

History and prospects of digital finance

Alessandra Tanda
Department of Economics and
Management - University of
Pavia

A History of Technology and Finance (pt 1)



Finance and technological innovation



A long-lasting relationship





























The transmission of technological innovation to finance and financial markets is becoming more intense and rapid



In the context of the digital economy, FinTech is developing → Fintech, i.e., the application of technology to finance





























A long-lasting relationship

Phase 1	Phase 2	Phase 3	Phase 4
Analogue technology, much paper (up to the 1960s)	First technological changes (1960s-2008)	Fintech disruption (2008-2020)	What's next? (2020-onwards)
 Analogue technology	 Digital technology, PC, Internet	 Big data, blockchain, data analytics, cloud computing, IoT, AI, biometrics	 All previous + additional applications and increasing computational power; aggregators, ecosystems
 Only authorised financial intermediaries	 Globalisation, birth of computerisation	 Digital economy	 Digital green economy
 First credit cards, debit cards and revolving credit card	 <ul style="list-style-type: none"> Financial intermediaries New players entering the market as financial intermediaries or through partnerships First specialised payment services providers 	 <ul style="list-style-type: none"> Traditional financial intermediaries Fintech companies Bigtech companies 	 <ul style="list-style-type: none"> Digitalised financial intermediaries Fintech companies Bigtech companies
	 Technology is used to provide distance services/self-services	 Technology is used to unbundle and rethinking banking and financial intermediation business model	 Technology is used to improve customer experience and get more data from interactions. Driver for cost saving initiatives
	 Internet banking, home banking	 Digital banks, crowdfunding, P2P platforms	 Intensive use of technology for channels, integration and interoperability among services. Banking from any device
	 Electronic payments, mobile payments, P2P payments, prepaid credit cards, e-wallets	 All previous + Instant payments, cryptocurrencies and stablecoins	 All previous + Central Bank Digital Currencies
	 Remote trading, phone trading	 Copy-trading, social trading, robo-advisor	 Standardised automated trading services for retail investors. High value added financial advice services for HNWI
		 Insurtech, on demand policies, social insurance	 Insurtech: all previous + refinement of AI and IoT tools









Legend	
	Technological trends
	Socio-economic trends
	Players providing financial services
	Use of technology
	Innovations in banking
	Innovations in payments
	Innovations in financial markets
	Innovation in insurance and related



A long-lasting relationship

Phase 1	Phase 2	Phase 3	Phase 4
Analogue technology, much paper (up to the 1960s)	First technological changes (1960s-2008)	Fintech disruption (2008-2020)	What's next? (2020-onwards)
 Analogue technology	 Digital technology, PC, Internet	 Big data, blockchain, data analytics, cloud computing, IoT, AI, biometrics	 All previous + additional applications and increasing computational power; aggregators, ecosystems
 Only authorised financial intermediaries	 Globalisation, birth of computerisation	 Digital economy	 Digital green economy
 First credit cards, debit cards and revolving credit card	 <ul style="list-style-type: none">• Financial intermediaries• New players entering the market as financial intermediaries or through partnerships• First specialised payment services providers	 <ul style="list-style-type: none">• Traditional financial intermediaries• Fintech companies• Bigtech companies	 <ul style="list-style-type: none">• Digitalised financial intermediaries• Fintech companies• Bigtech companies
	 Technology is used to provide distance services/self-services	 Technology is used to unbundle and rethinking banking and financial intermediation business model	 Technology is used to improve customer experience and get more data from interactions. Driver for cost saving initiatives
	 Internet banking, home banking	 Digital banks, crowdfunding, P2P platforms	 Intensive use of technology for channels, integration and interoperability among services. Banking from any device
	 Electronic payments, mobile payments, P2P payments, prepaid credit cards, e-wallets	 All previous + Instant payments, cryptocurrencies and stablecoins	 All previous + Central Bank Digital Currencies
	 Remote trading, phone trading	 Copy-trading, social trading, robo-advisor	 Standardised automated trading services for retail investors. High value added financial advice services for HNWI
		 Insurtech, on demand policies, social insurance	 Insurtech: all previous + refinement of AI and IoT tools

Legend

-  Technological trends
-  Socio-economic trends
-  Players providing financial services
-  Use of technology
-  Innovations in banking
-  Innovations in payments
-  Innovations in financial markets
-  Innovation in insurance and related

Fonte: Locatelli et al., in King et al., 2021,

Phase 1 & Phase 2: From Zero to Hero

Phase 1 (1860s–1960s): Analogue Technology, Much Paper

- use of analogue technology with manual processing and paper documents

*with today's eyes 👁👁

Phase 1

Analogue technology, much paper (up to the 1960s)



Analogue technology



Only authorised financial intermediaries



First credit cards, debit cards and revolving credit card

Phase 1 & Phase 2: From Zero to Hero

Phase 1 (1860s–1960s): Analogue Technology, Much Paper

- use of analogue technology with manual processing and paper documents
- telegraph and telephone communications were already in use in banking in the 1890s
 - Times were slow*: a page with **25 words** could be transmitted through telegraph, but the process took almost **two minutes** to be completed!



Picture taken from the internet

*with today's eyes 👁👁

Phase 1 & Phase 2: From Zero to Hero

Phase 1 (1860s–1960s): Analogue Technology, Much Paper

- use of analogue technology with manual processing and paper documents
- In the late 1800s the **pneumatic capsule** transportation was developed and employed later to the banking business to allow customers to **withdraw and deposit money** at their banks directly from their car



<https://www.digitalcheck.com/pneumatic-banking-tubes-micr-misreads/>

Phase 1 & Phase 2: From Zero to Hero

Phase 1 (1860s–1960s): Analogue Technology, Much Paper

- use of analogue technology with manual processing and paper documents
- **Accounting machines** were introduced in 1920s to provide balance on accounts and adopted by some very large banks - back office only

