in our backyard are each worth around $2 billion!
- S&L or thrifts: primarily fund mortgages

Commercial Banks, S&Ls and Credit Unions

- Services offered:
  - Checking/savings accounts
  - Certificate of deposits
  - Mortgages
  - Credit card lending
  - Student loan
  - Auto loans
  - Wealth management
  - Stock brokerage
  - Private banking
  - Insurance
  - Foreign exchange and remittances
  - Corporate loans
  - Corporate treasury services
  - Trade finance – letters of credit, bill collection, payments
  - Payroll services

Investment Banks (IBs)

- Needs of corporations, governments and large institutional investors are only partially met by commercial banks.
- When these clients need to raise funds IBs step in.
  - IBs assist companies and governments when they need to raise equity or debt
  - IBs assist investors by serving as brokers and dealers in financial products
  - Again, the basic role is intermediation: putting in touch investors with corporations that are looking to raise funds
- ***Products/Services offered:***
  - IPO/SEO services
  - Private placements
  - M&A
  - Trading
  - Securitization
  - Prime brokerage
  - Clearing and Custody services
  - Derivates (origination and trading)
  - Asset management
- This is a very competitive market. Even the largest player controls no more than 10% of market share in 2017.

Trading Activities

- Banks trade securities for their own accounts.
  - This increased dramatically after the 1999 repeal of 1933 Glass-Steagall Act.
  - The increased trading compounded issues during the 2008 crisis. Dodd-Frank Act and the Volcker rule tried to limit this.
  - Congress, recently, has softened Dodd-Frank rules.
  - Banks also provide analysis on the economy and companies to its institutional clients.
    - There have been cases were banks produced sub-standard analysis to benefit themselves or their clients (https://www.sec.gov/news/press/2003-54.htm)

Trading Activities

- SEC's Reg FD (Fair Disclosure) in 2000, mandated that several requirements that attempted to build a wall between different departments in a Banks (esp., Analysts and Investment Bankers)
  - The firms will separate research and investment banking, including physical separation, completely separate reporting lines, separate legal and compliance staffs, and separate budgeting processes.
  - Analysts' compensation cannot be based directly or indirectly upon investment banking revenues or input from investment banking personnel.
  - Investment bankers cannot evaluate analysts
  - An analyst's compensation will be based in significant part on the quality and accuracy of the analyst's research.
  - Investment bankers will have no role in determining what companies are covered by the analysts.
  - Research analysts will be prohibited from participating in efforts to solicit investment banking business, including pitches and roadshows.
  - Firms will implement policies and procedures reasonably designed to assure that their personnel do not seek to influence the contents of research reports for purposes of obtaining or retaining investment banking business.
  - Firms will create and enforce firewalls between research and investment banking reasonably designed to prohibit improper communications between the two. Communications should be limited to those enabling research analysts to fulfill a "gatekeeper" role.
  - Each firm will retain, at its own expense, an Independent Monitor to conduct a review to provide reasonable assurance that the firm is complying with the structural reforms. This review will be conducted eighteen months after the date of the entry of the Final Judgment, and the Independent Monitor will submit a written report of his or her findings to the SEC, NASD, and NYSE within 6 months after the review begins.

More services

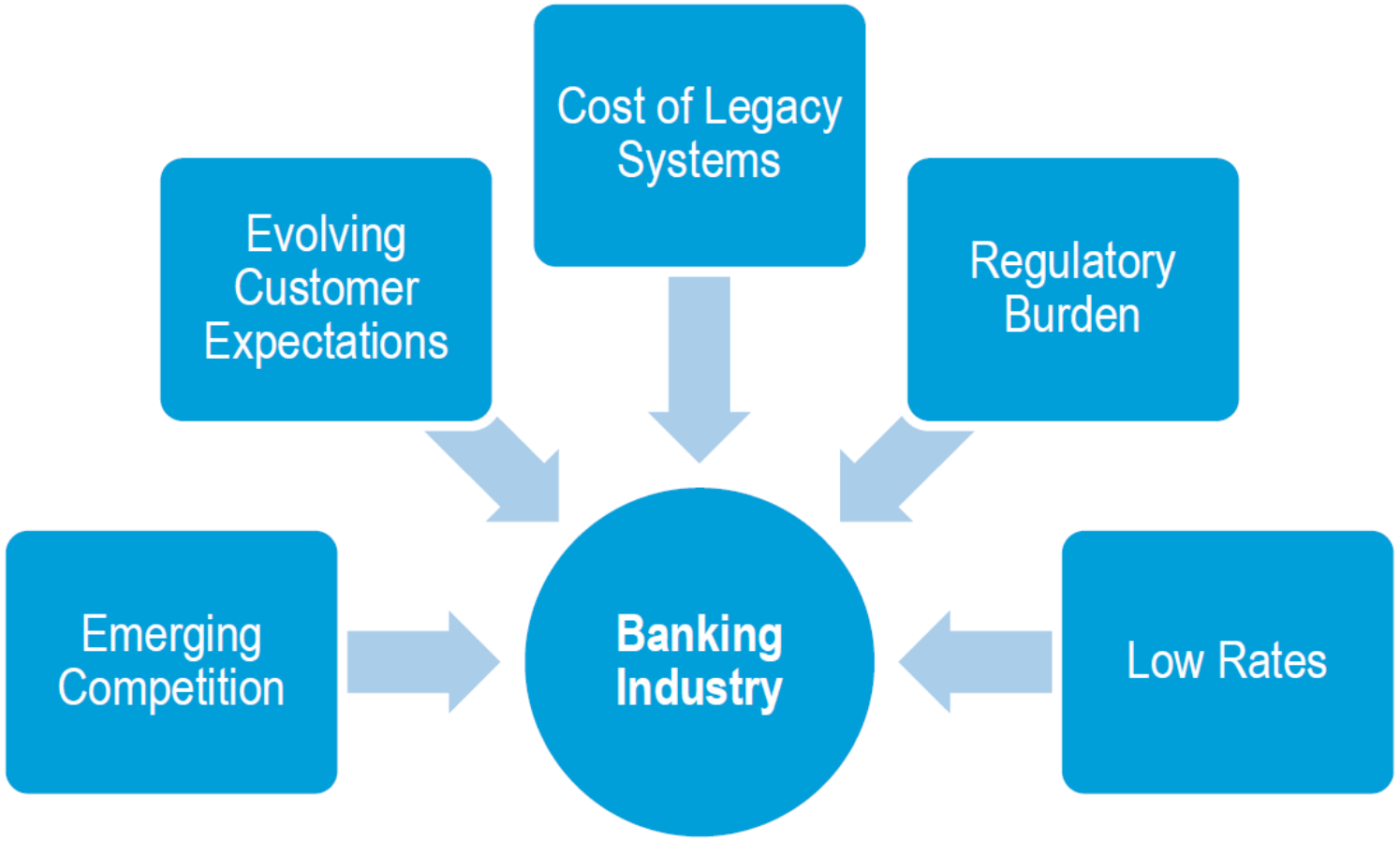
- **Asset Securitization:** The process of bundling assets of a bank and selling it in packages to investors.
  - Securitization of mortgages has been blamed for the 2008 crisis
- **Mergers and Acquisitions:** Banks advice both acquirers and targets on the price, financing arrangements, terms of the deal, etc.
- **Prime Brokerage**: A collection of services banks provide to hedge fund clients.
  - Securities lending
  - Trade execution
  - Risk management
  - IT services
  - Investor acquisition
  - Recent research has shown that prime brokerages also leak information on their loan clients! (potentially illegal)
- **Financial Crisis:**
  - https://www.youtube.com/watch?v=bx_LWm6_6tA

Banking: Transformation

FinTech and the Banking sector

What made FinTech a reality in banking?

Figure 59. Banks Face Multiple Pain Points



Source: Citi Research

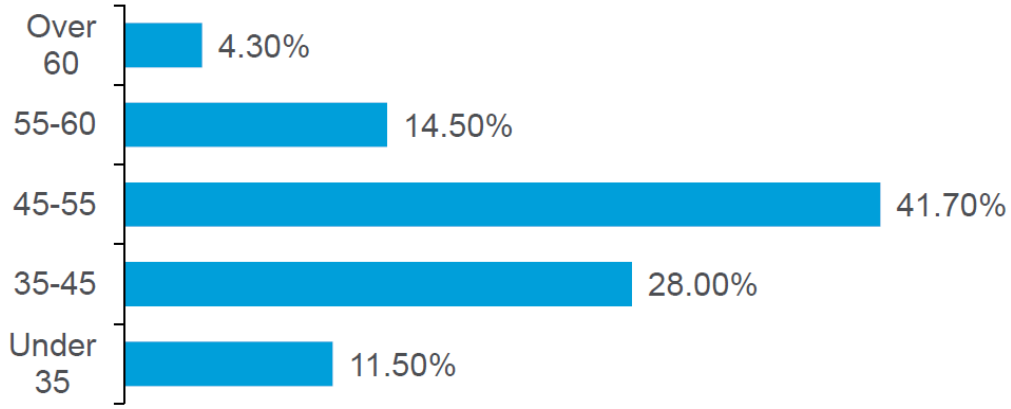
What made FinTech a reality in banking?

- **Banks and Customers:** Banks, and in turn customers, became transaction oriented.
  - "The aim was to do a deal, any deal", remembers one manager who prefers not to be named" (The Economist, April 15, 1995, Special Section: A Survey of Wall Street, p. 13)
  - "… Amid surging economies, low loan losses, and readily available cheap capital, it did not really matter whether a bank had top-or bottom-quartile capabilities […]. All that mattered were workable sales processes" (BCG, 2010)
  - Banks saw more profits from trading securities and other shadow banking activities which reduced the bargaining power of relationship banking side of the bank.
  - IT made it easier to close deals and, in many cases, removed the human element

What made FinTech a reality in banking?

- **Banks and Technology:**
  - Banks purchased their first mainframes in 1950s. Each mainframe was typically tasked with one job and did not interact with other systems, leading to data silos.
  - Ad hoc patchworks were put in place (by developers and executives who did not want to revamp the system) to make the disparate systems communicate, leading to a fragile and complex web of systems.
  - In order to maintain compatibility, developers stuck with the Fortran and COBOL, which meant new systems concepts were difficult to deploy.
  - While the older systems are reliable, they are slow and difficult to modify and innovate.
  - Technology itself has evolved from basic coding to Object-oriented and plug-and-play coding systems.

Figure 63. Age Distribution of COBOL Programmers



Source: Reuters, international COBOL Survey Report, Citi Research

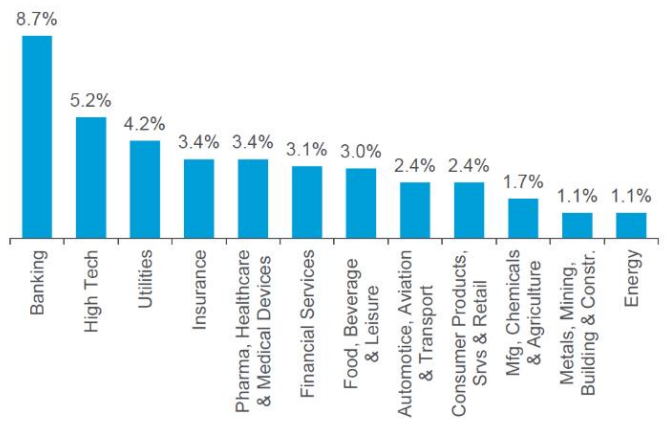
What made FinTech a reality in banking?

- All individual banking products were cookie-cut, which can be done by a machine in cost-effective manner on a larger scale.
  - Loss of customization!
- Technology has facilitated cost reduction in bank process.
  - But none of this savings resulted in the reduction of fees banks charged in the last 150 years.

Did Banks lose their edge?

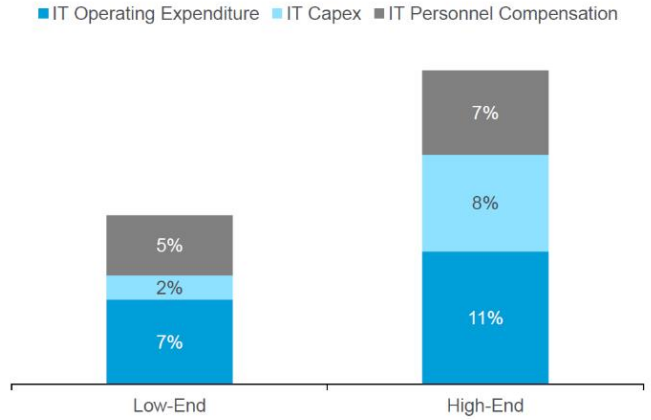
- Banks have stayed ahead of the competition by spending money:
  - They either innovate/copy innovations
  - Or buy innovators
- The financial crisis and the resulting onslaught of regulations meant that banks had to increase capital reserves and disclosures, in turn less attention paid to innovation
  - But banks did see record profits soon enough
  - They have been investing heavily in IT since 2008 for streamlining process and becoming operations-lean.
  - Recently, expenditure has been increased in data analytics as well.

Figure 55. Median IT Expense as % of Business Entity Revenue (2016)



Total IT expenditure includes operating expenditure and IT capital expenditure
Source: Citi Research, CEB, CEB IT Budget Benchmark, Arlington VA, 2016, p.6

Figure 56. Nearly 15-25% of Banks' Annual Budget Allocated to IT, 2016



*Based primarily on banks in the EU, U.S., and Australia
Source: Citi Research

Source: CITI GPS, Bank of the Future, 2018 report

Did Banks lose their edge?

- FinTech startups are not a *real* threat to big banks.
  - They are still in their early stages and not up to scale to challenge big banks
  - Eventually, investors would want to (successfully) exit and will force an IPO or M&A deal.
- Big technology and telecommunications companies *are* the real threats.
  - They have the technological expertise
  - Consumer base
  - Cash to innovate and sustain competition
- Ability to resist corporate raids and takeovers

Rise of FinTechs: Unbundling and re-bundling of banking services

We need banking, but not banks – Bill Gates

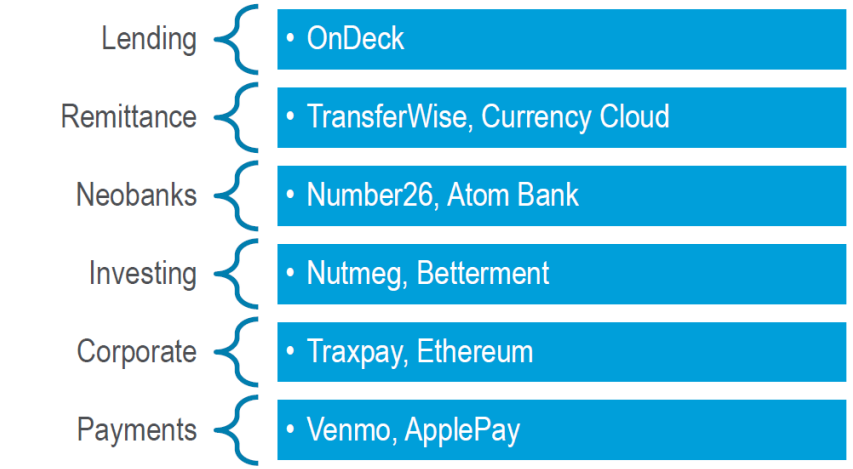
Rise of FinTechs: Unbundling of Banking services

- “The aim is to inflict death by a thousand cuts. Fintech start-ups are nimble piranhas, each focusing on a small part of a bank’s business model to attack” (Financial Times, 14 October 2015)

Source: CBInsights; https://www.cbinsights.com/blog/disrupting-banking-fintech-startups/

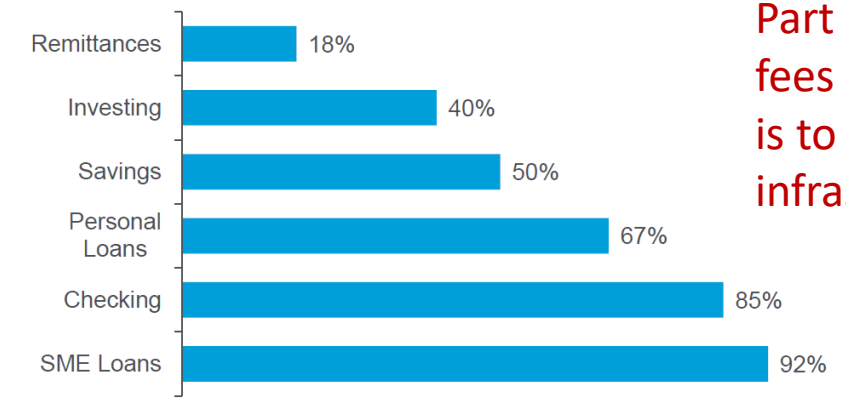
Rise of FinTechs: Unbundling of Banking services

Figure 60. Examples of Companies Attacking the Traditional Banking Value Chain



Source: Citi Research

Figure 61. Product Price Offered by "Disruptor" as % of Traditional Banking Incumbent Pricing



Disruptor pricing for savings has been adjusted to reflect a higher rate environment
Source: Citi Research, Citi GDS Analysis, McKinsey

Part of the reason for fees charged by banks is to pay for the infrastructure

Source: CITI GPS, Bank of the Future, 2018 report

- "Uber, the world's largest taxi company, owns no vehicles. Facebook, the world's most popular media owner, crates no content. Alibaba, the most valuable retailer, has no inventory. And Airbnb, the world's largest accommodation provider, owns no real estate." – Tom Goodwin, EVP, Zenith Media.

