



AI in Finance

Big Data Analytics

AI in FinTech: Financial Services Innovation and Application

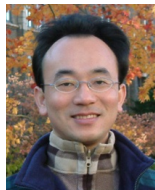
1081AIFBDA02

TLVXM2A (M2449) (8497) (Fall 2019)

(MBA, DBETKU) (3 Credits, Required) [Full English Course]

(Master's Program in Digital Business and Economics)

Tue, 2, 3, 4, (9:10-12:00) (B1012)



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Department of Information Management

Tamkang University

<http://mail.tku.edu.tw/myday>



Course Schedule (1/2)



Week	Date	Subject/Topics
1	2019/09/10	Course Orientation on AI in Finance Big Data Analytics
2	2019/09/17	AI in FinTech: Financial Services Innovation and Application
3	2019/09/24	ABC: AI, Big Data, Cloud Computing
4	2019/10/01	Business Models of Fintech
5	2019/10/08	Event Studies in Finance
6	2019/10/15	Case Study on AI in Finance Big Data Analytics I
7	2019/10/22	Foundations of AI in Finance Big Data Analytics with Python
8	2019/10/29	Case Study on Financial Industry Practice I
9	2019/11/05	Quantitative Investing with Pandas in Python

Course Schedule (2/2)



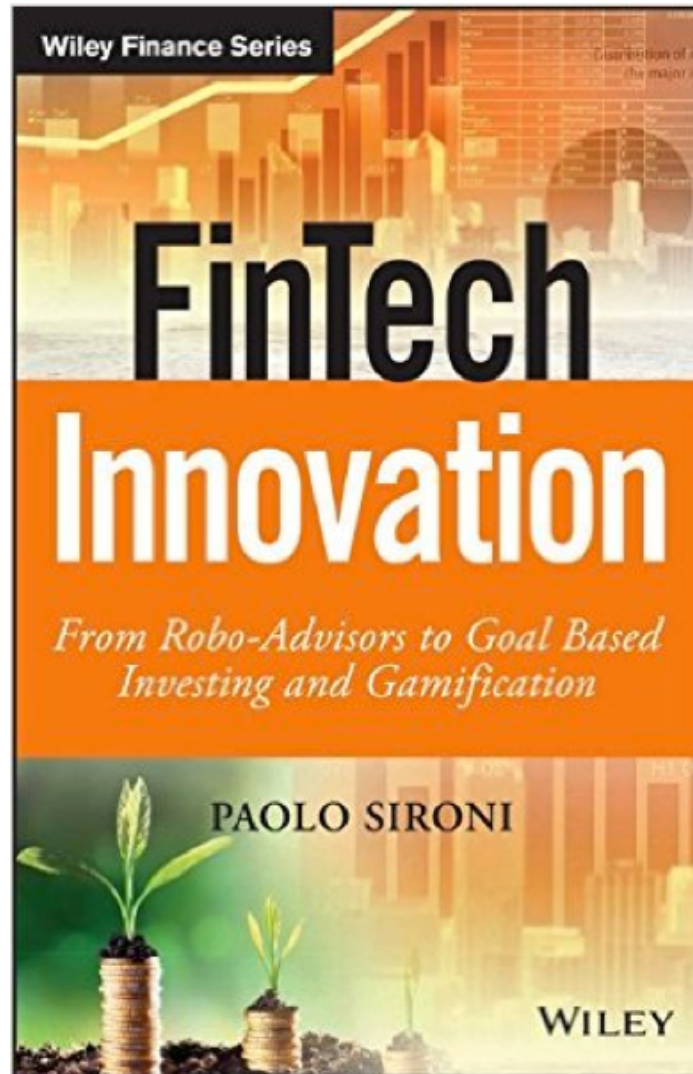
Week	Date	Subject/Topics
10	2019/11/12	Midterm Project Report
11	2019/11/19	Machine Learning in Finance Application with Scikit-Learn In Python
12	2019/11/26	Deep Learning for Financial Time Series Forecasting with TensorFlow I
13	2019/12/03	Case Study on AI in Finance Big Data Analytics II
14	2019/12/10	Deep Learning for Financial Time Series Forecasting with TensorFlow II
15	2019/12/17	Case Study on Financial Industry Practice II
16	2019/12/24	Deep Learning for Financial Time Series Forecasting with TensorFlow III
17	2019/12/31	Final Project Presentation I
18	2020/01/07	Final Project Presentation II