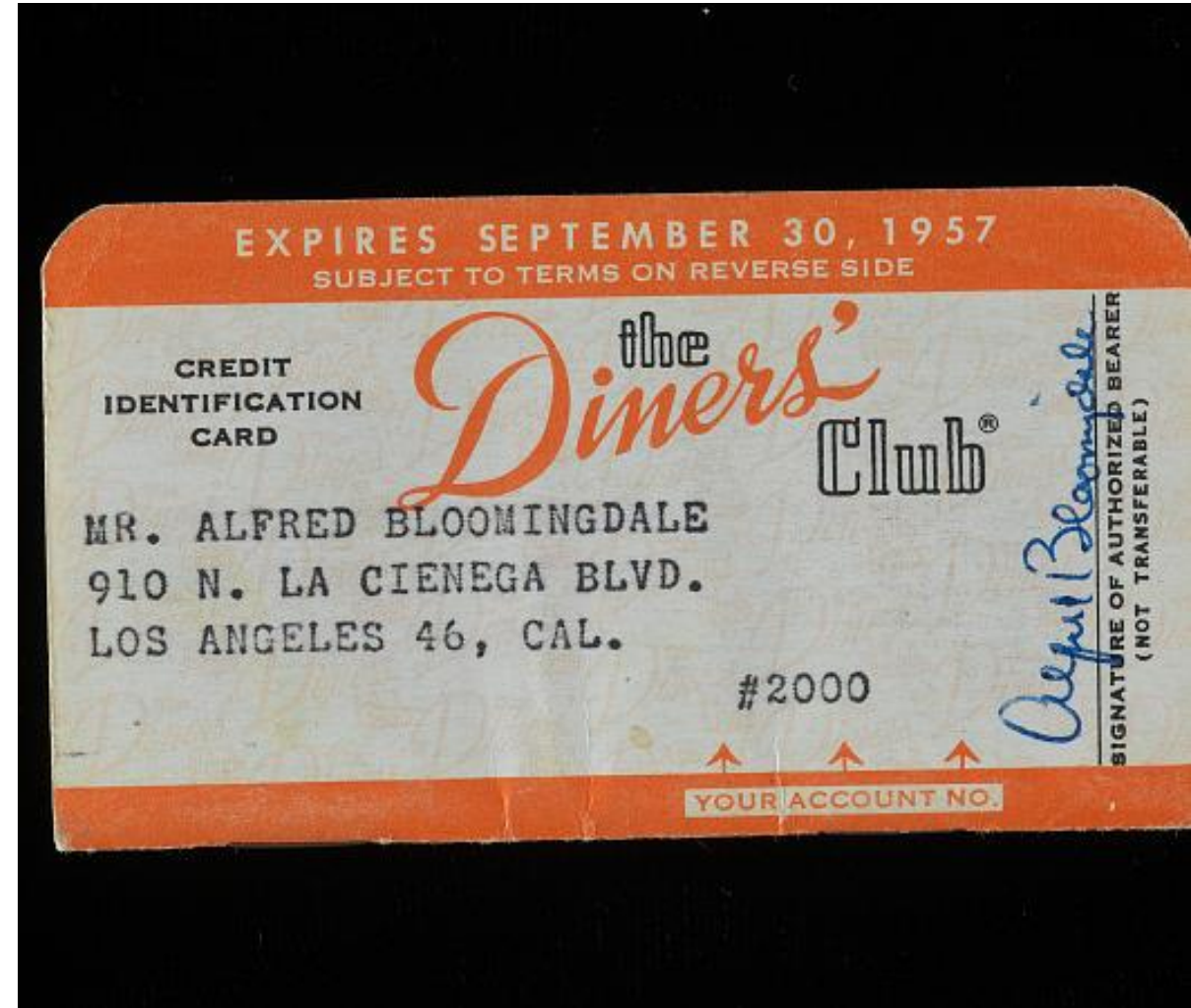


<https://histoire.bnpparibas/en/the-back-office-revolution-in-the-1930s/>

Phase 1 & Phase 2: From Zero to Hero

Phase 1 (1860s–1960s): Analogue Technology, Much Paper

- use of analogue technology with manual processing and paper documents
- First **credit cards** were invented
 - Frank McNamara (the inventor) forgot his wallet during dinner and later thought of a card that charged the purchases made during a month at the end of the following month.
 - In 1951 Diners Club had 42,000 members in the US.
 - In 1959 Diners Club reached one million members and listed on the New York Stock Exchange



Phase 1 & Phase 2: From Zero to Hero

Phase 1 (1860s–1960s): Analogue Technology, Much Paper

- use of analogue technology with manual processing and paper documents
- First **credit cards** were invented
 - The credit card had raised letters and numbers (like today) that were processed by a small printing press to imprint the information onto a twosheet, pressure-sensitive piece of paper.
 - One of the two paper was for the seller that input the information into a computing system to perform the debit order



https://www.cartedipagamento.com/storia_della_carta_di_credito.htm



<https://it.mobiletransaction.org/storia-del-terminale-pos/>

Phase 1 & Phase 2: From Zero to Hero

Phase 1 (1860s–1960s): Analogue Technology, Much Paper

- use of analogue technology with manual processing and paper documents
- Stock exchanges were already “old”
- Translux Corporation moving electronic display was introduced and in 1959 the electronic quote terminal was already available to display prices of securities



1918 | PNEUMATIC TUBES SPEED TRADES

New pneumatic tubes allowed floor brokers to send order slips to clerks quickly

Phase 1 & Phase 2: From Zero to Hero

Phase 2 (1960s–2008): First Technological Changes

Phase 2

First technological changes
(1960s–2008)



Digital technology, PC, Internet



Globalisation, birth of
computerisation



- Financial intermediaries
- New players entering the market as financial intermediaries or through partnerships
- First specialised payment services providers



Technology is used to provide
distance services/self-services



Internet banking, home banking



Electronic payments, mobile
payments, P2P payments, prepaid
credit cards, e-wallets

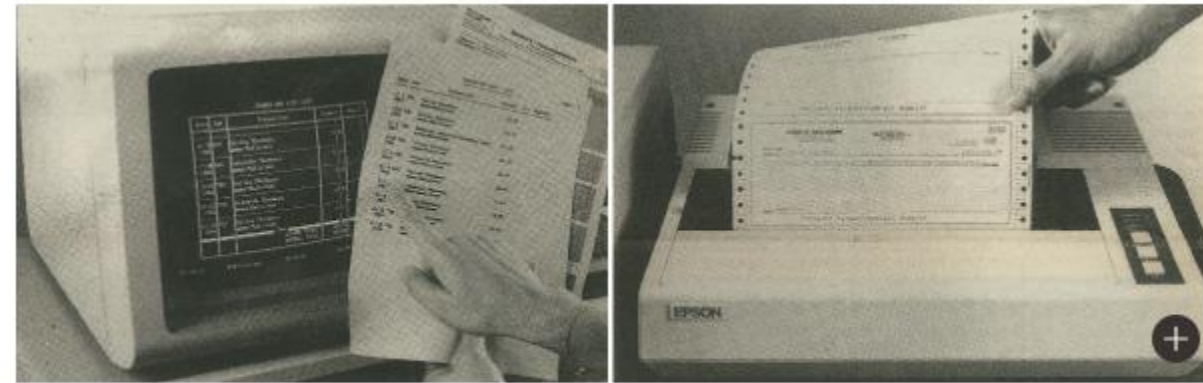
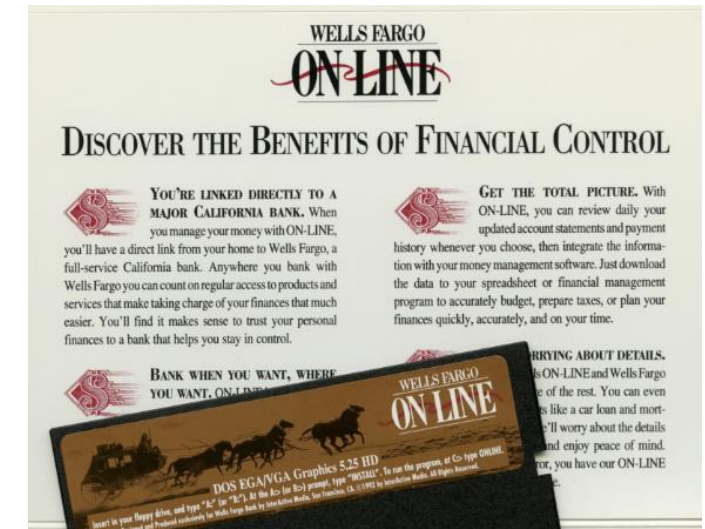