Rise of FinTechs: Unbundling of Banking services

- Banks offer a wide variety of services.
- It would be difficult for one startup to provide all those services in a cost-effective manner.
  - But, using technology, it is easier to offer one service to a large number of customers at fraction of the bank's overhead cost.
  - This is exactly what new entrants and incumbents did.
  - Machines are better cookie-cutters
  - Digitization lowers entry barriers

Rise of FinTechs: Unbundling of Banking services

- In the 1990s and 2000s, product stream-lining was the norm
  - Meant less options for customers but cost-savings for banks and better ability to compete
  - Many small banks went out of business due to competition
- In the early stages of FinTech (say 5-10 years):
  - We were given limited options when opening a bank account or applying for a loan via online platforms
  - Lending Club offers limited personal loans options
  - FinTechs sold us on the ease of executing transactions
- As competition and technology become better, we are getting more customization.

Rise of FinTechs: Unbundling of Banking services

- Given the lower cost of technology deployment, we are seeing that even smaller banks can offer better customization
- We are seeing a reemergence of customer-centric business model.
  - Only now, the customization is done by an algorithm (less costly).

Rise of FinTechs: Unbundling of Banking services

- What are the cost reductions from using technology in finance?
  - Search costs: Core function of the bank – matching savers with borrowers
  - Replication/Processing costs: Processing paperwork
  - Verification costs: Making sure the identity and assets are in place
  - Tracking costs: Track performance of loans
  - Transportation costs
  - Each of the above cost is expended to reduce information asymmetry and moral hazard in the relationship!

Banking services that FinTechs target

59% of banks' earnings are from pure fee products

- E.g., advice or payments, originations, sales, and distribution component of balance-sheet products, like loans or deposits.
- In these areas, returns on equity (ROE) average an attractive 22%.
- That's much higher than the 6% ROE of balance-sheet provision and fulfillment component of products, which have high operating costs and high capital requirements.

Challengers hope to disintermediate these relationships by slicing off higher-ROE segments (origination and sales), leaving banks with the basics of asset and liability management.

[1]Revenues generated by carrying loans and other assets already sold and sitting on the books.
[2]Asset management includes investment and pension products. Only insurance sold by banks is included.

Source: Analysis and data provided by Panorama (a McKinsey Solution)

Banking services that FinTechs target: Lending

- Lending is a prominent FinTech sector after payments.
- Lending, especially to individuals, is easier for FinTech to target.
  - Why?
  - Small business loans (up to 150K) are also going digital! (https://www.wsj.com/articles/a-150-000-small-business-loanfrom-an-app-11546002022?mod=hp_lead_pos9)

Banking services that FinTechs target: Lending

- But lending is a costly operation. Banks get cheaper capital (from lower interest deposits) and give out loans (higher rates).
  - They enjoy public trust and are subject to tight regulations.
- Where do P2P platforms get money to lend?
  - Money is from investors and not from deposits!
  - Are they subjected to the same tight regulations?

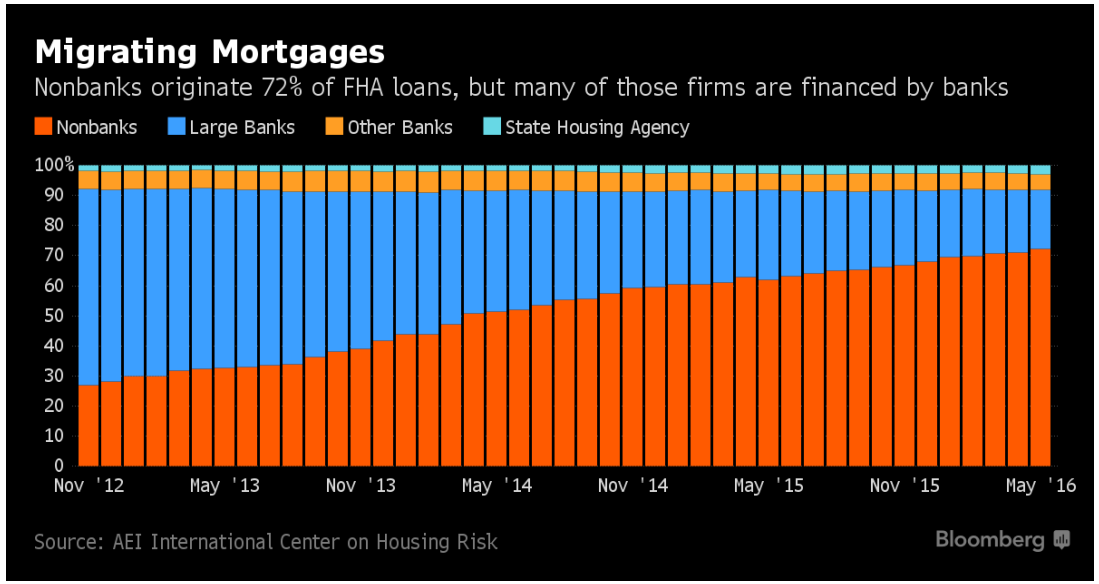
Banking services that FinTechs target: Mortgages

Fintechs grew to 15% of the mortgage market within 8 years.

- *Lending Home* targets motivated investment-property buyers looking for cost-effective mortgages with accelerated time horizons.
- *Moneysupermarket.com* started with a single product springboard—consumer mortgages—and now not only offers a range of financial products but serves as a platform for purchases of telecom and travel services, and even energy.

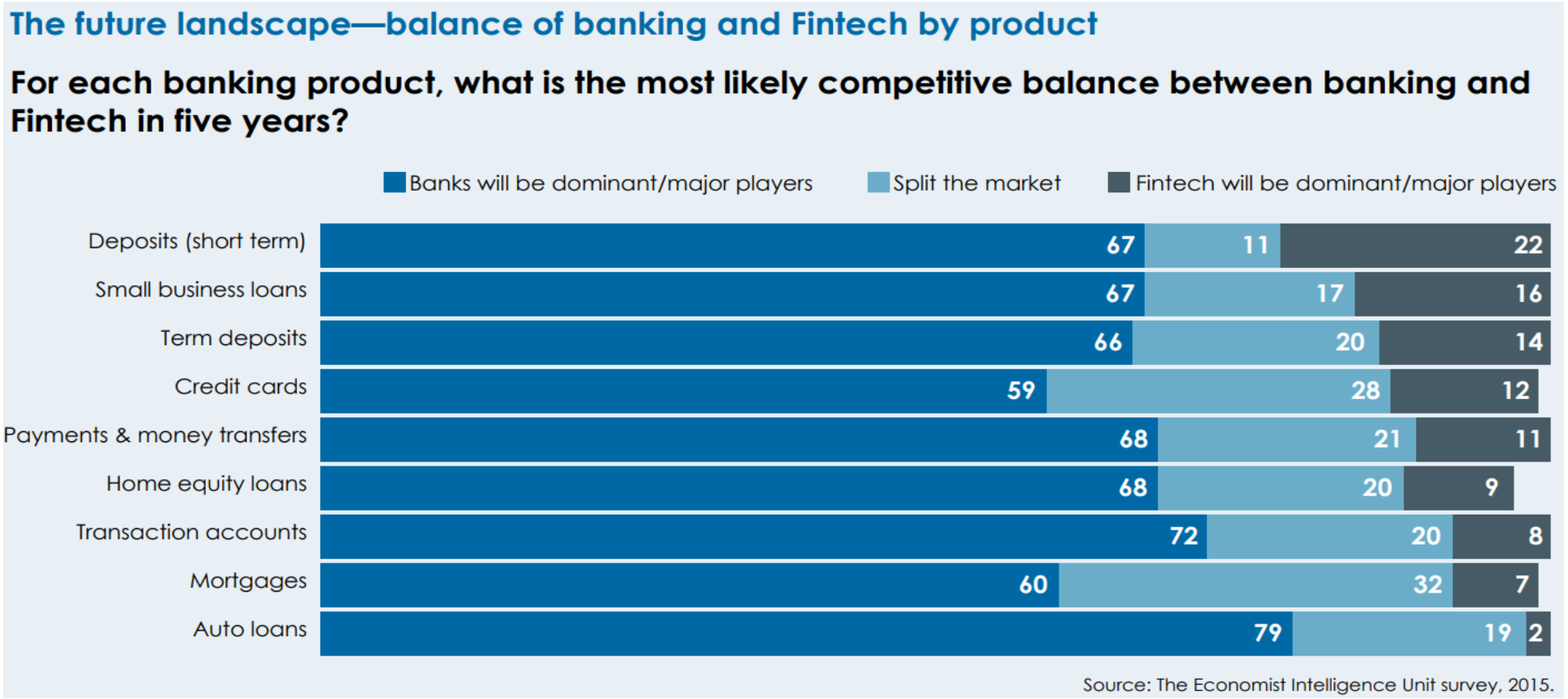
- *Fintech lenders appear to serve more creditworthy borrowers and are more active in the refinancing market.*
- *Fintech lenders charge a premium of 14–16 basis points and appear to provide convenience rather than cost savings to borrowers.*

  - Buchak et al. (2018, J. Fin. Econ.)



Banking services that FinTechs target

- From an incumbent's perspective, emerging FinTechs in corporate and investment banking (including asset and cash management) appear to be less disruptive than retail innovators are.



Banking services that FinTechs target

- Note that most fintech players don’t want to be banks and are not asking customers to transfer all their financial business at once.
- They are instead offering targeted and more convenient services.

- This also means that customers can easily switch among providers effortlessly
  - Platforms such as NerdWallet (in the United States) or India’s BankBazaar.com aggregate the offerings of multiple banks in loans, credit cards, deposits, insurance, and more and receive payment from the banks for generating new business.
  - Wealthfront targets fee-averse younger investors who favor automated software over human advisers.

Banking services that FinTechs target

- Customers most susceptible to cherry-picking are millennials, small businesses, and the underbanked
  - Three segments particularly sensitive to costs and to the enhanced consumer experience that digital delivery and distribution afford.
  - For instance, Alipay, the Chinese payments service (a unit of e-commerce giant Alibaba), makes online finance simpler and more intuitive by turning savings strategies into a game and comparing users' returns with those of others.
  - It also makes peer-to-peer transfers fun by adding voice messages and emoticons.

Challenges for FinTechs

- Can FinTechs replace Banks?
- Will they increase competition, enhance efficiency in a market with high entry barriers, or rather cause disruption and financial instability?

My View: FinTechs increase competition in financial markets, provide services that traditional financial institutions do less efficiently (or do not provide), and widen the pool of users of such services.

Challenges for FinTechs: Business Model

- But FinTechs will not replace many key functions of banks:
  - The value chain of banks includes many bundled services and activities.
  - FinTechs provide a more efficient way to provide the same services.
  - Banks are well placed to adopt technological innovations.
  - The business model of FinTechs is likely to converge towards that of banks
    - That is, they are likely to start offering all services of bank (e.g., Ant Financial & Revolut are good examples)

Challenges for FinTechs: Business Model

- FinTechs are currently operating under an “agency model” (marketplaces) opposed to the “wholesale model” of banks
  - FinTechs need to quickly grow to achieve “scale” so they can have both ample markets on the borrower and lender sides
  - FinTechs, now, generate revenue through fees and advertising.
  - Lending is more than matching investors and borrowers.
    - Risk management, Non-performing assets and trust (in some cases liquidity) are more pressing concerns

Challenges for FinTechs: Information Acquisition

- Banks act as delegated monitors.
- The screening capacity of FIs is based on hard information derived from huge data sets
  - FinTechs rely on data to screen, match and make decisions on their clients
  - Incumbent large traditional operators, such as banks, also have an informational advantage
- FinTechs lack the ability to collect soft information and reply on non-traditional sources to gain advantage.

Challenges for FinTechs: Regulatory Regimes

- FinTechs and Banks are NOT on a level regulatory field.
- FinTechs are evolving as marketplaces who originate assets and sell them.
  - This structure increases moral hazard issues which need to be addressed to maintain consumer/regulatory confidence.
- Regulators may force FinTechs to maintain more of their assets on their balance sheets and quickly turning them into bank-equivalents.
- As FinTechs expand their range of services, the scope for regulatory arbitrage will decline!
  - Then the only competitive advantage left will be from technology use.

Challenges for FinTechs

- These issues could lead to increased information asymmetry and moral hazard when competition increases.
- Zopa took the easy way out and got a banking license. Companies in the US rejected such an offer from regulators in November 2018.

- It is more likely that FinTechs would take over parts of the operations of banks in the medium term.
- Intermediation will stay as a crucial function of financial markets.

- *Note: Banks are actively investing in FinTech startups! They are not missing the action.*

FinTechs' Self-assessment

Fintech's self-assessment of their weaknesses in competing against banks

How important are each of the following in driving competitive disadvantage for Fintech?
(Fintech executives who cited "Very Important")

Source: The Economist Intelligence Unit survey, 2015.

Fintech's self-assessment of their strengths in competing against banks

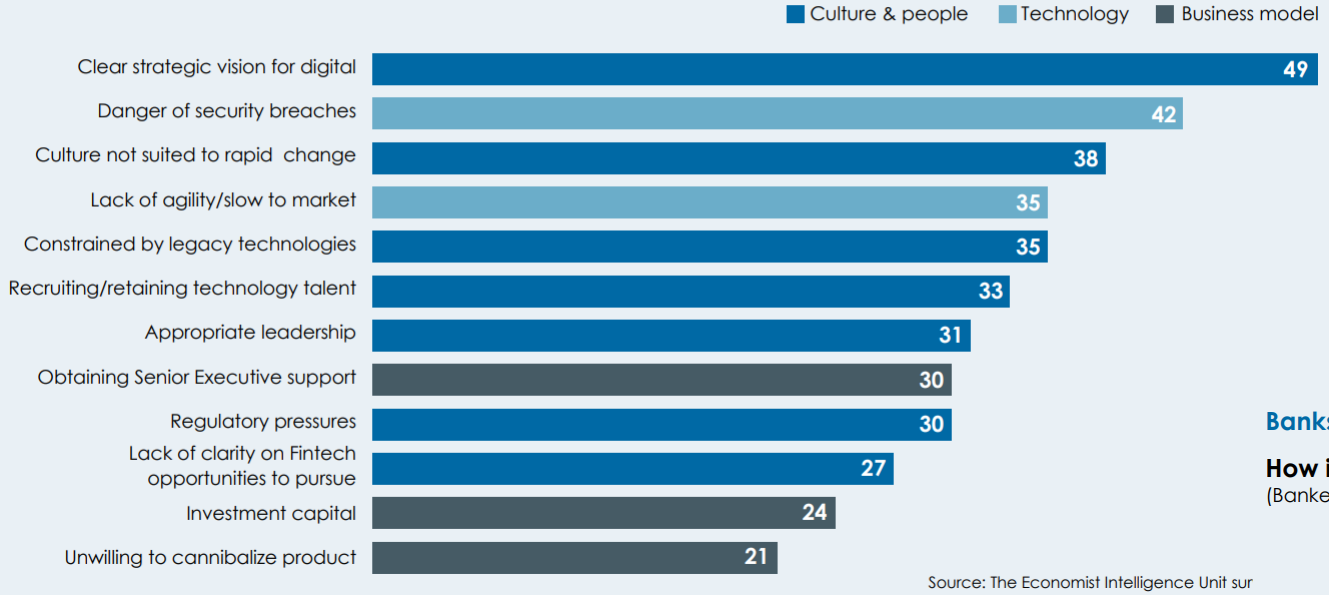
How important are each of the following in driving competitive advantage for Fintech?
(Fintech executives who cited "Very Important")

Source: The Economist Intelligence Unit survey, 2015.

Banks' Self-assessment

Banks' self-assessment of their weaknesses in competing against Fintech

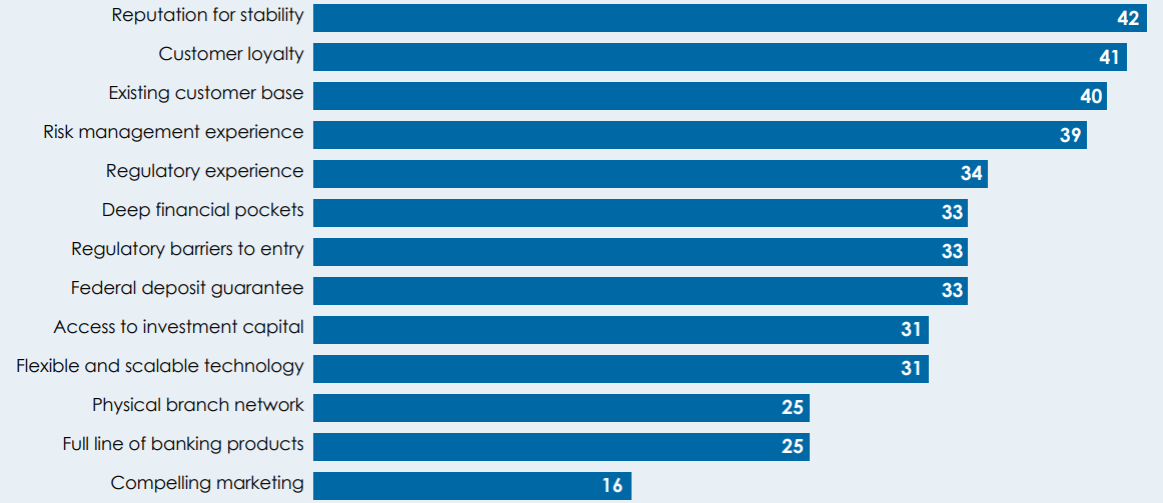
How important are each of the following in driving competitive disadvantage for banks?
(Bankers who cited "Very Important")



Source: The Economist Intelligence Unit sur

Banks' self-assessment of their strengths in competing against Fintech

How important are each of the following in driving competitive advantage for banks?
(Bankers who rated each "Very Important")



Source: The Economist Intelligence Unit survey, 2015.

Bank response to the rise FinTechs

- *"We need to revolutionize our business because the world has changed so much. It's only through the concept of us becoming an applied technology company that we'll achieve it."* – John Cryan, CEO, Deutsche Bank

- Inorganic:
  - Collaboration: Partnerships or outsourcing parts of the services to new entrants
    - In February 2015, Australian banks helped to set up a $2million AUS not-for-profit start-up center in Sydney to support new fintech firms
  - Mergers and Acquisitions
  - Startup Investment in FinTechs
- Organic:
  - In-house development – Build your own teams and solutions
  - Joint FinTech programs

Bank response to the rise FinTechs: Collaboration

- ***Kabbage***, a U.S.-based leading online lender, has partnered with large players such as Scotiabank, for streamlining online lending; MasterCard, for business loans through MasterCard's network of acquirers; ING, to provide capital to small businesses; and Santander Bank, for loans to small and medium enterprises.

- ICICI Bank, India's largest private bank, and ***Paytm***, the country's largest digital payments platform, have jointly launched a digital credit account on the Paytm app. Paytm-ICICI Bank Postpaid gives customers access to instant micro-credit for everyday expenses — from bill payments to movie tickets. Its algorithm – from ICICI – is based on a customer's financial and digital behavior and evaluates credit-worthiness in seconds.

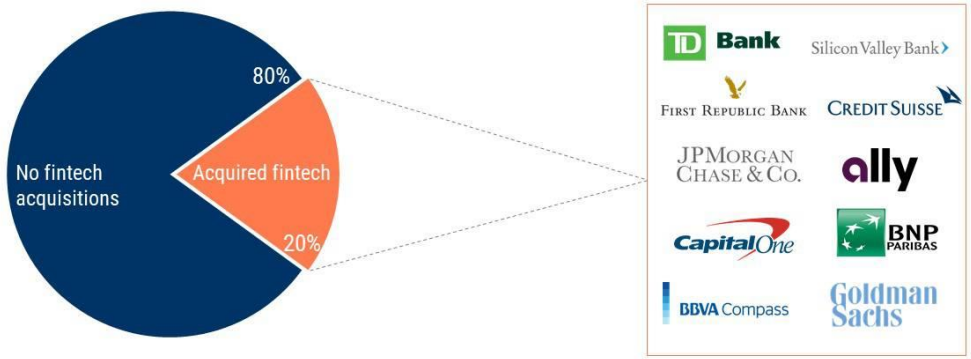
- Bocom International, the investment banking arm of China's Bank of Communications, has partnered with Hong Kong fintech firm ***FDT-AI*** to develop intelligent, personalized investment research based on bank clients' past transactions. The hope is to offer more tailor-made investment advice.

- ING Group has partnered with ***Scalable Capital***, a leading online wealth manager and robo-advice firm in Europe, to offer a fully digital investment solution to ING's retail customers starting in Germany. Customers do a paperless registration in under 15 minutes. With a minimum investment of 10,000 euros they can monitor their portfolios on both Scalable Capital and ING mobile apps and online portals.

Bank response to the rise FinTechs: Mergers & Acquisitions

Majority of big banks have not acquired a fintech startup

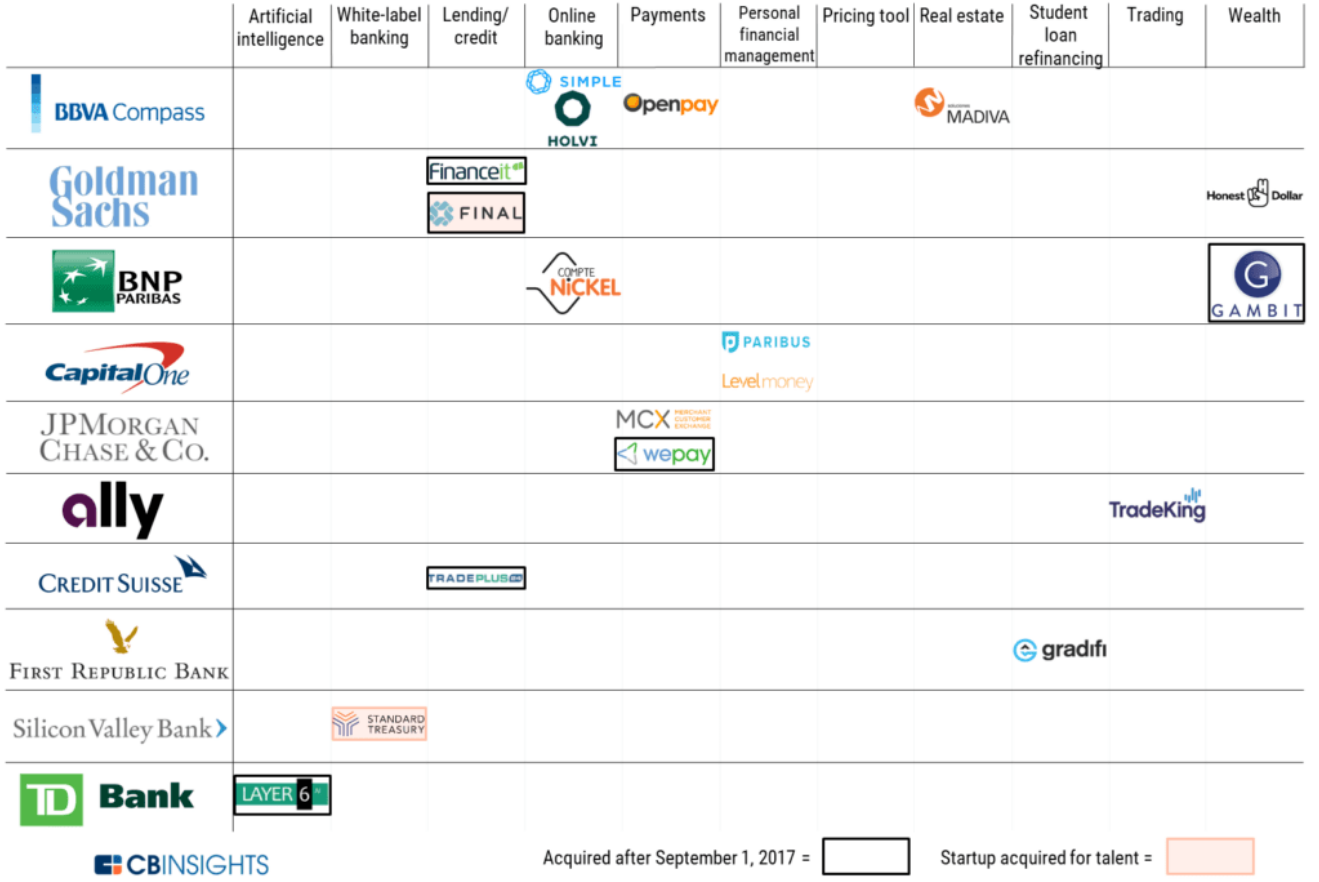
Only 20% of top 50 banks operating in the US have acquired a fintech startup, 2013 – 2018 YTD (02/07/2018)



CBINSIGHTS

Few fintech startups have been acquired by top banks

18 fintech startups have been acquired by top 50 US banks, 6 of which have been after Sept 1, 2017; 2013 – 2018 YTD (02/07/2018)



CBINSIGHTS

Bank response to the rise FinTechs: Startup Investments

- Many financial institutions including Citibank, Barclays, Goldman Sachs and Nomura have accelerator programs for FinTechs, while UBS, Deutsche Bank, Societe Generale, BNP Paribas and HSBC have invested in FinTech firms offering solutions across blockchain, data analytics, personal finance, wealth management, lending, payments, and settlement and regulatory technology

- India's Kotak Mahindra Bank.
  - Started its fintech partnership program in 2017 to look at fintech solutions from top to bottom. The Kotak team identifies the bank's business problems and then looks out for FinTechs that can solve them. It also looks at available solutions from FinTechs to see if they could work for the bank.
- Keybank, U.S.A.
  - Typically takes equity stakes in startups that perform back-end operations and markets the startup's products to their clients. The consumer facing system belongs to Key Bank thus ensuring a uniform customer experience.

Bank response to the rise FinTechs: In-house development

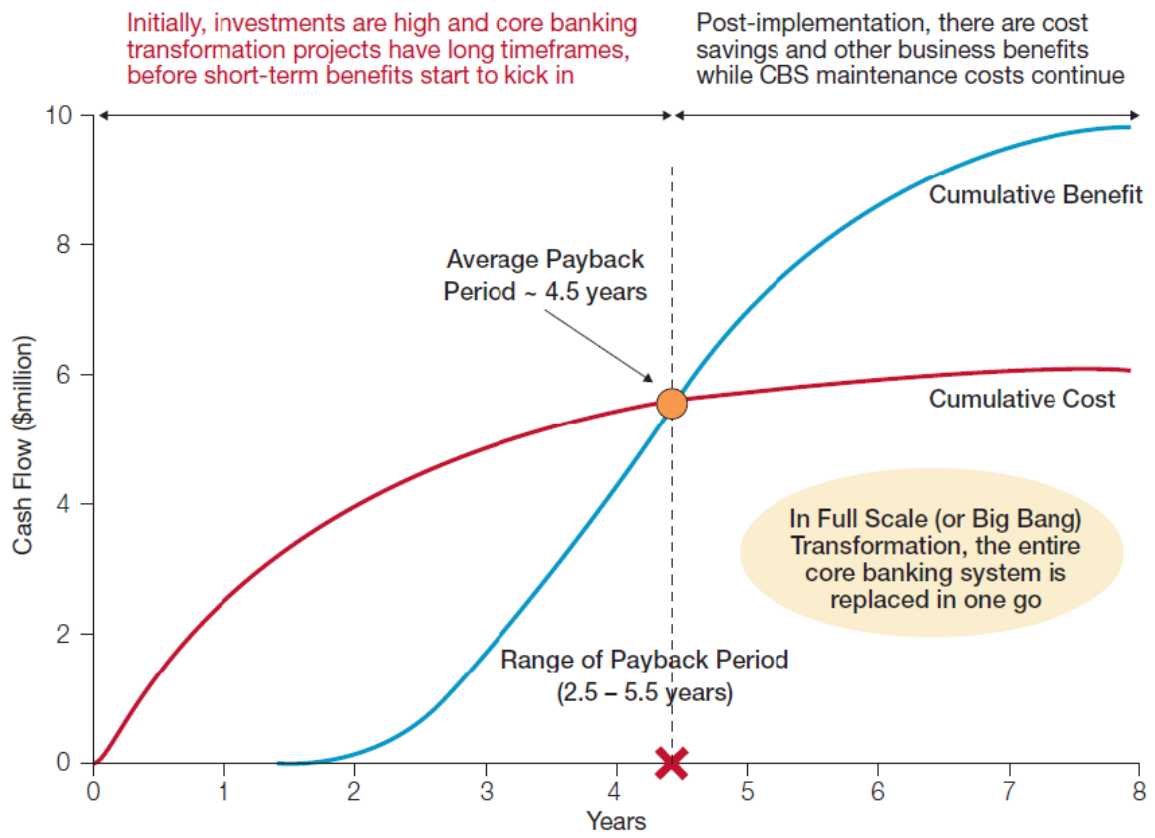
- Germany's Fidor Bank
  - Established FidorOS3, a middleware with an open Application Programming Interface (API) that can connect to existing core banking platforms to offer a range of modern services including lending money to friends, sending money via Twitter and arranging an emergency 24-hour loan.

Bank response to the rise FinTechs: Joint FinTech programs

- Build partnerships with incumbents to speed up adoption
  - Goldman Sachs' placement of its proprietary source code on the online collaboration tool GitHub. This allows external coders to try and optimize it, fostering competition amongst erstwhile Goldman Sachs programmers and while potentially seeing improvements from their efforts
  - Open Banking regulations in England as part of PSD2
  - Addition and Fairwinds are building new identity verification systems using Blockchain technology.

Bank transformation is expensive

Figure 66. Payback Period For Core Banking Transformation



Note: The plot comprises 29 banks belonging to Tier 1 (>US$500m), Tier 2 (US$100-500mn, Tier 3 (US$5-100m), and Tier 4 (<US$5m) category, with a majority of banks belonging to Tier 3 and Tier 4 category.
Source: Capgemini Analysis, 2013; Core Banking Systems Cost Benchmark, IBS Intelligence, 2012

Digital Banks of the Future

We need banking, but not banks – Bill Gates

Digital Banks of the Future

- Banking will continue to flourish with or without banks.
- If banks want to stay relevant, they need to transform their operations from the ground up.
  - It will not be enough to add better user interfaces.
  - Plug and play solutions will not be adaptable to the next change.
  - The legacy core banking systems though reliable have been a drag on systemic innovation.
- Let’s look at the past impact of technology to understand the future trajectory of banks

First wave: Value added incremental

- The ATM story is a landmark study in corporate innovation
- The concept was simple: deploy machines that could process transactions such as cash withdrawals and check deposits. What was revolutionary was what followed: banks historically had been open with limited daytime hours, say 9am – 3pm, which was inconvenient for people who had a job.
- In the 1950's, most householders in the U.S. had a single earner, and the stay-at-home-wife was able to handle banking needs during the day.
- The U.S. saw a rise in two-income households, which in turn led to a diminution in the ability of people to take advantage of daytime banking services – Evening utilization of ATMs surged.
- Online banking, likewise, was piloted in the 1980s by Citi, Chemical Bank, through Minitel (France), and Prestel (UK), but didn't really take off until the 1990s in conjunction with soaring internet usage.
- While the incumbent commercial banks initially were the purveyors of online banking, the rise of the internet also saw the rise of the internet bank – most prominently NetBank in 1996

Second wave: Digital hybrids

- Frequently taking advantage of front-end systems to better market and connect with consumers, they remain shackled by legacy back and middle office infrastructure, risk modeling systems, and sometimes labor models.
- Often these hybrid banks will have an incumbent bank as their backend
- Simple Bank was founded in 2009 with several innovations to streamline account management and costs, but uses The Bancorp as its backend
- Hybrid banks such as Fidor Bank (Germany), Atom Bank (UK), LHV Pank (Estonia), and DBS Digibank (Singapore) enjoy *purpose-built IT infrastructure that is 60- 80% less expensive to build, and 30-50% less expensive to maintain*, than legacy banks. Headcount is considerably lower, about 10-15% the levels of a traditional bank.
- These "digital hybrids" still use centralized databases, cloud-based storage and primitive user data protocols. They represent a bridge solution between the Main Street bank of yesterday and the fully digital bank of the future.