Remote trading, phone trading

Phase 1 & Phase 2: From Zero to Hero

Phase 2 (1960s–2008): First Technological Changes

- Digital technology developed in the ICT sector
- Including personal computers, the internet and mobile communication technology
- 1965: UK and US banks adopt the first computer in branches
- In the 1980s banks became large customers for computers and related, overcoming other industries
- 1990-2000: internet banking, home banking and online trading, dematerialization of securities
- Introduction of **self-service banking**

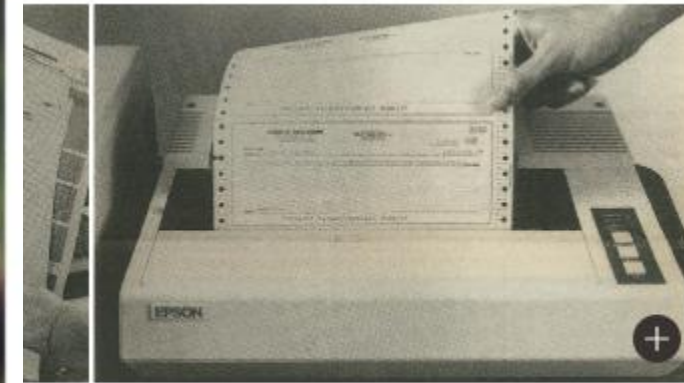


Demonstration of Quicken software's check register (left) and check printing (right) features in 1984. Photo Credit: Wells Fargo Corporate Archives.

Phase 1 & Phase 2: From Zero to Hero

Phase 2 (1960s–2008): First Technological Changes

- Digital technology developed in the ICT sector
- Including personal computers, the internet and mobile communication technology
- 1965: UK and US banks adopt the first computer in branches
- In the 1980s banks became large customers for computers and related, overcoming other industries
- 1990-2000: internet banking, home banking and online trading, dematerialization of securities
- Introduction of **self-service banking**

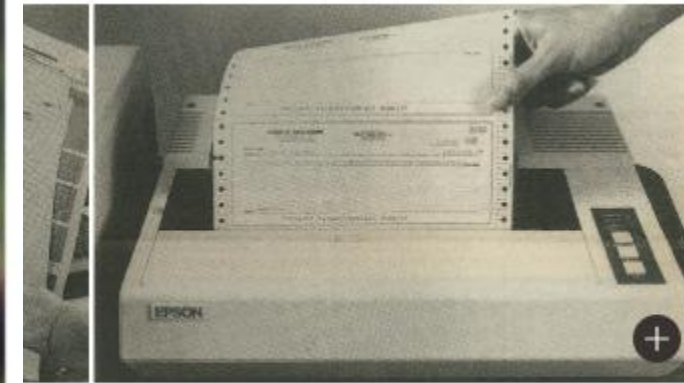


left) and check printing (right) features in 1984. Photo Credit: Wells

Phase 1 & Phase 2: From Zero to Hero

Phase 2 (1960s–2008): First Technological Changes

- Digital technology developed in the ICT sector
- Including personal computers, the internet and mobile communication technology
- 1965: UK and US banks adopt the first computer in branches
- In the 1980s banks became large customers for computers and related, overcoming other industries
- 1990-2000: internet banking, home banking and online trading, dematerialization of securities
- Introduction of **self-service banking**



left) and check printing (right) features in 1984. Photo Credit: Wells

Phase 1 & Phase 2: From Zero to Hero

Phase 2 (1960s–2008): First Technological Changes

- In the **payment** sector.
 - **Credit cards** now have magnetic stripe and/or chips
 - **ATMs** are installed
 - Birth of **newcomers** (e.g., Paypal and Alipay)
- In the **trading** markets:
 - 1971: NASDAQ, the first electronic stock exchange opens
 - Orders are also placed via phone or PC



Courtesy of the Museum of American Finance

Pictures from the internet; <https://tg24.sky.it/economia/2017/06/26/27-giugno-1967--50-anni-bancomat>; Nasdaq website

Phase 1 & Phase 2: From Zero to Hero

Phase 2 (1960s–2008): First Technological Changes

- In the **payment** sector.
 - **Credit cards** now have magnetic stripe and/or chips
 - **ATMs** are installed
- In the **trading** markets:
 - 1971: NASDAQ, the first electronic stock exchange opens
 - Orders are also placed via phone or PC



Trading places – movie scene



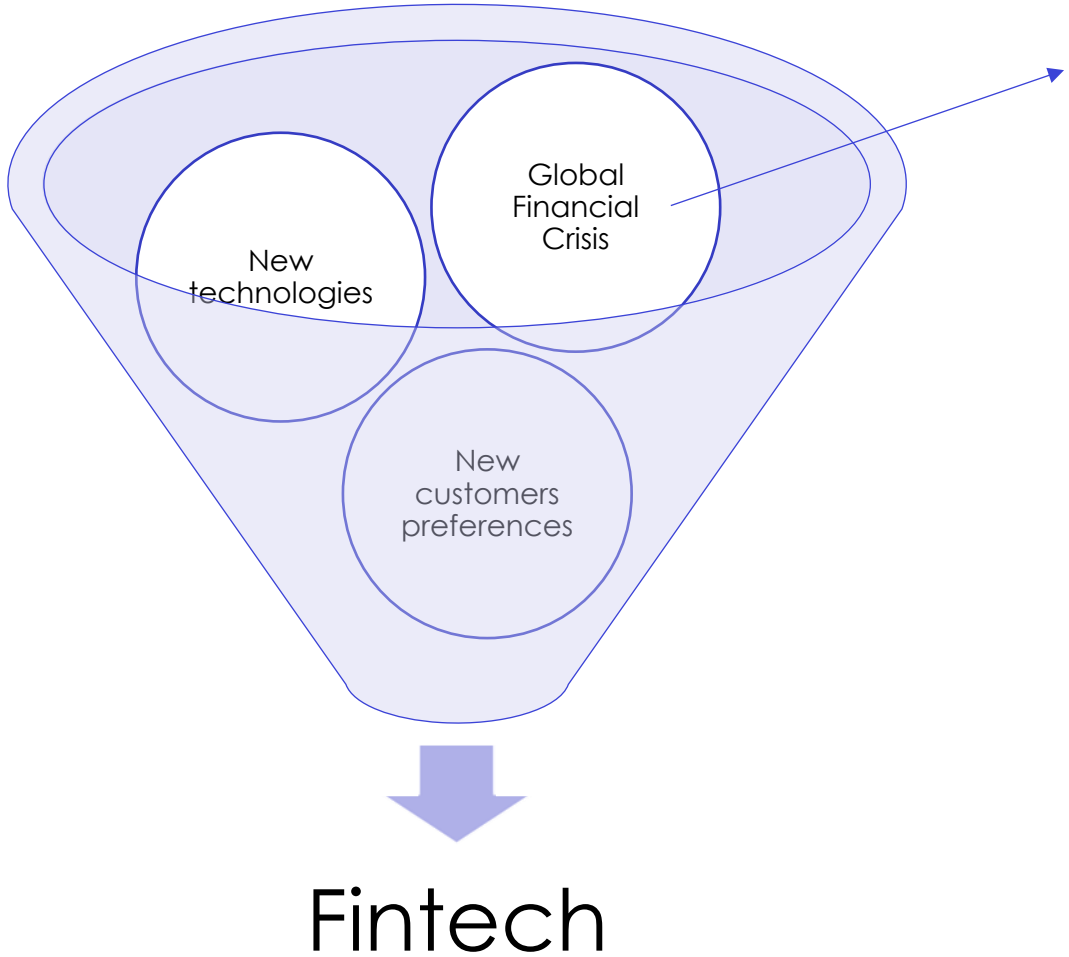
Courtesy of the Museum of American Finance