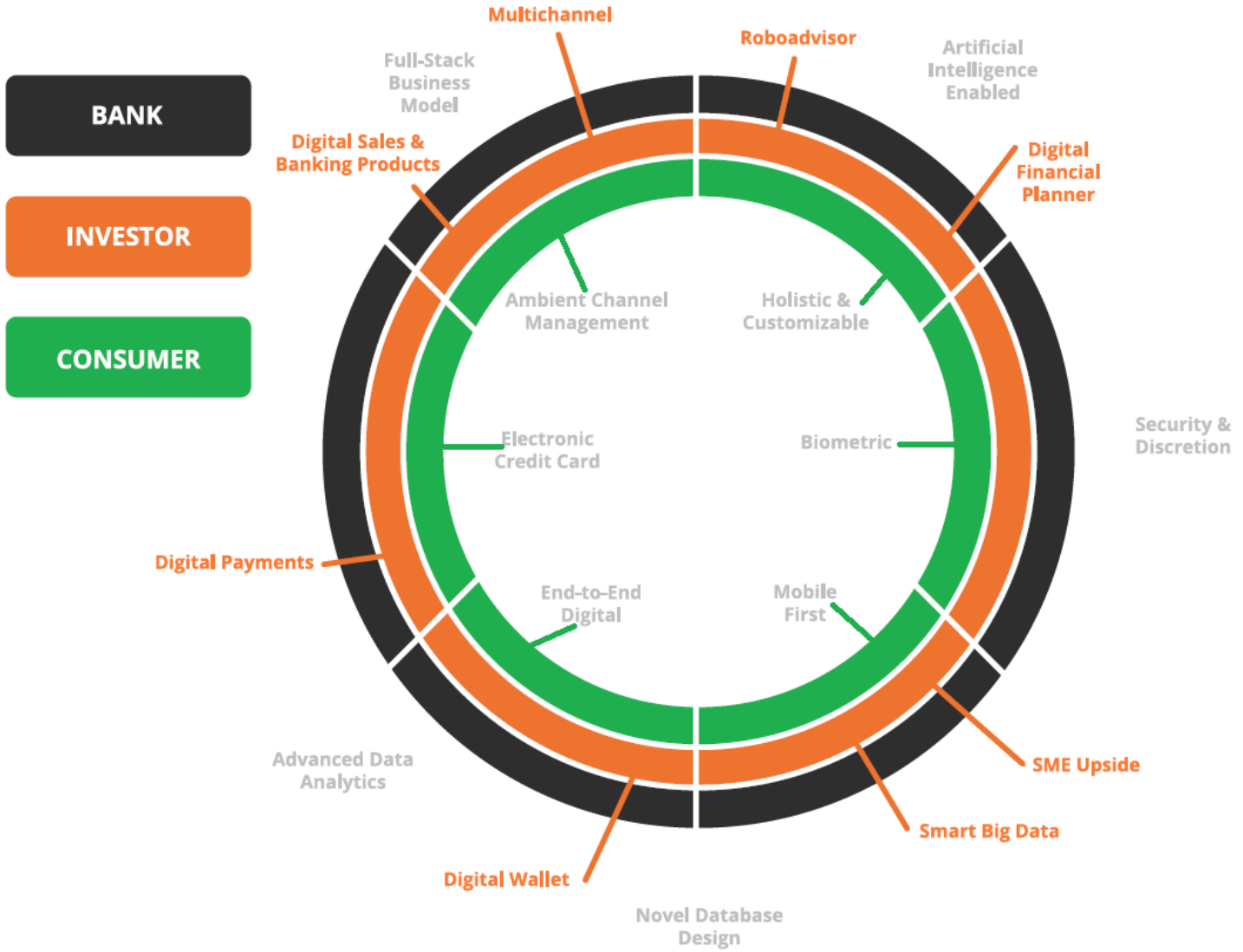
Third wave: Digital Banks of Future

- The 50 and under crowd that grew up with computers as a daily part of their lives

- A new set of technologies is emerging that permit close integration with consumers' lives, promise access to the 2.5 billion unbanked or underbanked consumers globally

- DBFs are expected to use a secure, encrypted, distributed data system. Personal data stores not only permit better digital walleting, but also greater security around personal biometric data which is integral to the digital bank's security protocols

Stakeholder Perspectives: Digital Banks of the Future

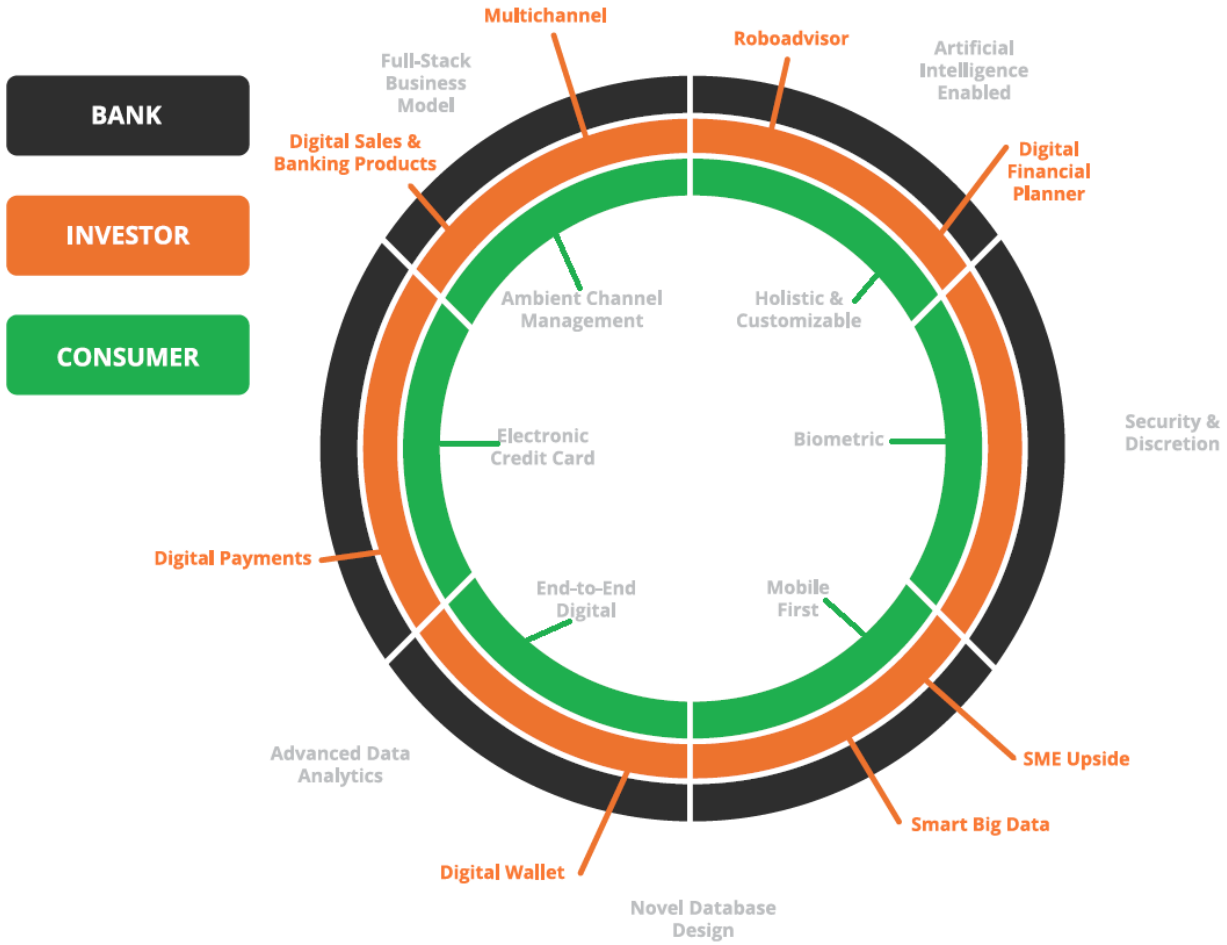


Source: Digital Banking Manifesto: The End of Banks?

Stakeholder Perspectives: Consumers' view of a digital bank

Holistic & Customizable Experience:

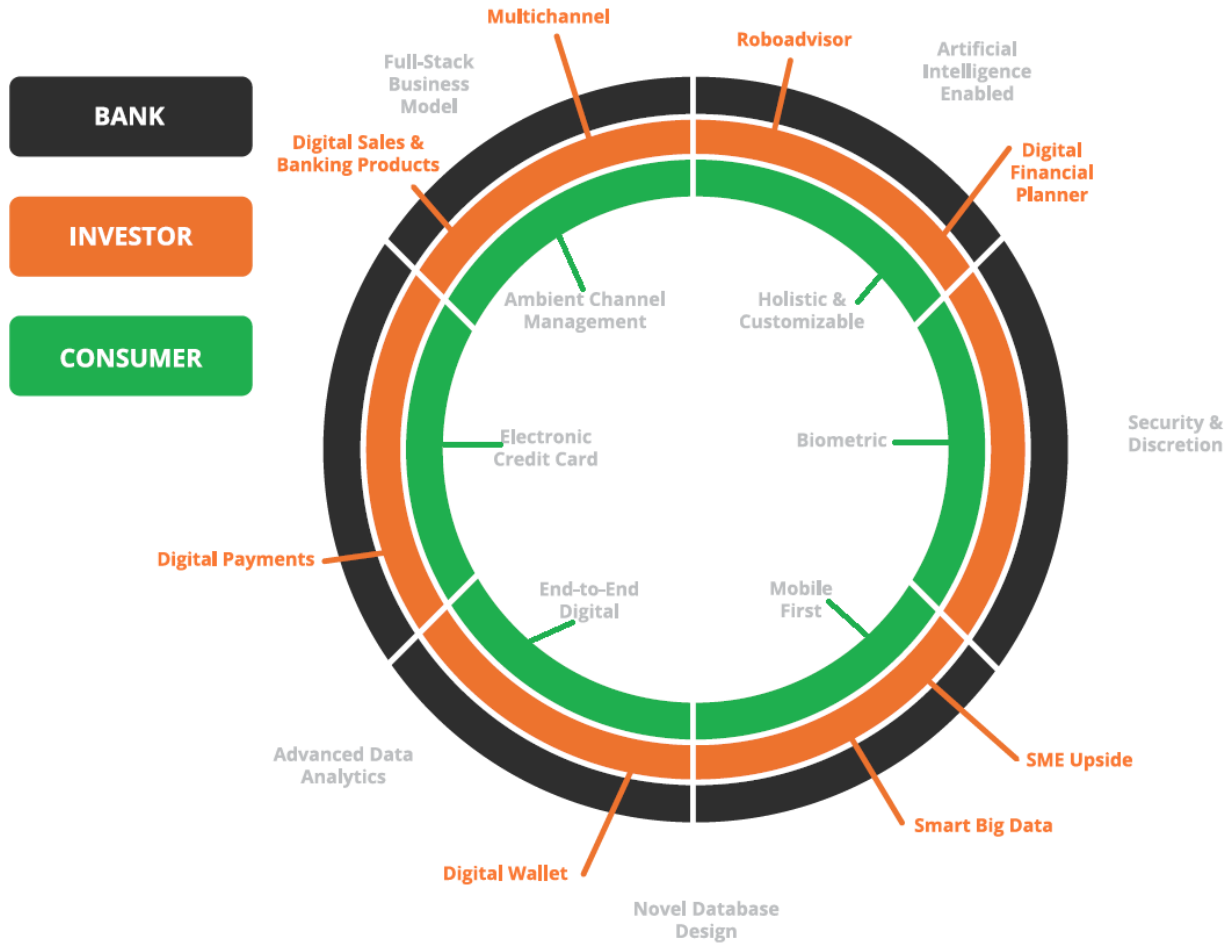
- Provide a holistic, interactive, and intuitive overview of the customers' money and, more broadly, their financial life, including information on their current account and deposit balances, transactions, outstanding loans, recurring payments, pension contributions and accumulation as well as securities accounts.
- Tailor its services for different customer segments such as small and informal merchants, mass affluent, youth market, international travelers, or low- income customers.
- Offer a trusted and relatively inexpensive source of credit for its customers.



Stakeholder Perspectives: Consumers' view of a digital bank

End-to-End Digital:

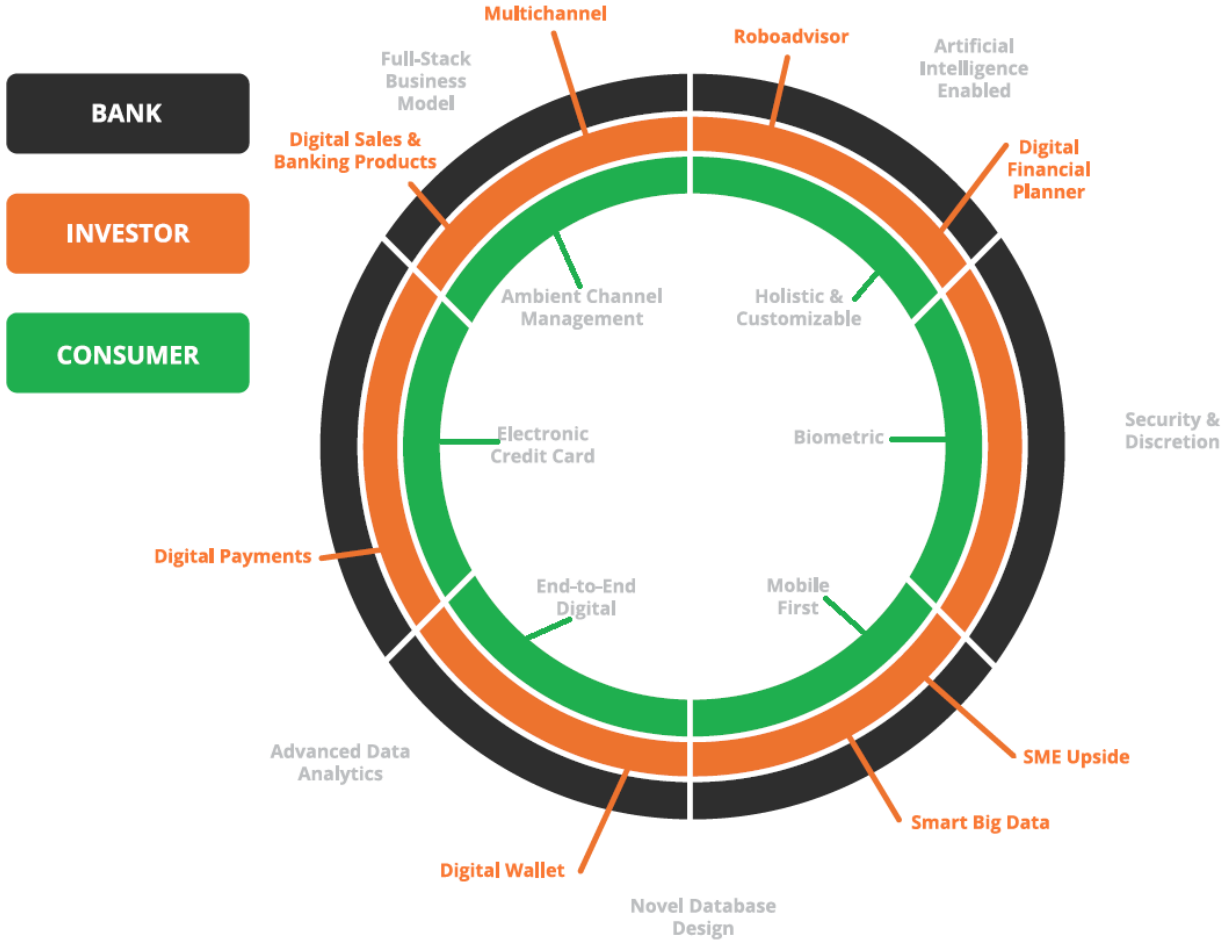
- Provide a holistic fully digital experience for customers, including, paperless application and passing of the KYC (Know Your Client) process.
- Provide an interactive and intuitive digital financial planner to organize customers' financial life and optimize their resources: immediate cash flow requirements, savings, including tools for automatic savings, medical expenses, education, retirement, including robo-advisory with *services previously accessible by high end investors only*, investments, including tools for trading securities.
- Empower customers to electronically apply for mortgage or loan, competitive insurance contracts for home, liability, medical and travel insurance, with credit checking procedures expanded to social media.
- Provide reporting documentation related to bank activity, including tax statements, etc.
- Provide access to Personal Data Store (PDS).



Stakeholder Perspectives: Consumers' view of a digital bank

Mobile First:

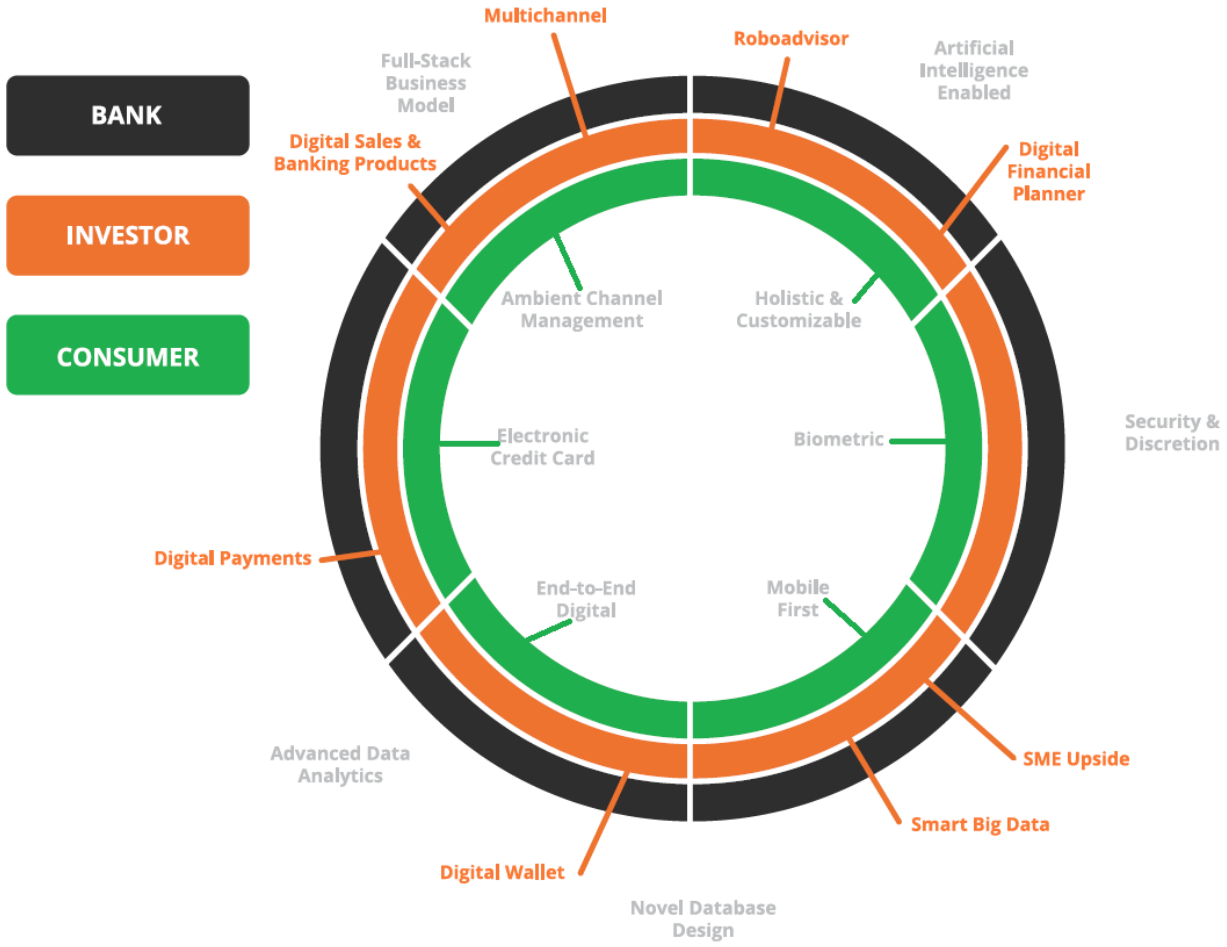
- Enable natively driven mobile e-payment solutions, including domestic and international payments and remittances, automatic bill payments, and peer- to-peer (P2P) payments and money transfers.
- Rather than having mobile as an afterthought or an added capability, everything changes if you start with mobile and build out from there – not just UX but fundamental infrastructure and credit analytics.



Stakeholder Perspectives: Consumers' view of a digital bank

Foreign Exchange:

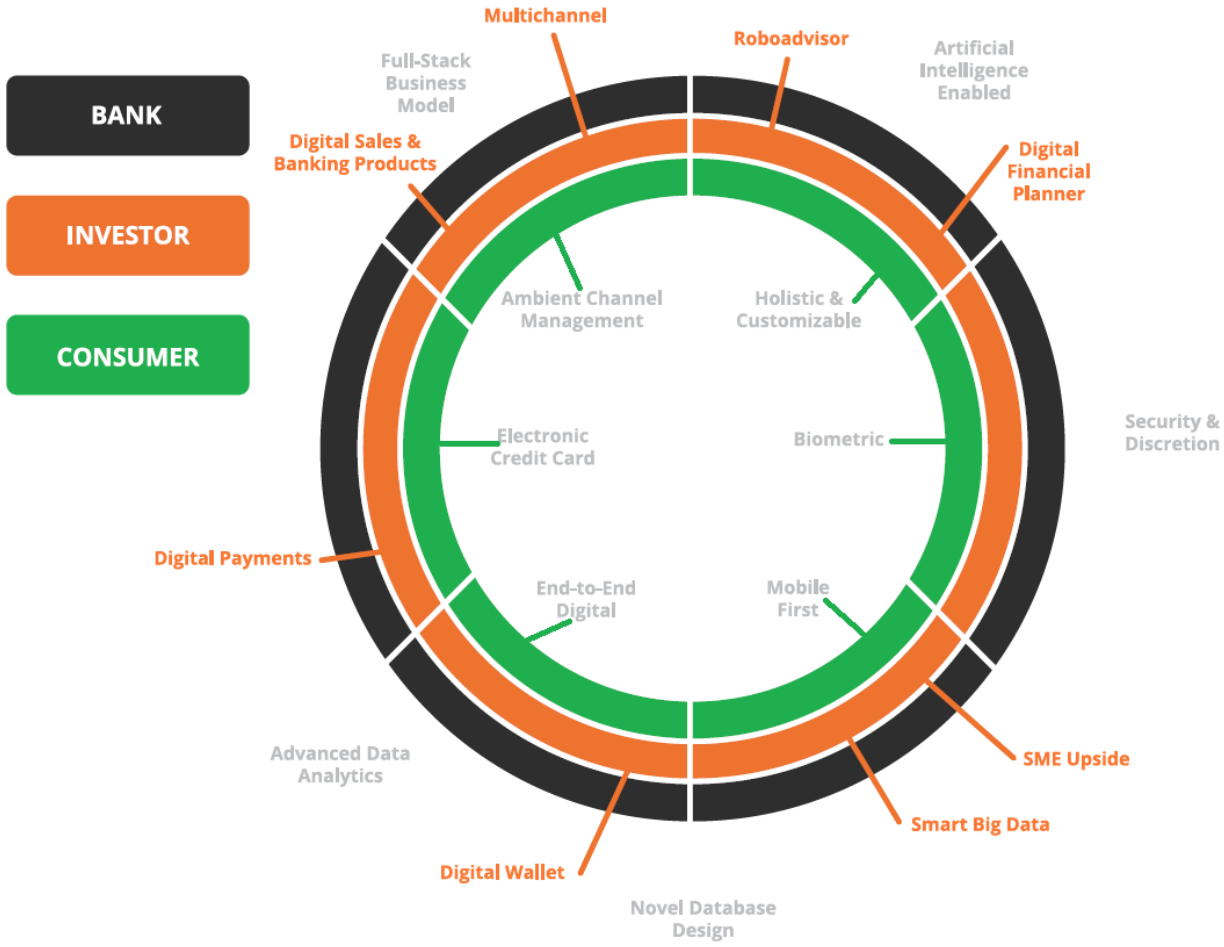
- Deliver seamless and inexpensive foreign exchange services, including protection against exchange rate fluctuations by providing multi-currency accounts.
- A full range of instruments for hedging against foreign exchange risk, including forward contracts, spot contracts, swaps, and exchange traded options can be offered.
  - Is this a good idea?



Stakeholder Perspectives: Consumers' view of a digital bank

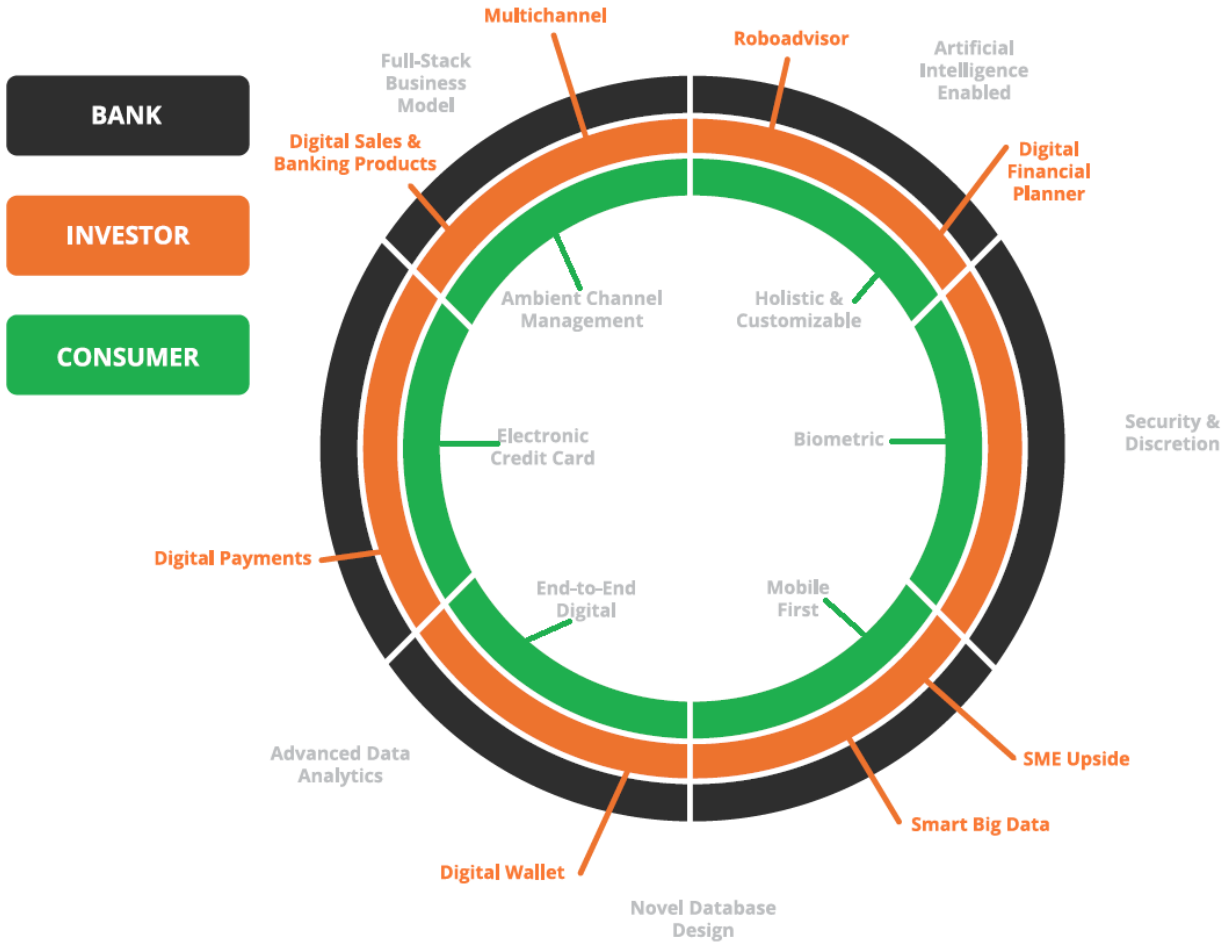
Biometrics:

- Offer biometric technology such as face and voice biometrics, already actively used at airports and international border controls, as core credentials for customers with preference for biometrics to PIN or password as a way of authentication for logging in.
  - How many of you use Face ID/fingerprint as your login?
- Behavioral biometric, which is being developed at the moment, is a promising venue for achieving an extra degree of protection.



Stakeholder Perspectives: Consumers' view of a digital bank

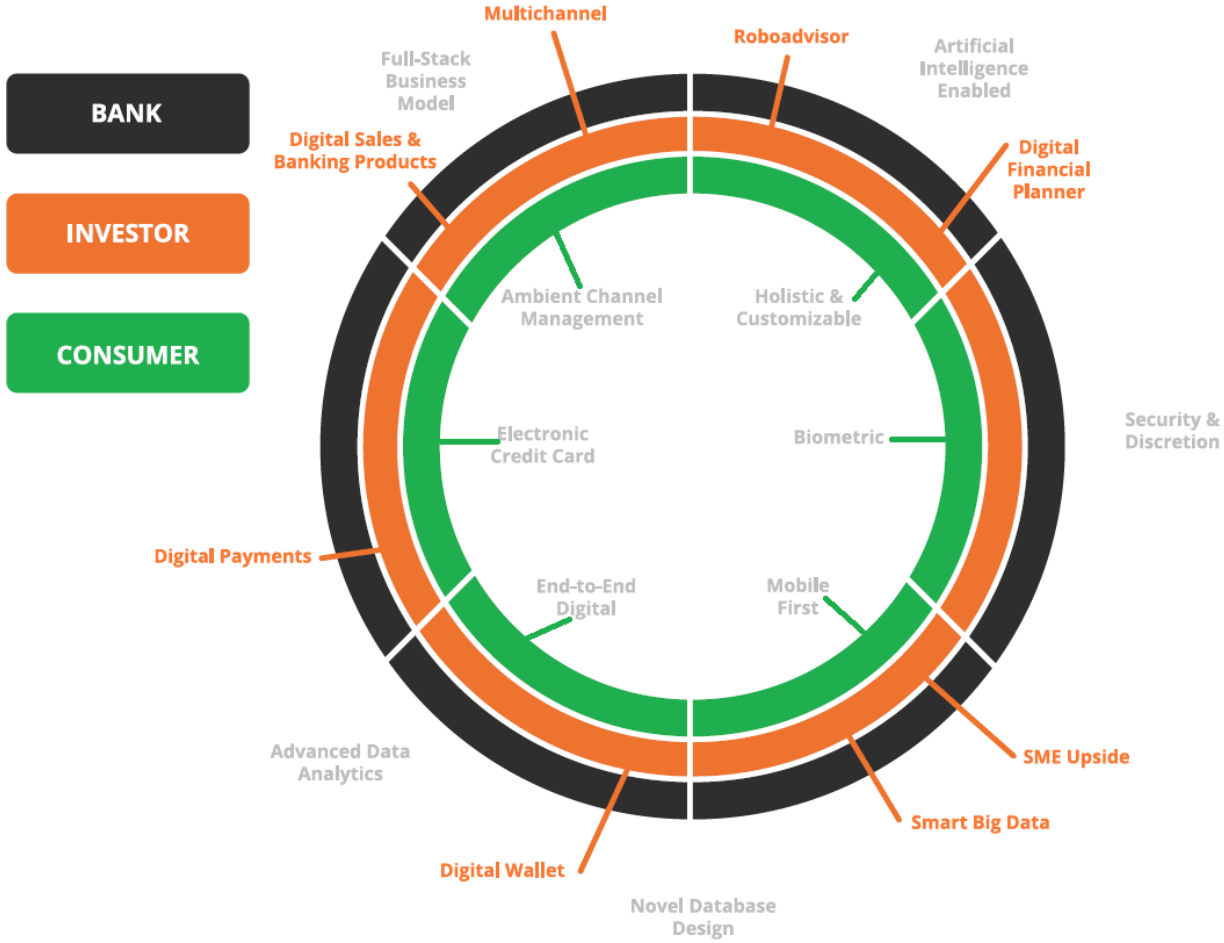
- **E-Credit Card:** Implement bank e-credit card based on customer's own preferences with pre-set limits and permitted transactions, consumption-related patterns, and a comprehensive digital wallet and PDS, which includes, at the minimum, electronic ID, e-card for secure online purchases, and tools to view, pay, organize, analyze, archive e-bills, and generate relevant tax documents;
- **Access to P2P World:** Provide access to "crowd-everything" including P2P payment and lending opportunities.



Stakeholder Perspectives: Investors' view of digital banks

- Digital bank is an exciting investment opportunity and inevitable business step because legacy banks are no longer able to adequately service their customers' needs in the digital age.

- E.g., Atom Bank in the UK intends to grow into a £5 billion balance sheet business in five years with just 340 full time staff, while legacy bank Metro has that size balance sheet with 2,200 people.