Pictures from the internet; <https://tg24.sky.it/economia/2017/06/26/27-giugno-1967--50-anni-bancomat>; Nasdaq website

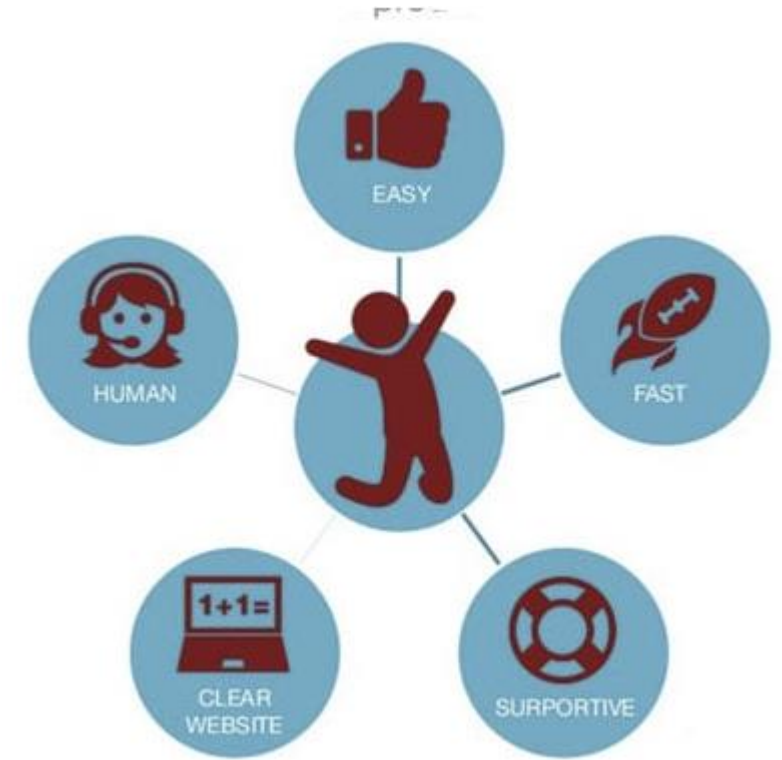
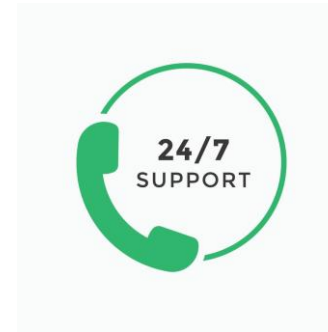
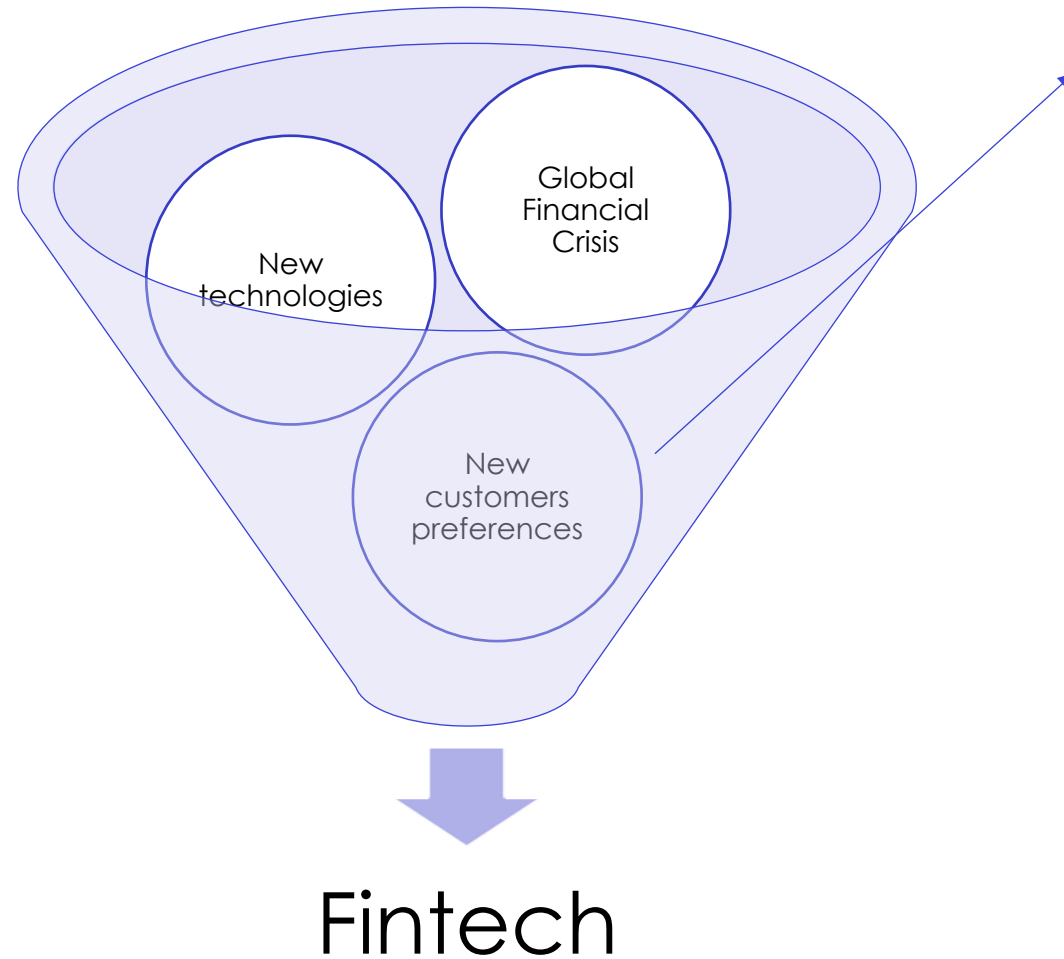
A History of Technology and Finance (pt 2)