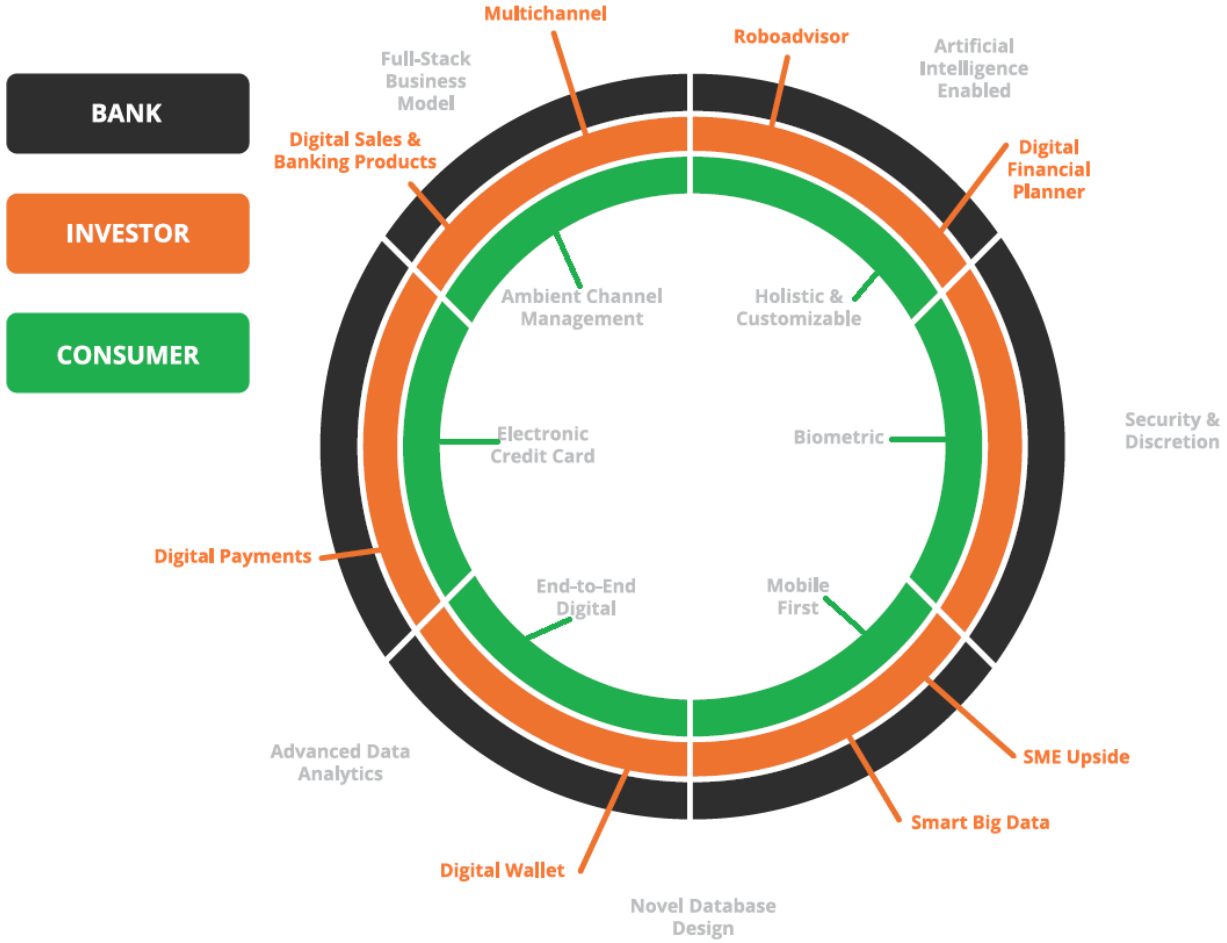


Stakeholder Perspectives: Investors' view of digital banks

Digital banks have several opportunities to monetize this gap in services and create value:

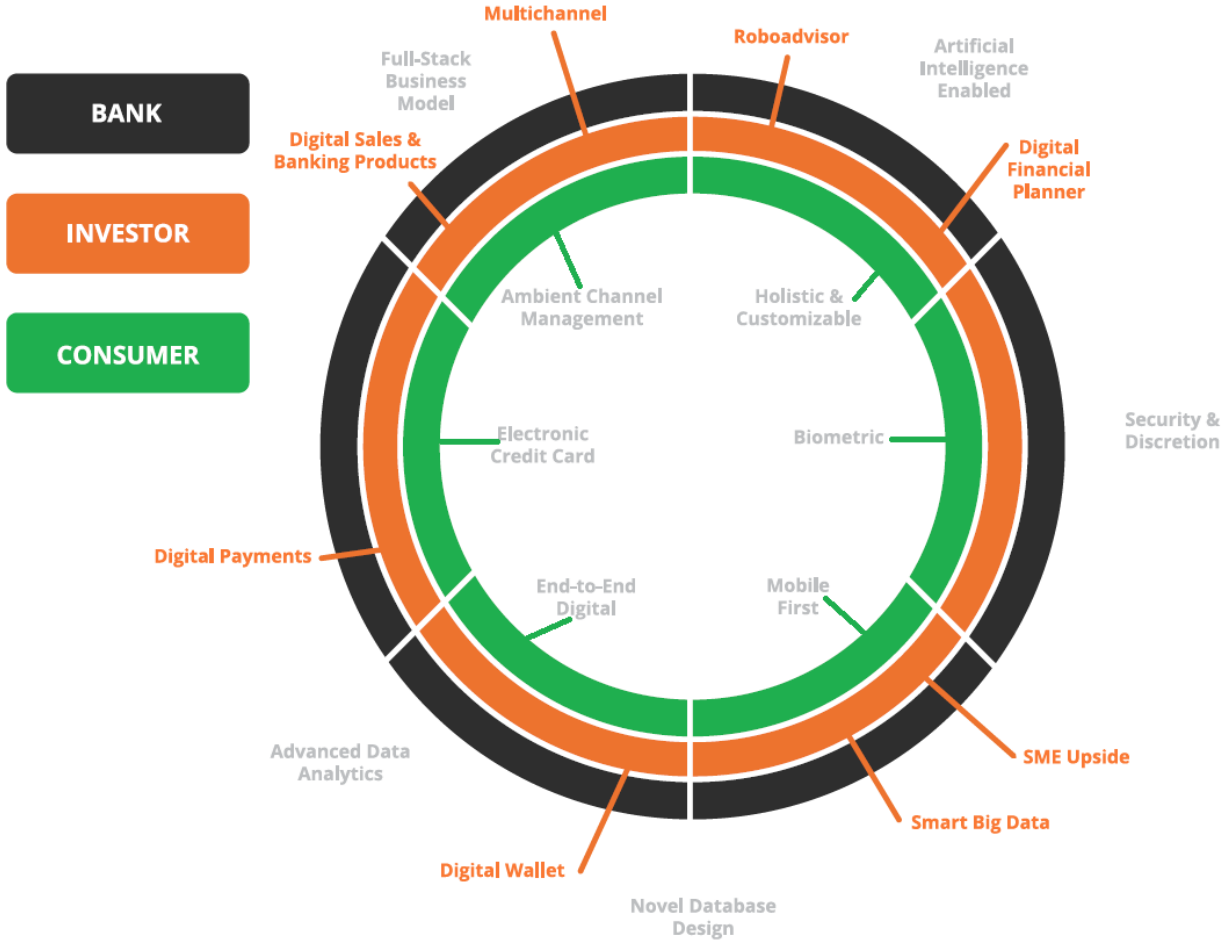
Digital Payments:

- Digital payments form the core of monetization. They include mobile and online payments, both domestic and foreign, as well as mobile P2P interactions.
- Digital payments enable banks to boost fees and interest income and reach a broader set of customers with more diverse services; they are done more cost effectively than by incumbent banks, allowing market share gains through competitive pricing and/or accessing 2.5Bn unbanked & underbanked.



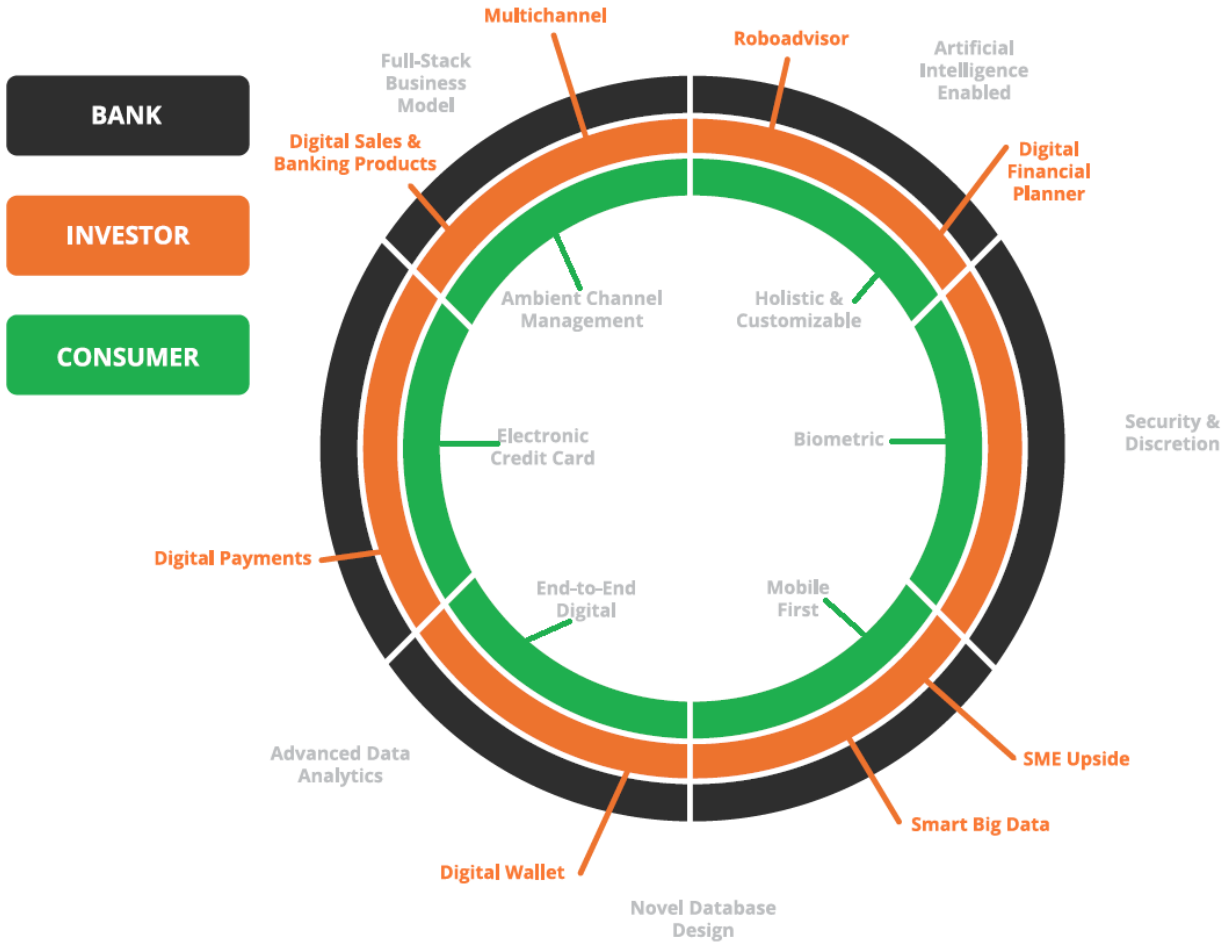
Stakeholder Perspectives: Investors' view of digital banks

- **Digital wallet:** Digital wallet is essential for digital commerce and ecosystems built on value-added services. In addition, it optimizes transaction costs for customers and funding costs for banking operations.
- **Digital Sales & Banking Products:** Artificial intelligence (AI) assisted sales of banking products, such as deposits, loans, and mortgages are conducted through direct channels, including social media. That is in line with shifting consumer preferences and behavior trends in e-commerce, especially directed at Generation Y and tech- savvy customers.



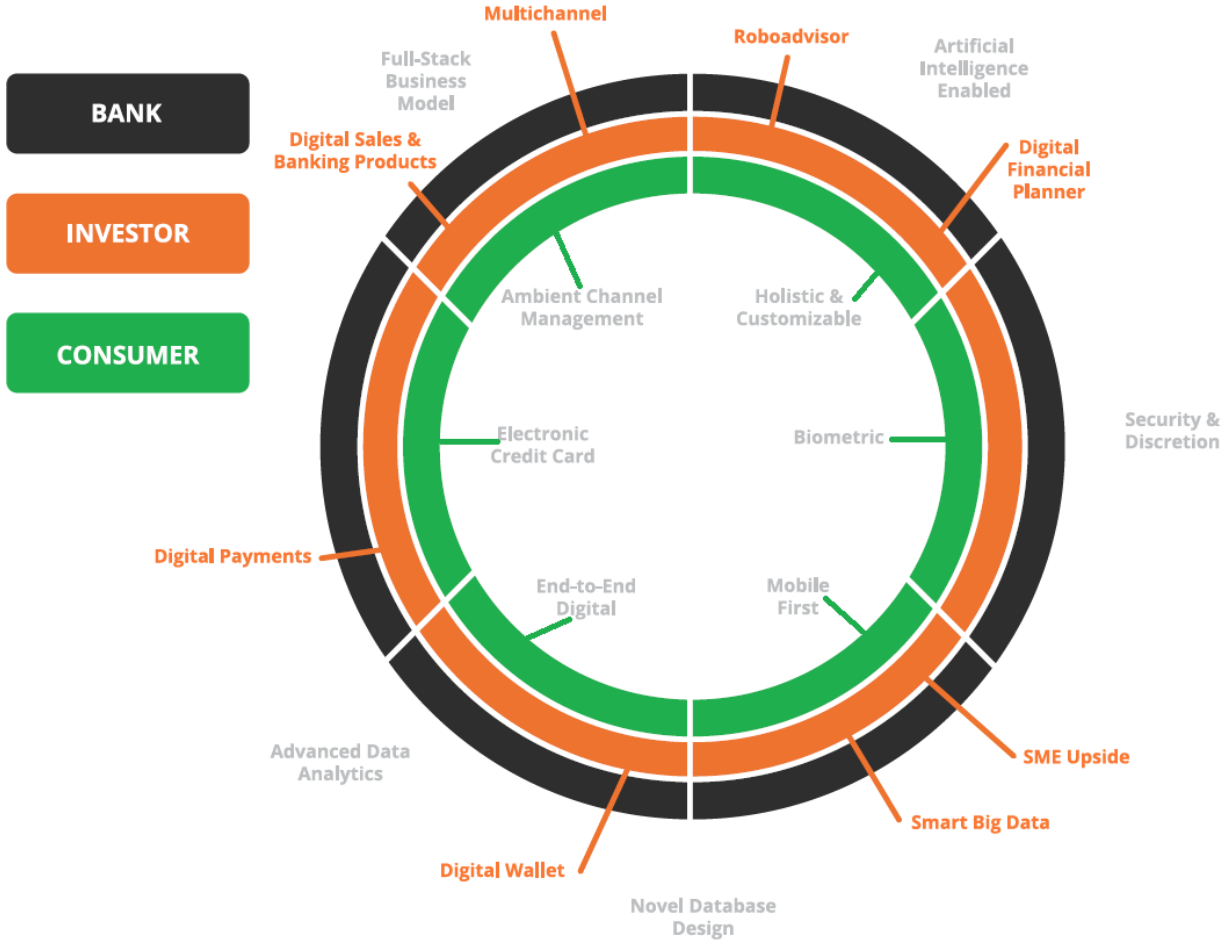
Stakeholder Perspectives: Investors' view of digital banks

- **Multi-channeling:** An integrated and seamless multichannel approach to sales increases the bank's share of customers' wallet, boosts customer loyalty, thereby making a significant difference in customer adoption rates.
- **Digital Financial Planner & Robo-advisory:** AI-based digital financial planner manages monthly income, recurring payments, savings and investments, increasing interaction between the digital bank and customers. The bank acts as a trusted shepherd defining customer life-cycle financial needs. Logical continuation of the circle of trust between the digital bank and customers, where customers rely on the Robo-advisory services to optimize investment portfolios based on individual goals and preferences, regularly adjust them and record incremental results and properly allocate resources for each phase of the customer's voyage towards all things digital.



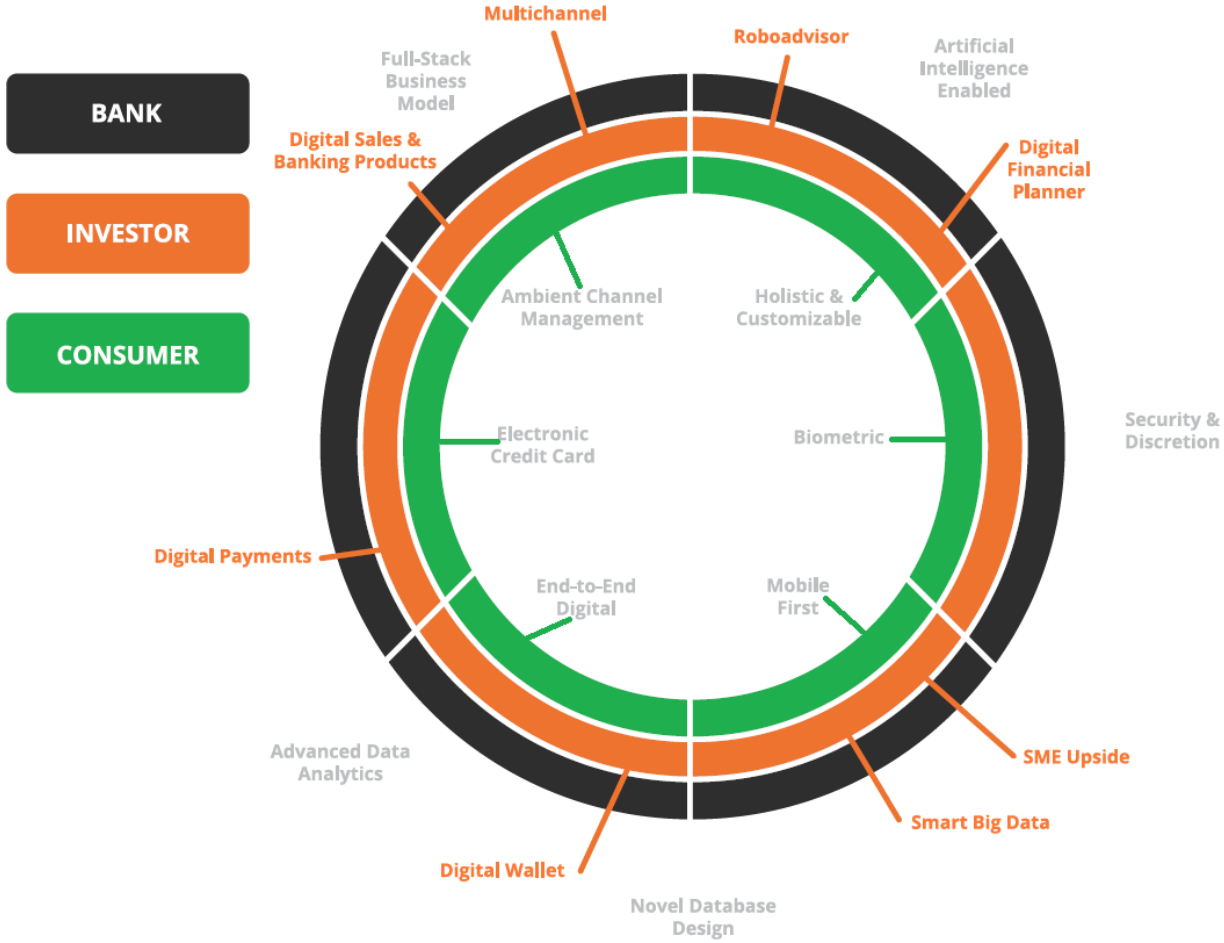
Stakeholder Perspectives: Investors' view of digital banks

- **Smart Big Data:** Advanced analytics allows the digital bank to transform its data into more personalized client service aimed at data monetization.
- **SME Upside:** AI- and big-data based credit models enabling risk-managed provisioning of credit access to SMEs, banking the 45 million underbanked SMEs globally. By 2018, banks in Scandinavia, the United Kingdom, and Western Europe are forecast to have half or more of new inflow revenue coming from digital related activities in most products, such as savings and term deposits, and bank services to SMEs.



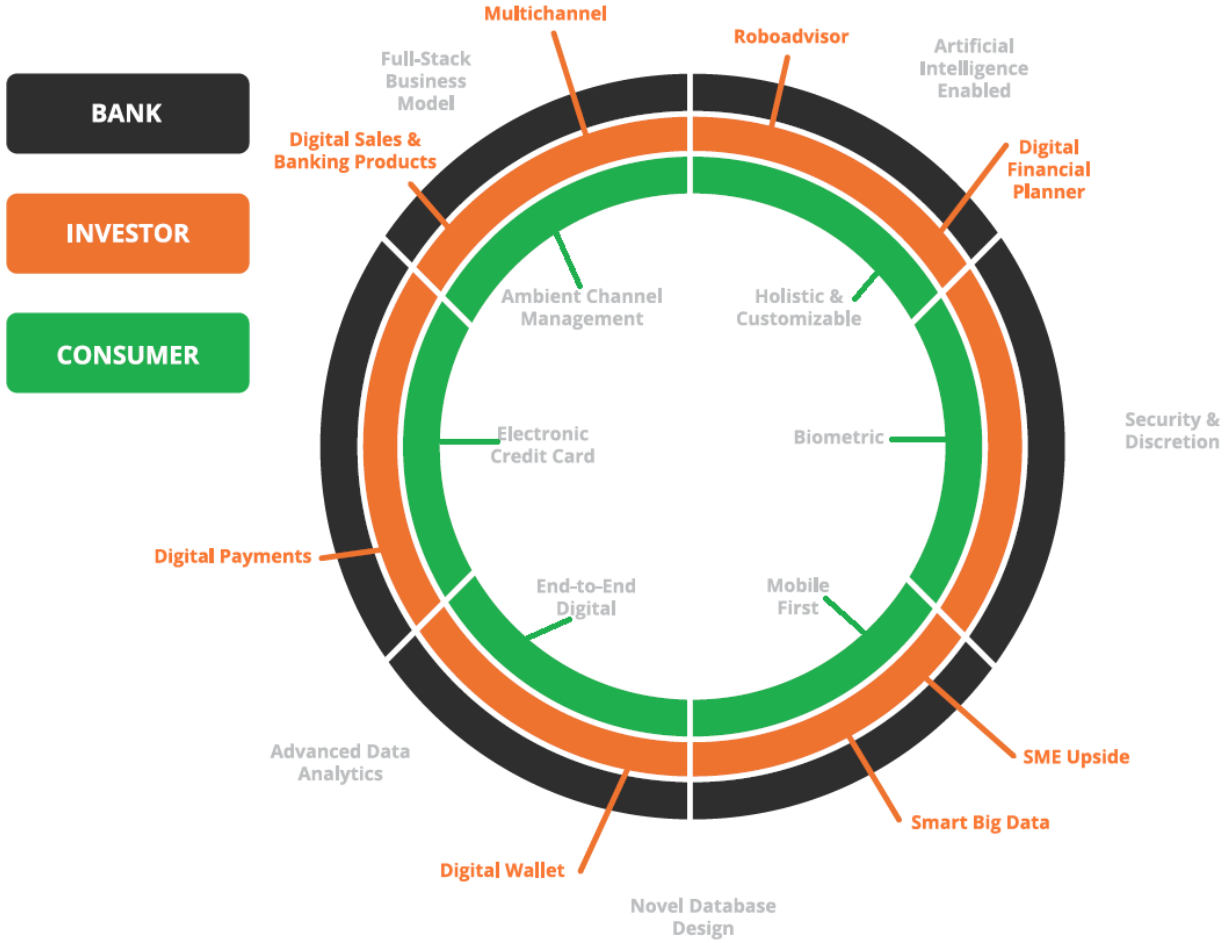
Stakeholder Perspectives: Banks' view of digital banks

- *"Banks are mired in the legacy of old IT systems that are bad... The first automated banking system was introduced by Coutts in 1967. The joke is that they are still running on it today."*



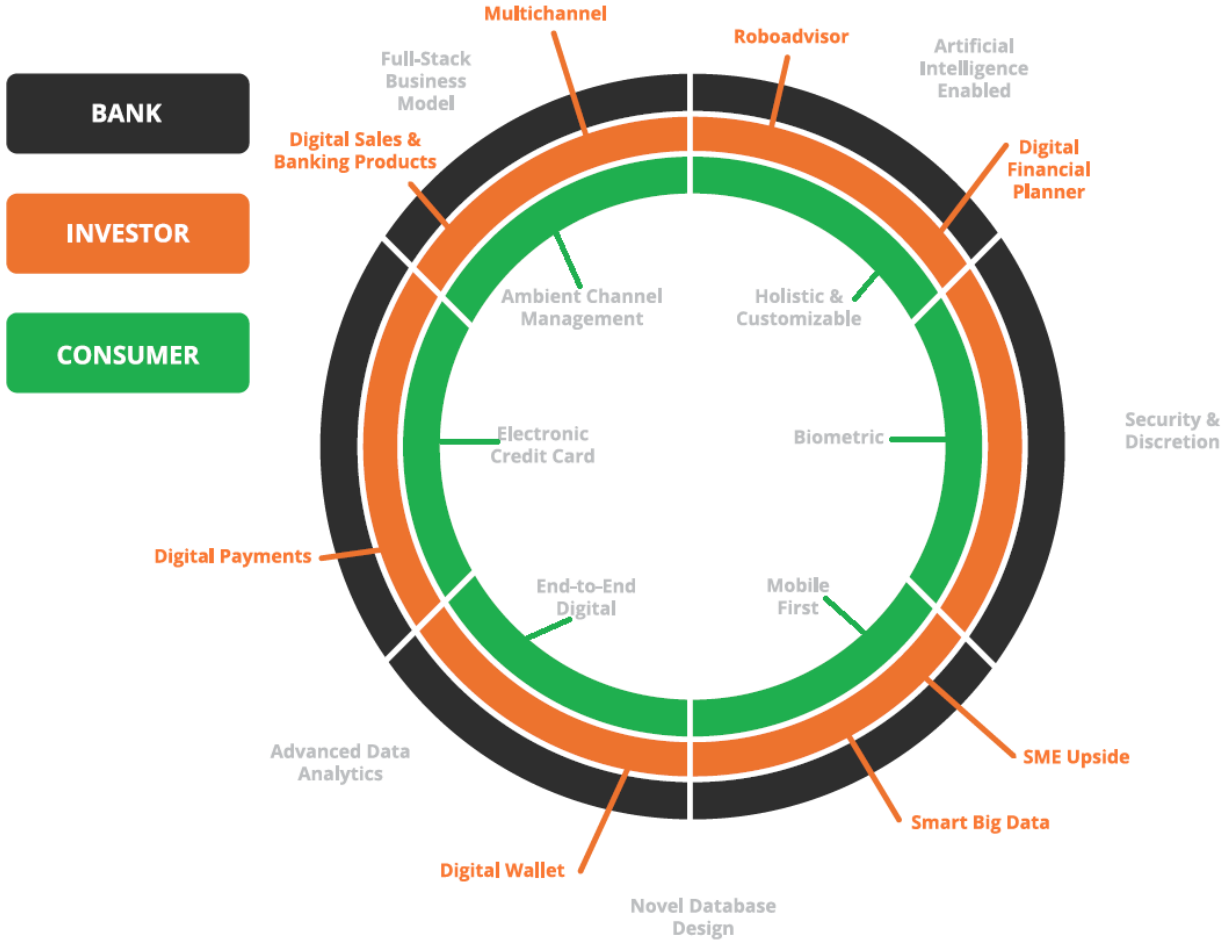
Stakeholder Perspectives: Banks' view of digital banks

- By its very nature, a digital bank is a cross between a Fintech company and a bank.
- While a digital bank, similar to a conventional one, can be organized into five divisions: Retail Banking, Private and Business Banking, Analytics and IT, Finance Management and Operations, and Risk Management, the relative importance of these departments is not the same.
  - Can you guess which division will be the largest based on what happened in 2008?
- Moreover, the relationship map between various divisions is different in digital and legacy banking, with analytics and IT being the cornerstone of the digital banking edifice.



Stakeholder Perspectives: Banks' view of digital banks

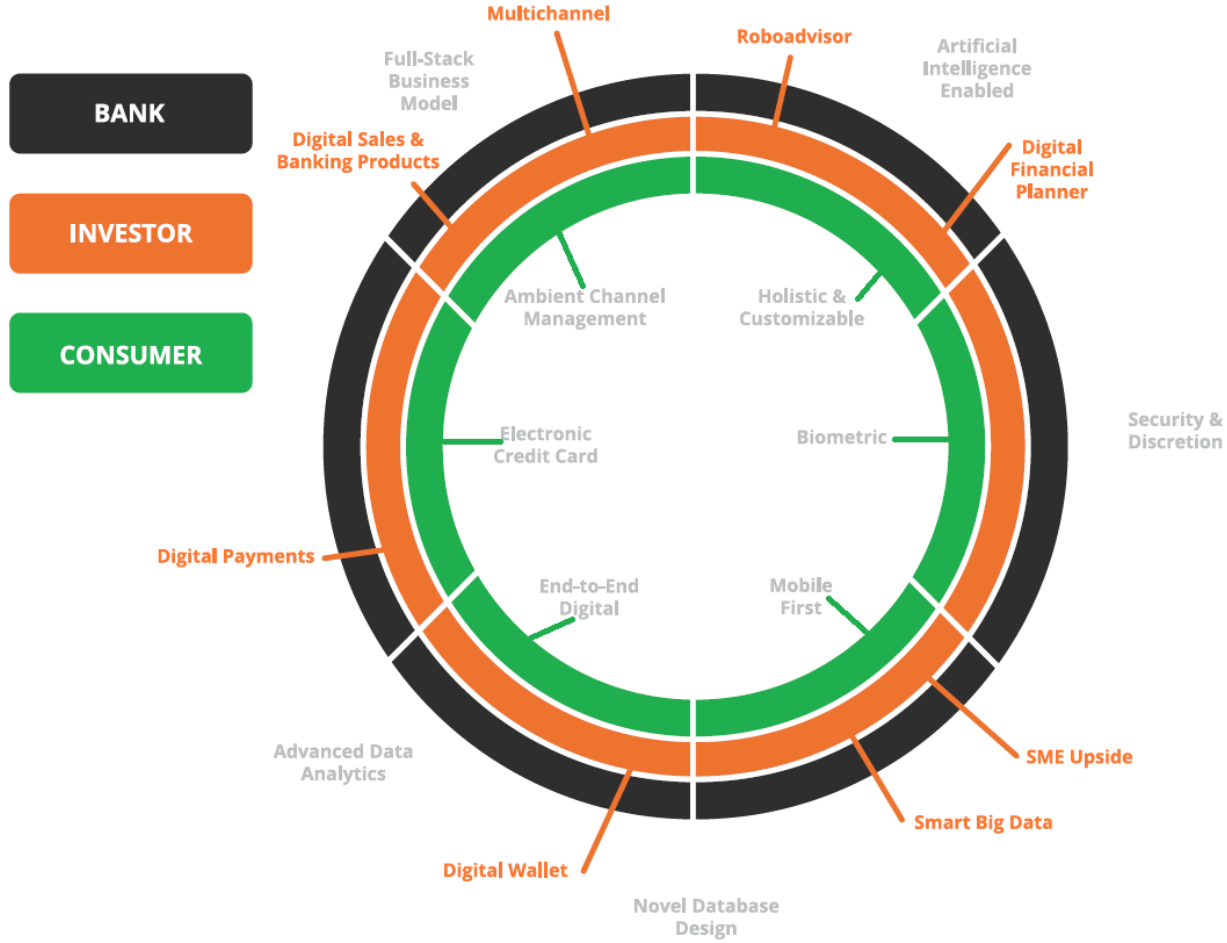
- **Novel IT Infrastructure**: Building a digital bank from scratch enables to create a flexible IT infrastructure, which provides state of the art risk management, helps to optimize the bank's balance sheet to achieve return on capital significantly higher than return of the incumbents, and guarantees compliance with constantly changing banking regulations in real time, which is achieved via building modern RegTech capabilities.
- **Database Design**: The bank IT is based on the state-of-the-art database technology, which can cope with the exponential growth in data, new internet technologies and analysis methods. This technology is expected to be based on distributed ledger framework.