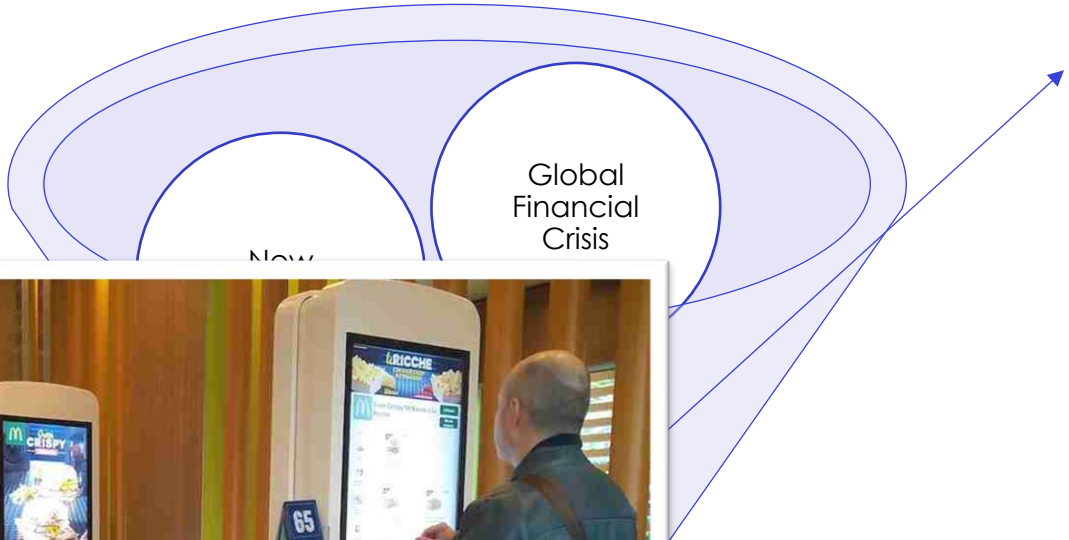
Phase 3 (2008–2020): FinTech Disruption



Phase 3 (2008–2020): FinTech Disruption



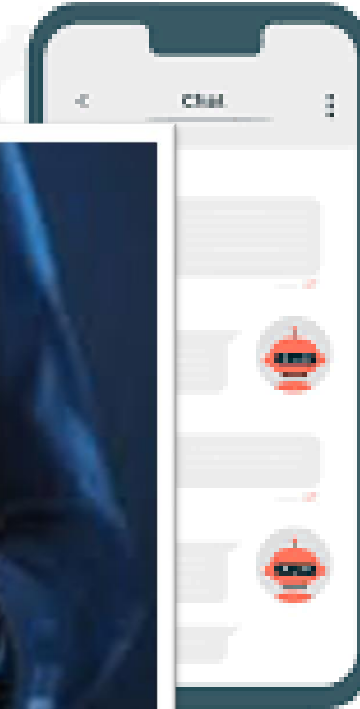
Phase 3 (2008–2020): FinTech Disruption



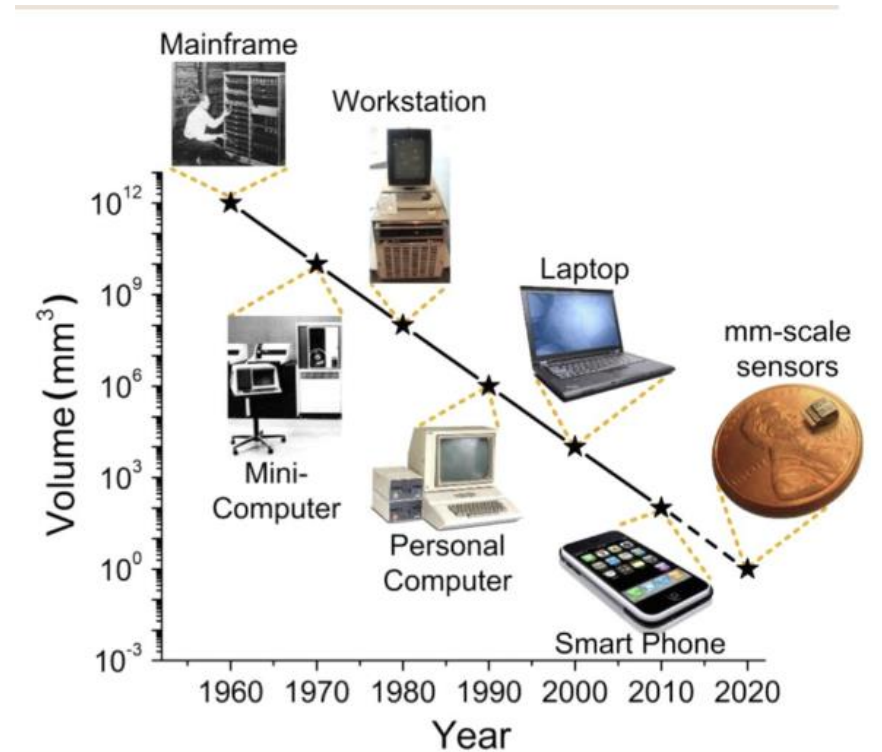
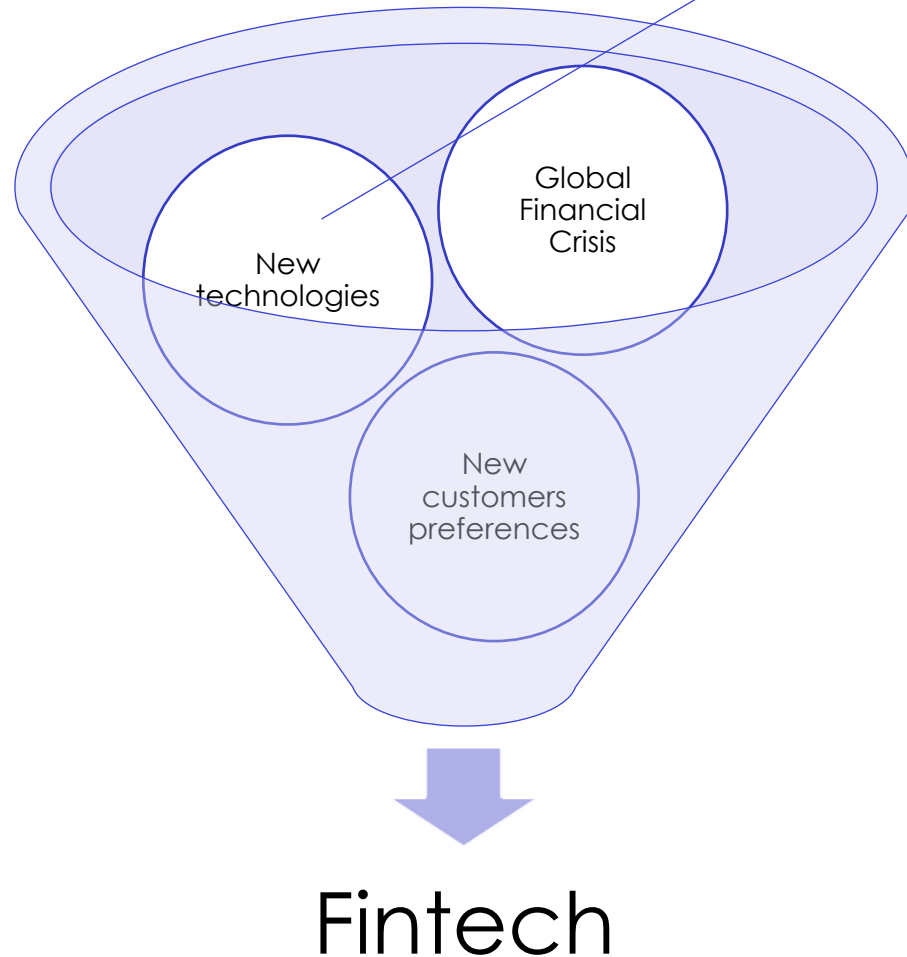
Phase 3 (2008–2020): FinTech Disruption



Phase 3 (2008–2020): FinTech Disruption

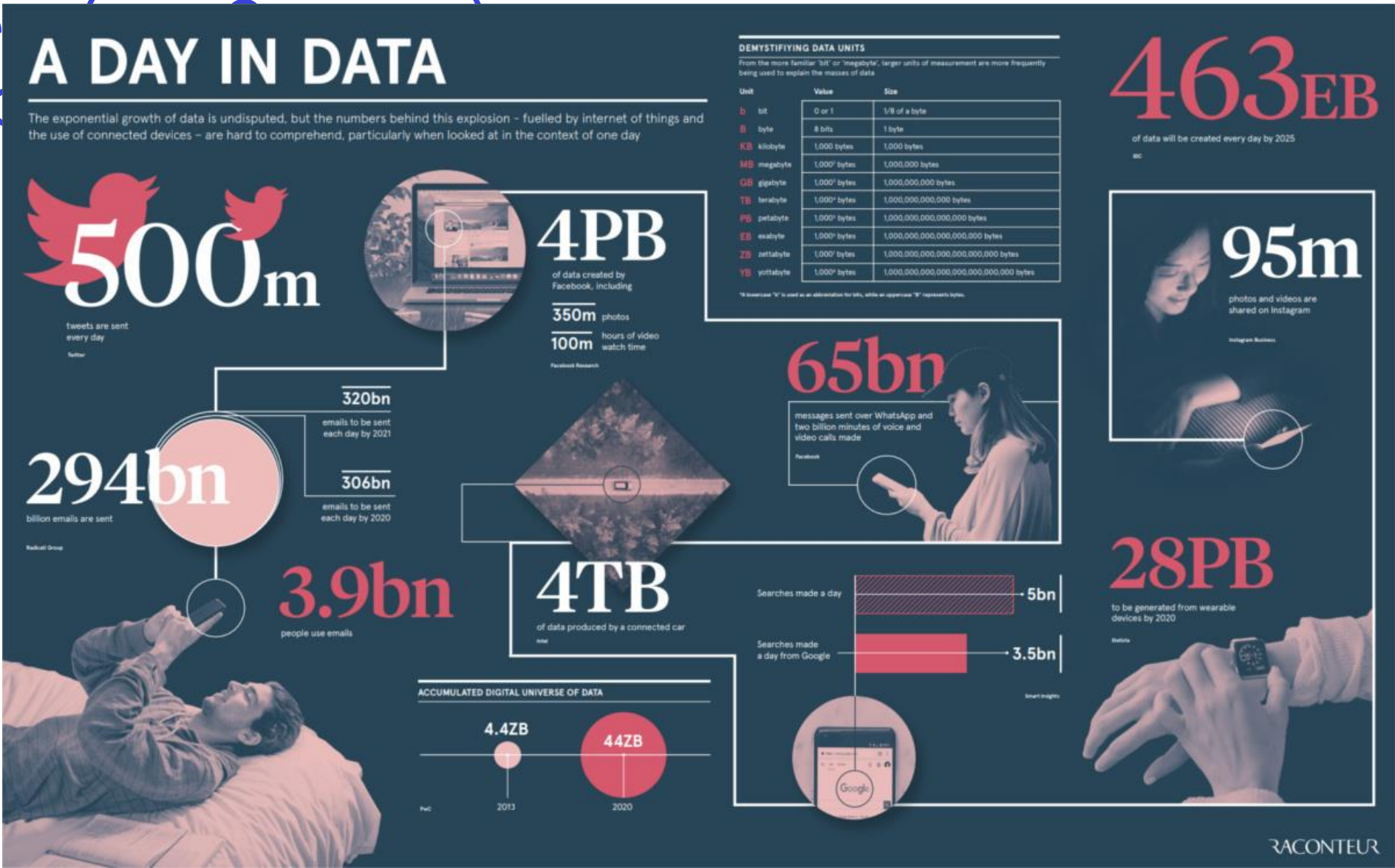


Phase 3 (2008–2020): FinTech Disruption

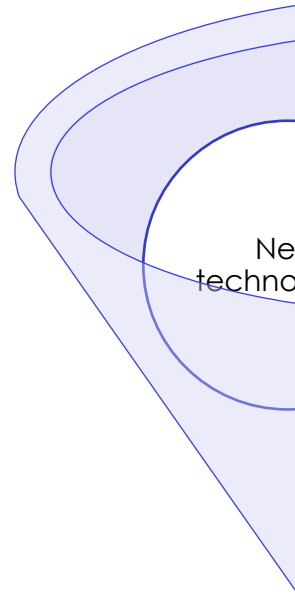


<https://computerhistory.org/blog/the-worlds-smallest-computer/>

Phase
FinTech

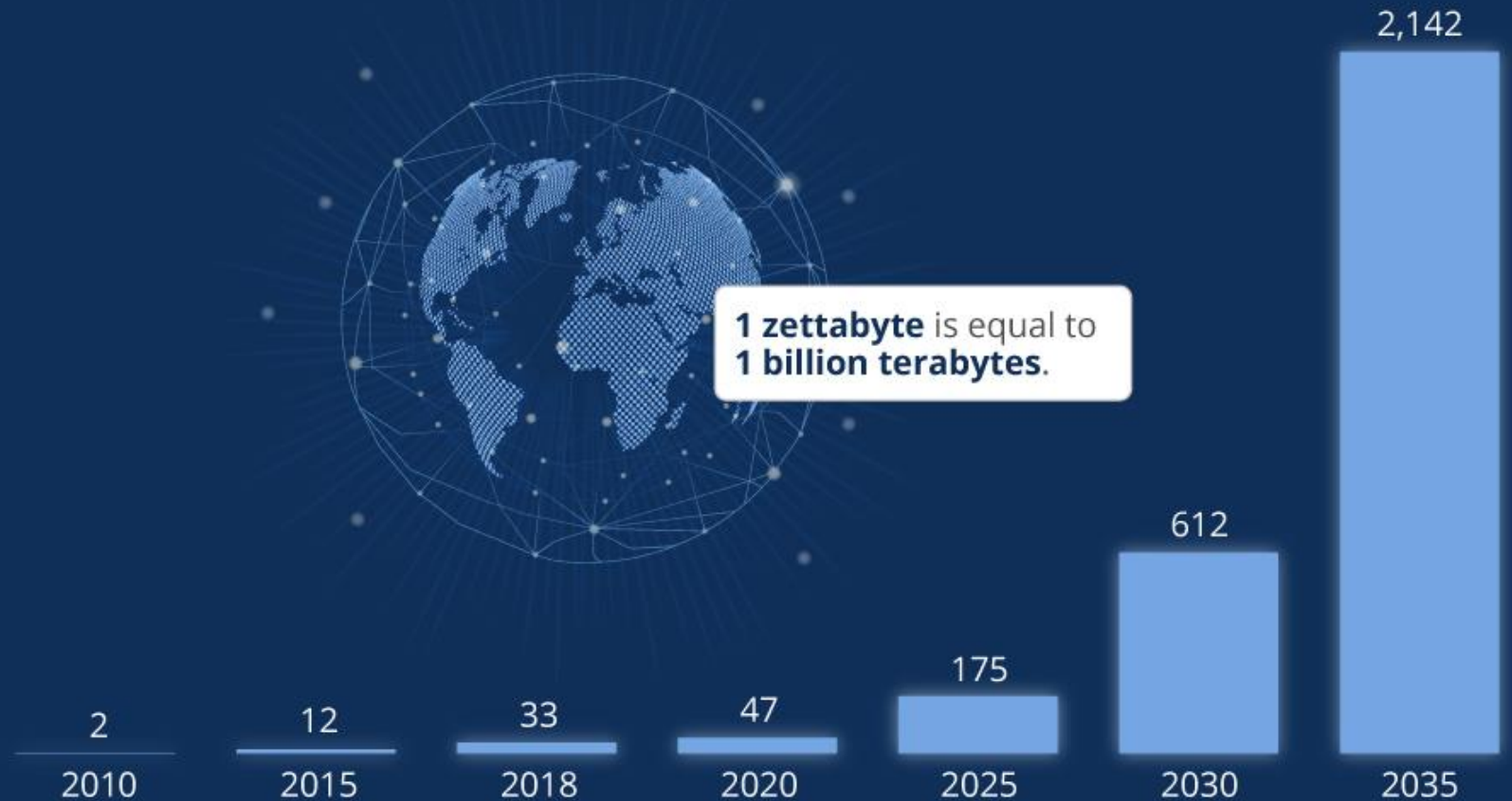


Phase 3 (2008– FinTech Disrupt



Global Data Creation is About to Explode

Actual and forecast amount of data created worldwide 2010-2035 (in zettabytes)

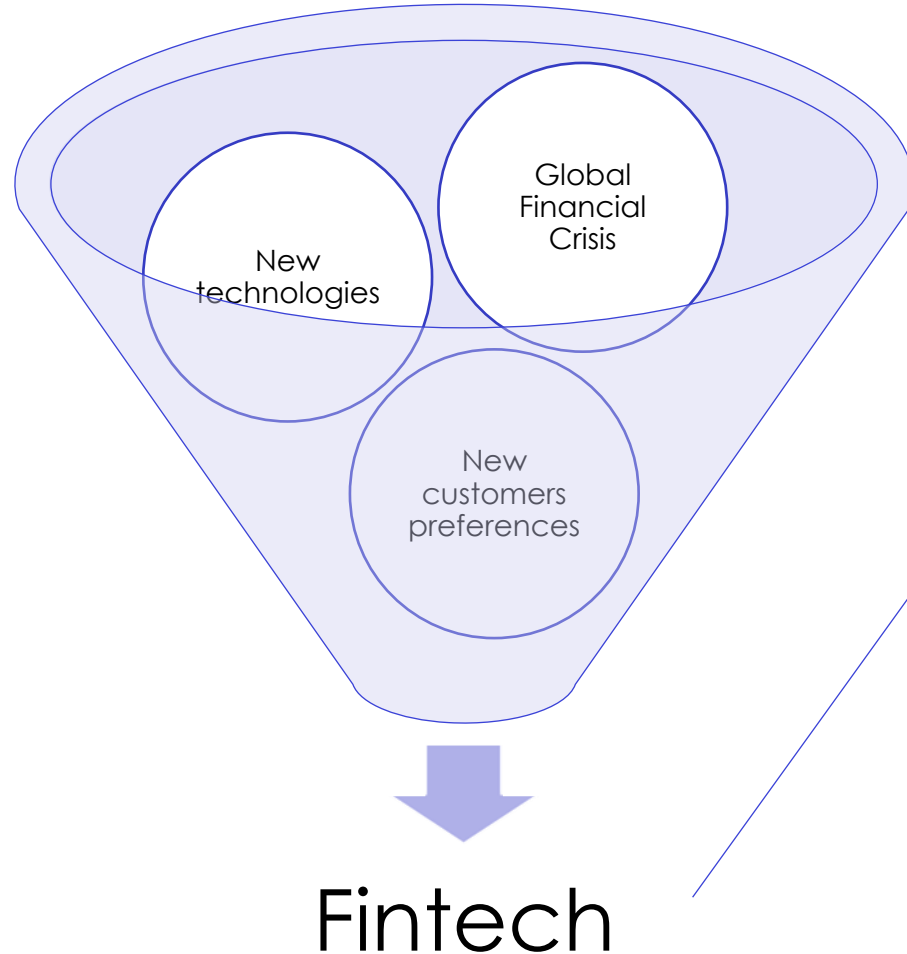


@StatistaCharts

Source: Statista Digital Economy Compass 2019

statista

Phase 3 (2008–2020): FinTech Disruption



- FinTech refers to the **application of technology to finance**", Arner et al. 2016,
- "FinTech is defined as technology-enabled **innovation in financial services that could result in new business models, applications, processes or products** with an associated material effect on the provision of financial services", FSB, 2017