Stakeholder Perspectives: Banks' view of digital banks

Advanced Data Analytics:

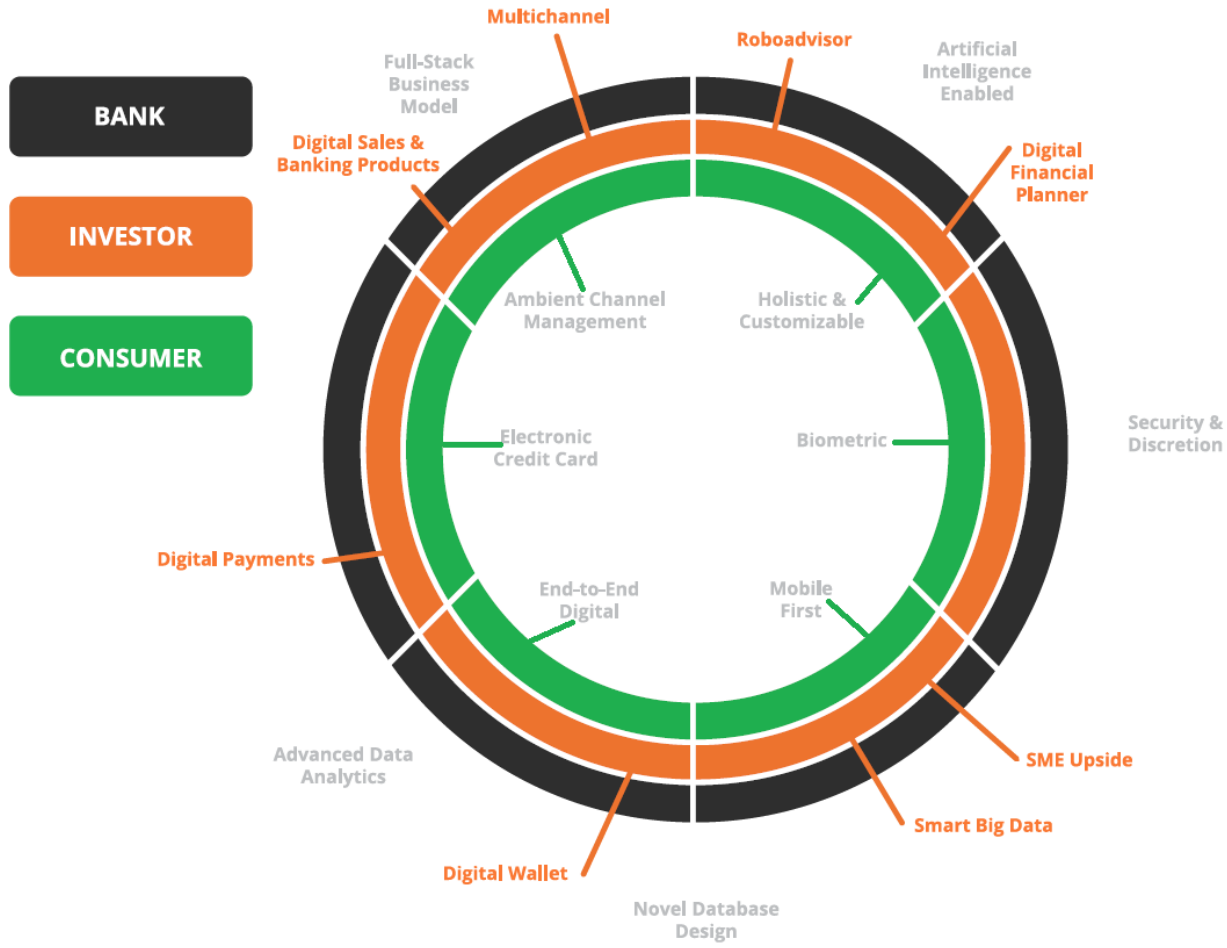
- Banks own rich reserves of raw behavioral data, which can provide valuable insights into future customer choices, the value proposition offered by digital banking can be extended.
- Bank should consolidate data across deposits, consumer finance, and other transaction accounts for a unified view of customer activities (Similar to tech companies). E.g., customers' in- store payments are far more accurate than conventional profile data (for example, age, income, geography) in predicting their future financial activities and credit worthiness; their geospatial mobility among stores providing extra improvements.
- In addition, using customer data, digital banks can create offerings ranging from payment solutions and information services, savings and deposit-taking right through to online banking, advisory services, and simple financing.
- It is imperative to be able to evaluate collected customer transactions in real time and connect them for prediction of future customer behavior using deep learning and other probabilistic algorithms.
- It is important to build in safeguards of customer privacy in accordance with their preferences and legal requirements.



Stakeholder Perspectives: Banks' view of digital banks

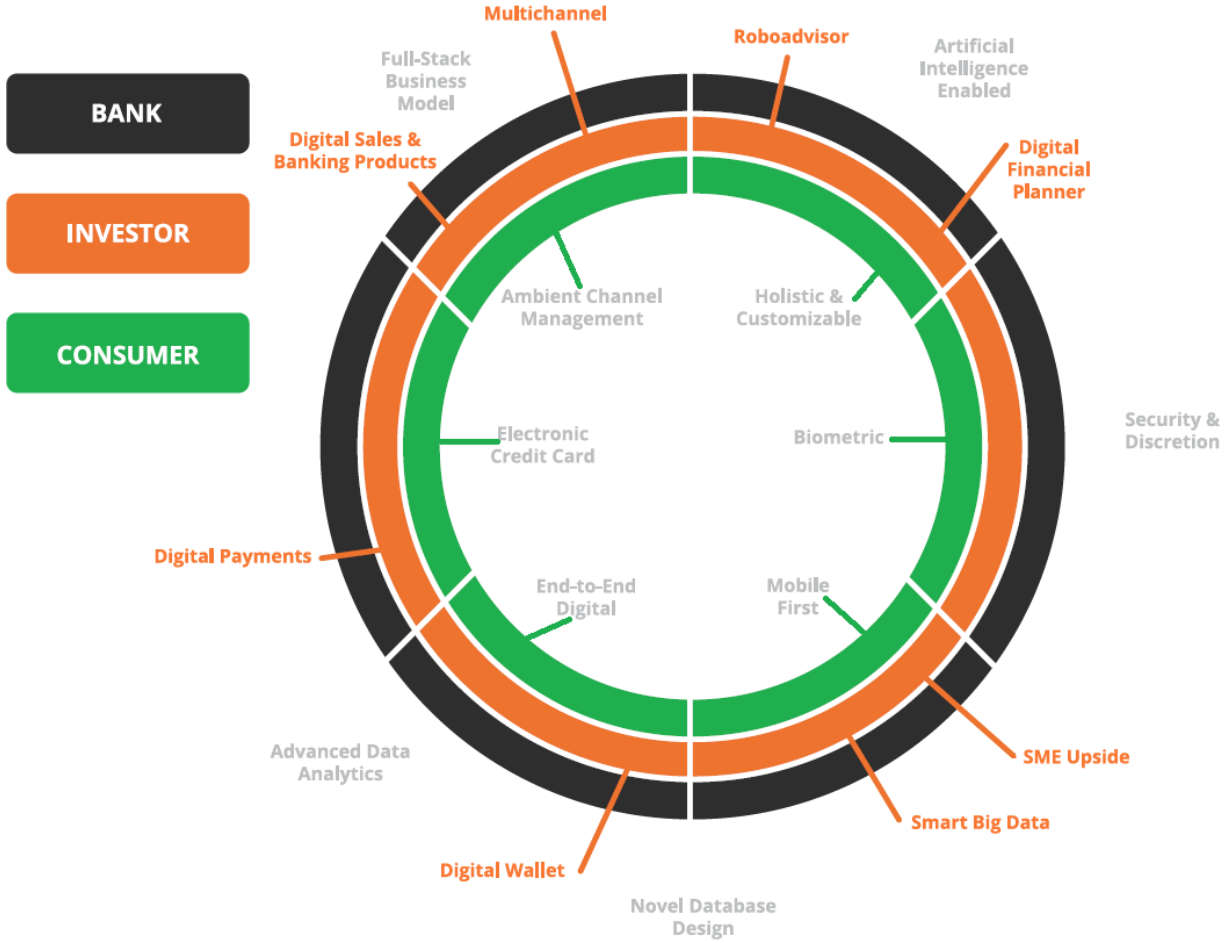
Artificial Intelligence:

- Autonomous selection of best methodology when presented with arbitrary data enables banks to dynamically adopt to novel information and build a full financial profile of its customers, including credit worthiness, debt capacity, and risk appetite for financial planning.
- In addition, AI can rapidly adapt to customer needs and present the best offers at the right time, changing dynamically as the customer evolves.
- A "smart bank" can more rapidly capitalize on shifts in a customer's life cycle and assist them in achieving their financial goals.



Stakeholder Perspectives: Banks' view of digital banks

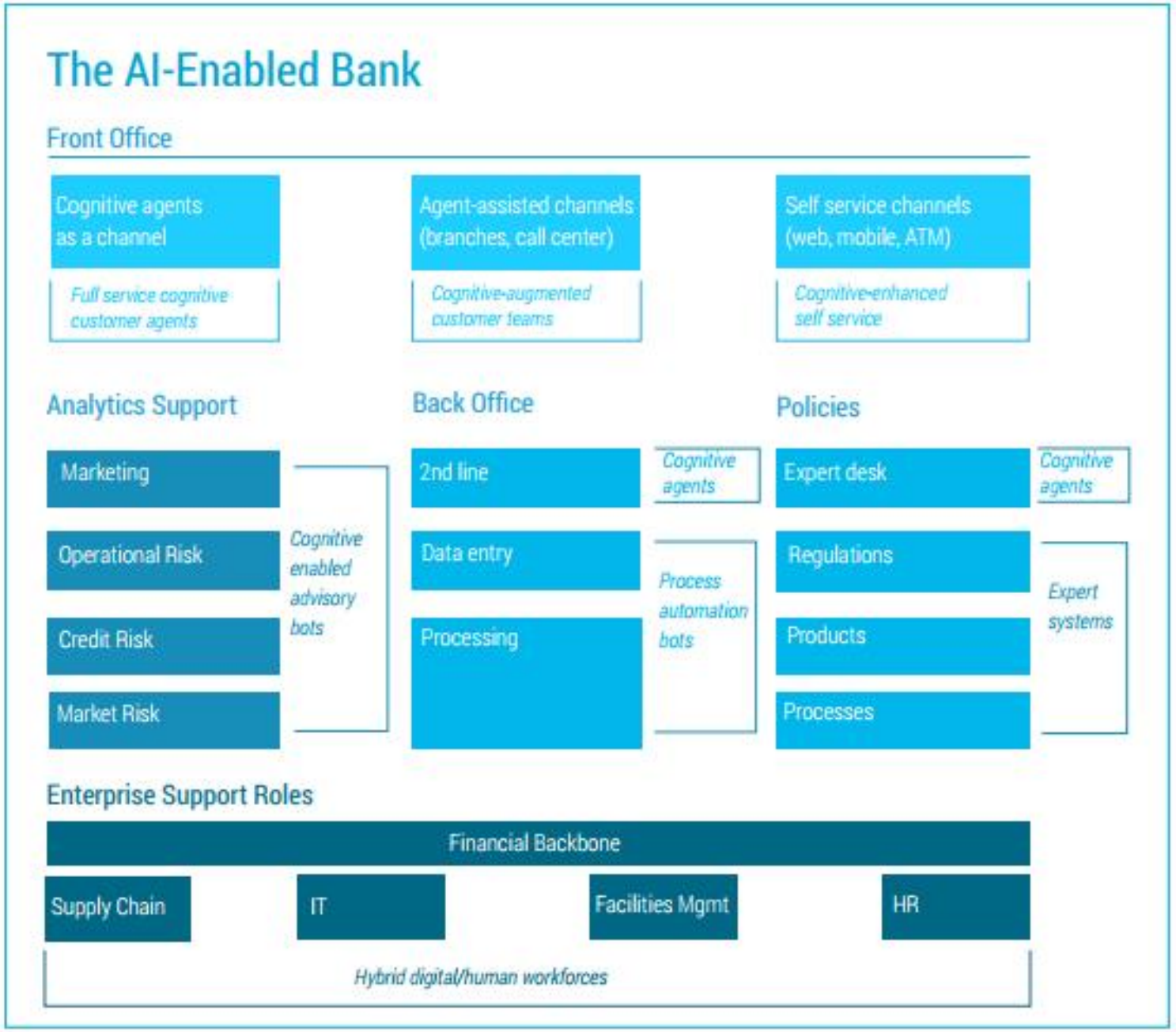
- **Full-Stack Business Model:** The full-stack business model is crucial to the total client experience. This approach facilitates the bank's compliance with the regulatory framework, which enforces money laundering and fraud prevention and guarantees customers' protection. In general, intelligent fraud detection and remediation systems can function in a far more superior fashion than conventional methods.
- **Security and Discretion:** If implemented correctly, bulletproof security and customer protection is the area of a great competitive advantage for digital banks compared to other financial service providers. These features are embedded in a secure IT architecture from the onset and preclude both data misuse and data sales to third parties. They naturally include implementation of new cryptographically secured distributed data management.



End result

- In 2017, John Cryan, Deutsche Bank CEO, told a Frankfurt conference: *"In our bank we have people doing work like robots. Tomorrow we will have robots behaving like people."*

- Just for fun: https://www.youtube.com/watch?v=i35xfEGAu-I



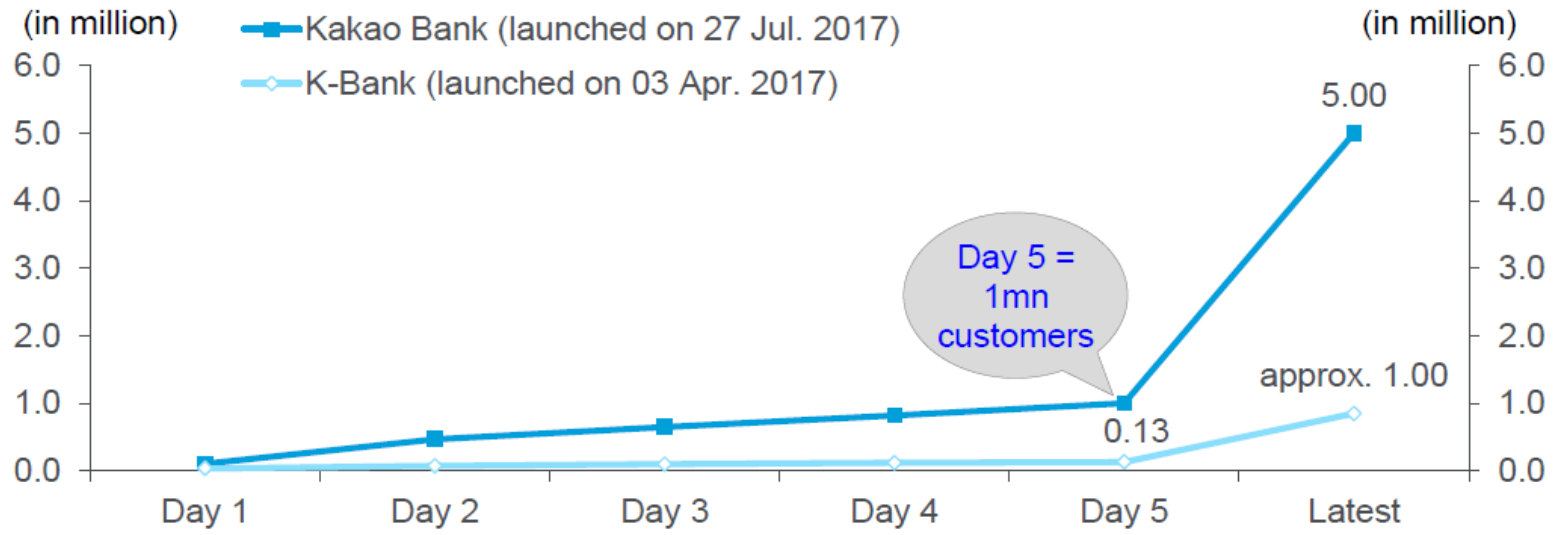
Case Studies: Kakao Bank

- **Kakao Bank** launched in Korea, backed by the KakaoTalk messaging app with ~42 million clients, gained 2 million banking clients within two weeks of its launch and has more than 10+ million clients within two years from launch.

- Kakao Bank offers a better user experience, such as easy access/online-only authentication, as well as lower loan rate/fees.

- The first Internet bank in Korea, K-Bank, has grown more slowly – platform company support matters.

Figure 1. Korean Internet-Only Banks – Aggregate Number of New User Accounts



Source: Press Reports (Business News Daily Korea), Citi Research

Case Studies: DigiBank by DBS

- DBS, the largest bank in Singapore, has successfully transformed itself without replacing its legacy core system but rather by reducing its dependence on it.
- DBS launched its technology transformation back in 2009 and in 2014 accelerated that transformation in the face of growing digital competition.
- While DBS called its transformation “digital to the core” – it would not simply apply “digital lipstick” to the front-end systems – the bank decided not to replace its legacy core banking system. Instead, DBS decided to reduce its dependence on it by moving functions to micro-servers and designing systems and processes which would migrate to the cloud.
- Following this transformation, DBS says that its digital customers have a cost-to-income ratio of 34% versus traditional customers at 55%, and that digital customers generate a return on equity (ROE) of 27% versus a ROE of 19% for traditional customers.
- Fun fact: DBS used to be called “damn bloody slow”

Case Studies: DigiBank by DBS

Takeaways:

- It demonstrates the benefits for a bank that fundamentally transforms itself into a digital bank.
- A bank that does so must reduce its dependence on its legacy core banking system even if it does not replace it
- This approach is likely only an option for the very largest banks with scale and substantial resources
- Banks lacking the size are likely better off using a third-party vendor to re-platform.