Phase 3 (2008–2020): FinTech Disruption

- Technology has become the **enabler** to disrupt the financial industry landscape
- Industry players are no longer just traditional financial intermediaries, but also **other** (often unregulated) digital native entities
- Consumers are now increasingly **aware** of alternatives, standards have moved higher
- Higher **speed** of adoption and incorporation of technological innovations
- **innovation** of channels and **processes** and **product** innovation (e.g., cryptocurrencies and cryptoassets)

Phase 3

Fintech disruption (2008-2020)



Big data, blockchain, data analytics, cloud computing, IoT, AI, biometrics



Digital economy



- Traditional financial intermediaries
- Fintech companies
- Bigtech companies



Technology is used to unbundle and rethinking banking and financial intermediation business model



Digital banks, crowdfunding, P2P platforms



All previous + Instant payments, cryptocurrencies and stablecoins



Copy-trading, social trading, robo-advisor



Insurtech, on demand policies, social insurance

Phase 3 (2008–2020): FinTech Disruption

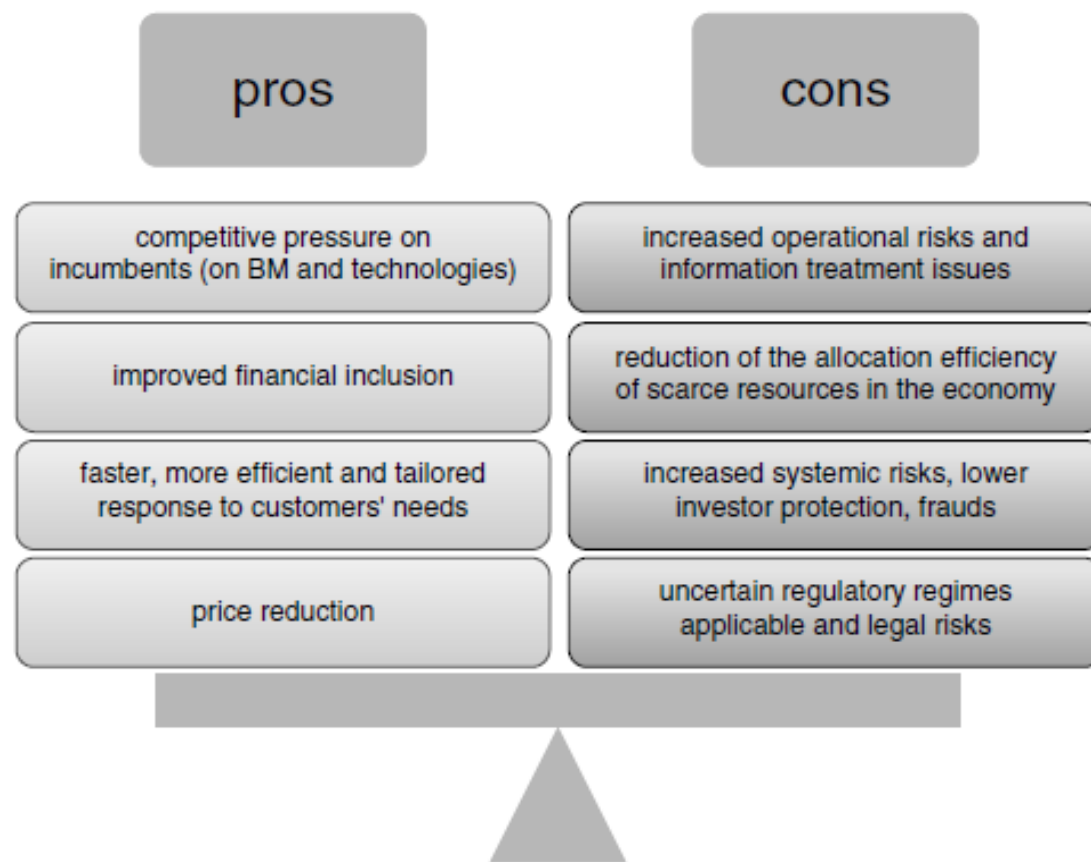
- Customer needs and expectations are changing
- Service must be
 - Omnichannel, 24/7, and instantaneity
 - Increasing importance of experience
 - Understanding needs and products
- Importance of after-sales service

It is necessary to pay attention not to leave the less digital customer segments "behind"

Fintech pros and cons

Other relevant topics

- Digital literacy
- Financial literacy
- Digital financial literacy



Locatelli R., Tanda A., 2021,

The actors

Next classes



Fintech
companies



Incumbents



Bigtech or Techfin
companies

Phase 4 (Post-2020): What's Next?

- Technological evolution continues at an **impressive** pace
- “forced” push after Covid-19 outbreak
 - It is no longer possible to postpone the digitalisation of channels for banks
- Data has become the real **key asset**
- **IT systems** must become accessible, scalable and interoperable
- FIs need new competencies and skills to compete with Bigtechs
- Estimates suggest that 20–40% of banks will **disappear** in Europe in the next 10 years (DNB, 2020)

Phase 4

What's next? (2020-onwards)



All previous + additional applications and increasing computational power; aggregators, ecosystems



Digital green economy



- Digitalised financial intermediaries
- Fintech companies
- Bigtech companies



Technology is used to improve customer experience and get more data from interactions. Driver for cost saving initiatives



Intensive use of technology for channels, integration and interoperability among services. Banking from any device



All previous + Central Bank Digital Currencies

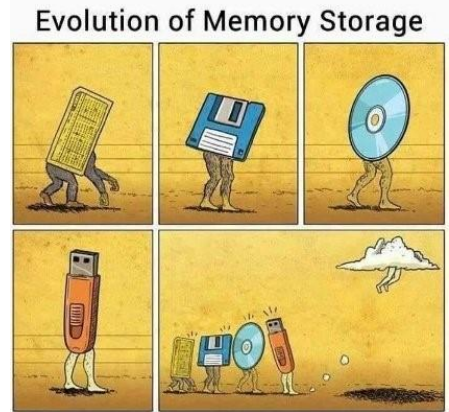


Standardised automated trading services for retail investors. High value added financial advice services for HNWI



Insurtech: all previous + refinement of AI and IoT tools

Phase 4 (Post-2020): What's Next?



- Technological evolution continues at an **impressive** pace
- “forced” push after Covid-19 outbreak
 - It is no longer possible to postpone the digitalisation of channels for banks
- Data has become the real **key asset**
- **IT systems** must become accessible, scalable and interoperable
- FIs need new competencies and skills to compete with Bigtechs
- Estimates suggest that 20–40% of banks will **disappear** in Europe in the next 10 years (DNB, 2020)
- Green finance and **sustainable** development driveres



Picture from the internet

Key takeaways...

- Different phases of technological adoption in the financial system
 - Drivers of development of Fintech
- Pros and cons of digitalisation in the financial system