AI in FinTech: Financial Services Innovation and Application

Paolo Sironi (2016)

FinTech Innovation:

From Robo-Advisors to Goal Based Investing and Gamification,
Wiley

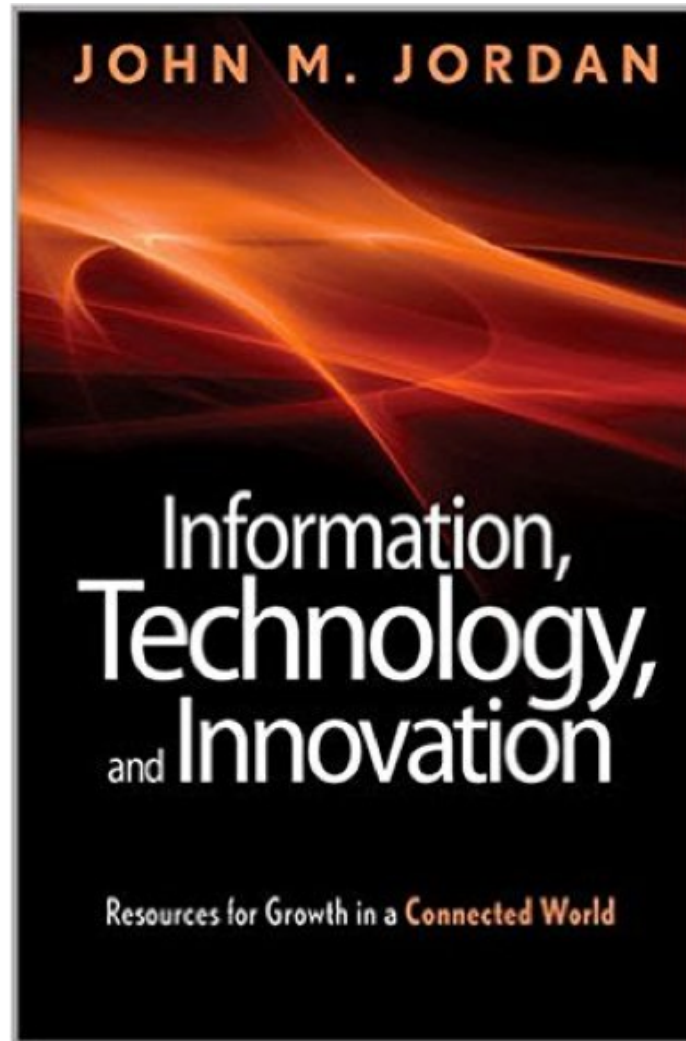


John M. Jordan (2012),

Information, Technology, and Innovation:

Resources for Growth in a Connected World,

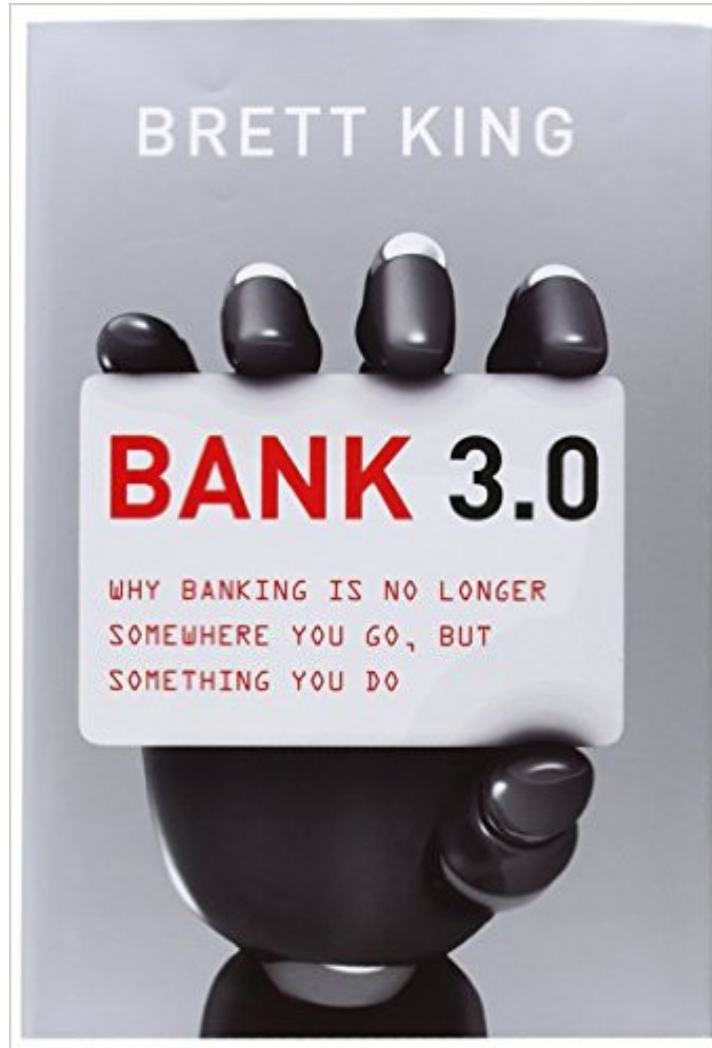
Wiley



Brett King (2012),

Bank 3.0

Why banking is no longer somewhere you go, but something you do,
Marshall Cavendish International Asia Pte Ltd

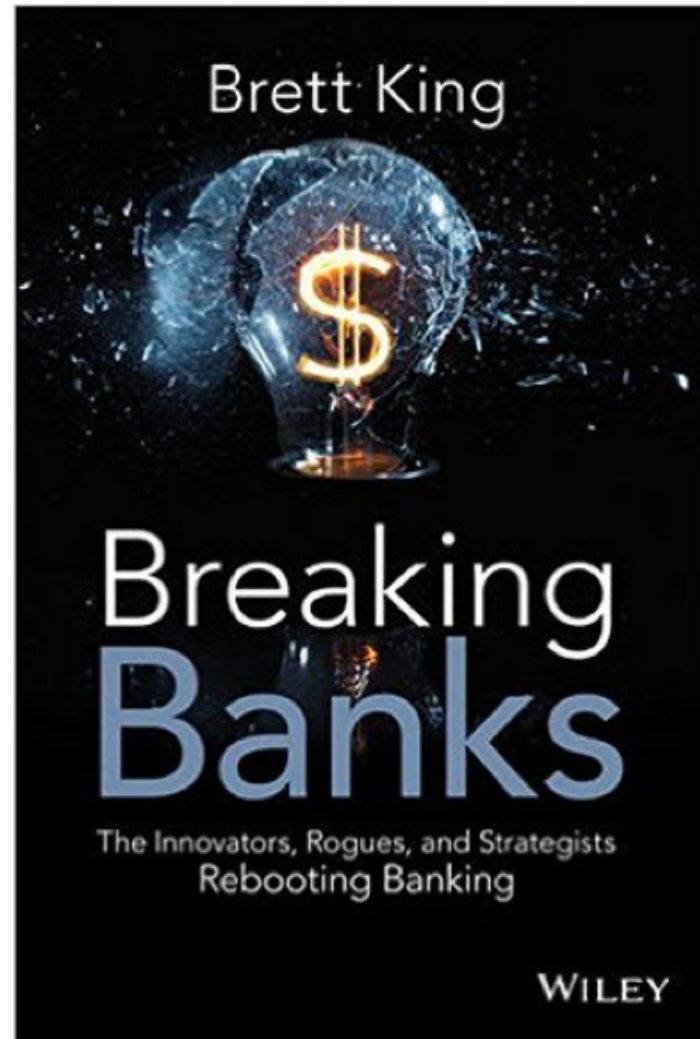


Brett King (2014),

Breaking Banks:

The Innovators, Rogues, and Strategists Rebooting Banking

Wiley

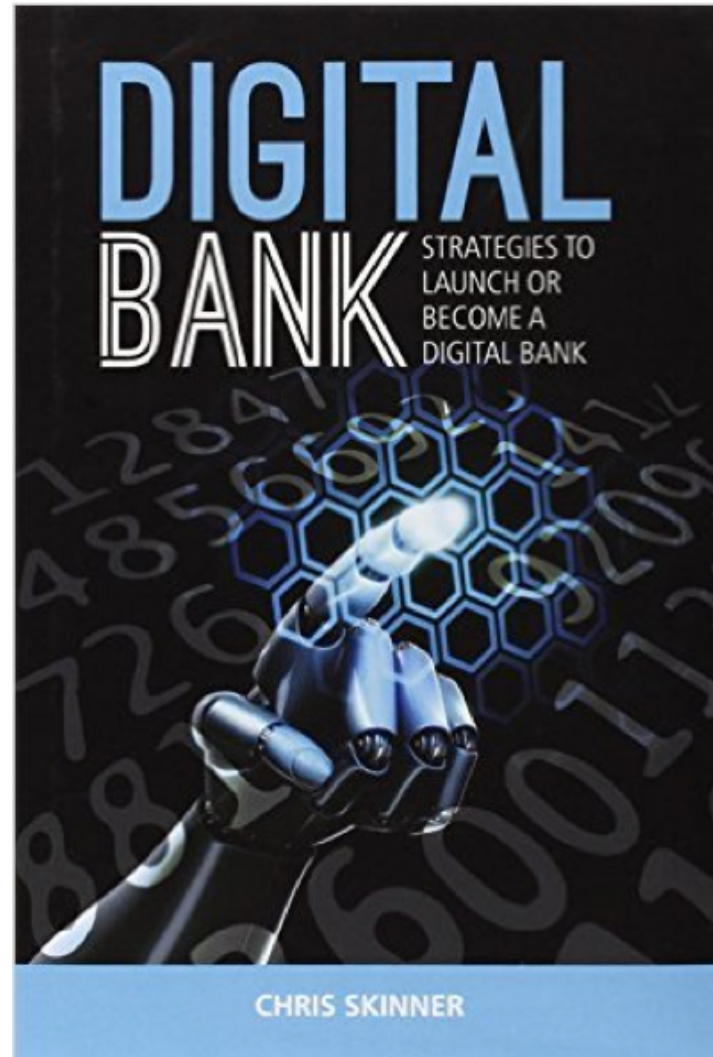


Chris Skinner (2014),

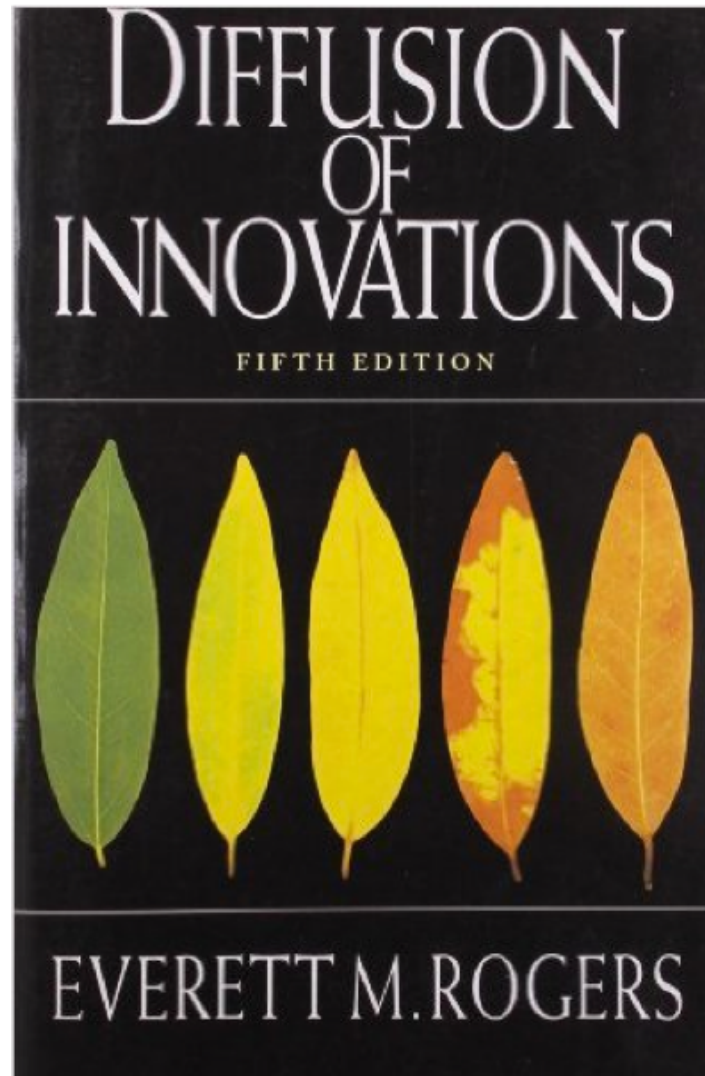
Digital Bank:

Strategies to Launch or Become a Digital Bank,

Marshall Cavendish International Asia Pte Ltd



Everett M. Rogers (2003),
Diffusion of Innovations,
5th Edition, Free Press



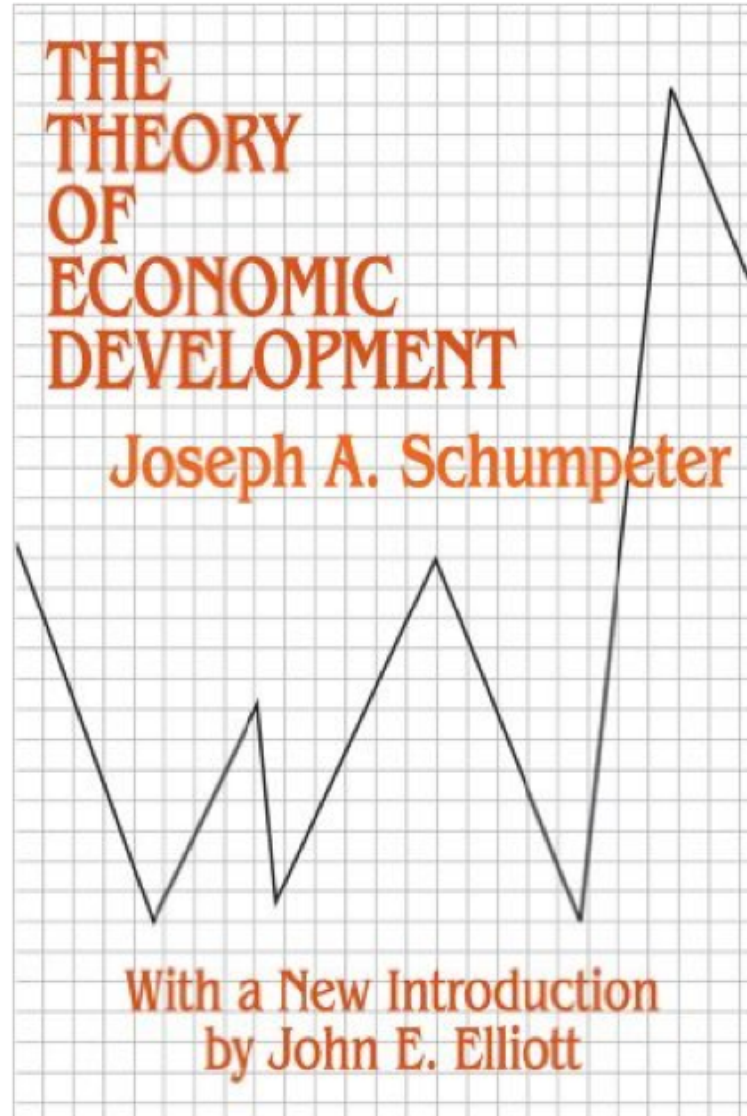
(Rogers,
1962;
1971;
1983;
1995;
2003)

Joseph A. Schumpeter,

The Theory of Economic Development:

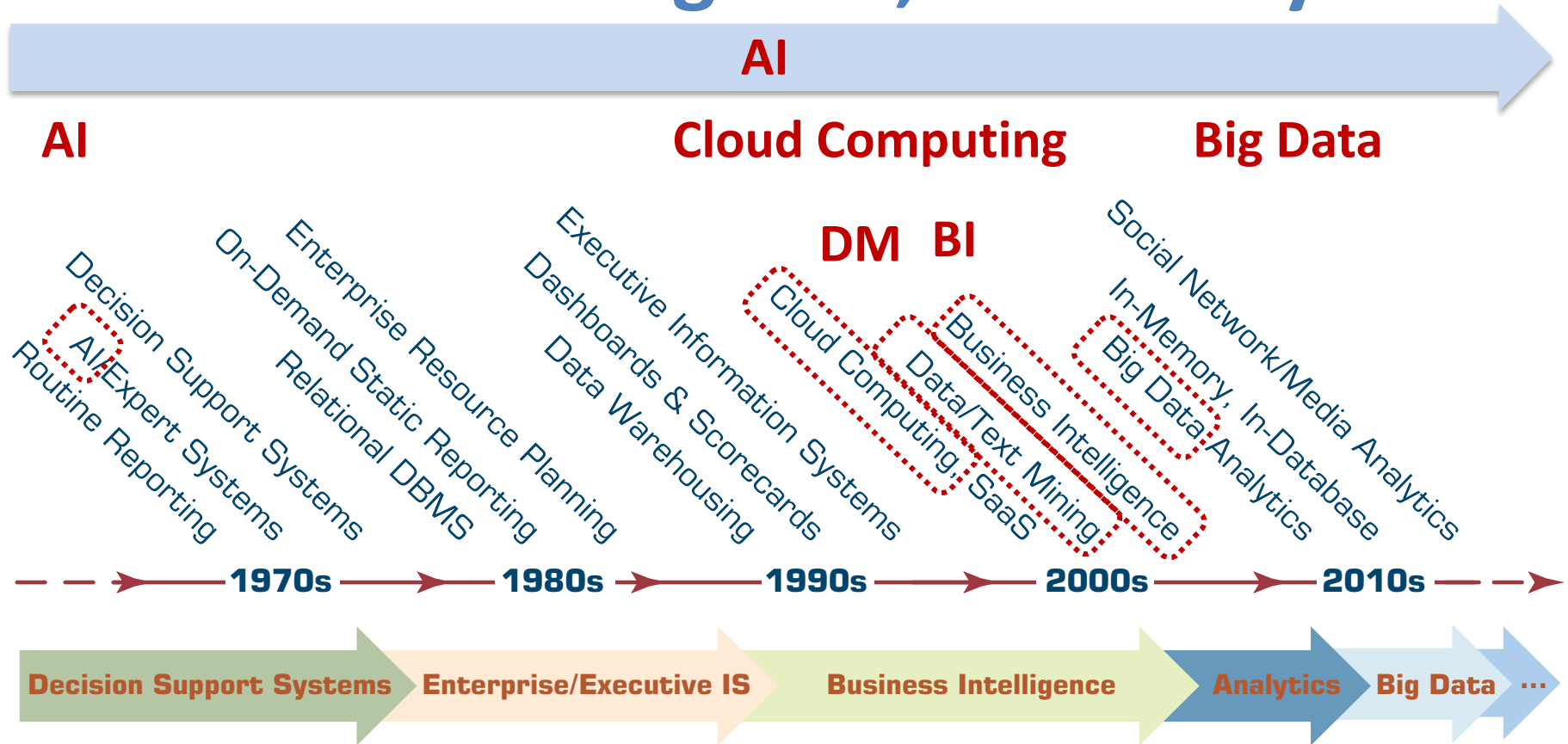
An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle,

Transaction Publishers, 1982



(Schumpeter, 1912)

AI, Big Data, Cloud Computing Evolution of Decision Support, Business Intelligence, and Analytics



AI

Definition of Artificial Intelligence (A.I.)

Artificial Intelligence

**“... the science and
engineering
of
making
intelligent machines”
(John McCarthy, 1955)**

Artificial Intelligence

**“... technology that
thinks and acts
like humans”**

Artificial Intelligence

**“... intelligence
exhibited by machines
or software”**

4 Approaches of AI

Thinking Humanly	Thinking Rationally
Acting Humanly	Acting Rationally

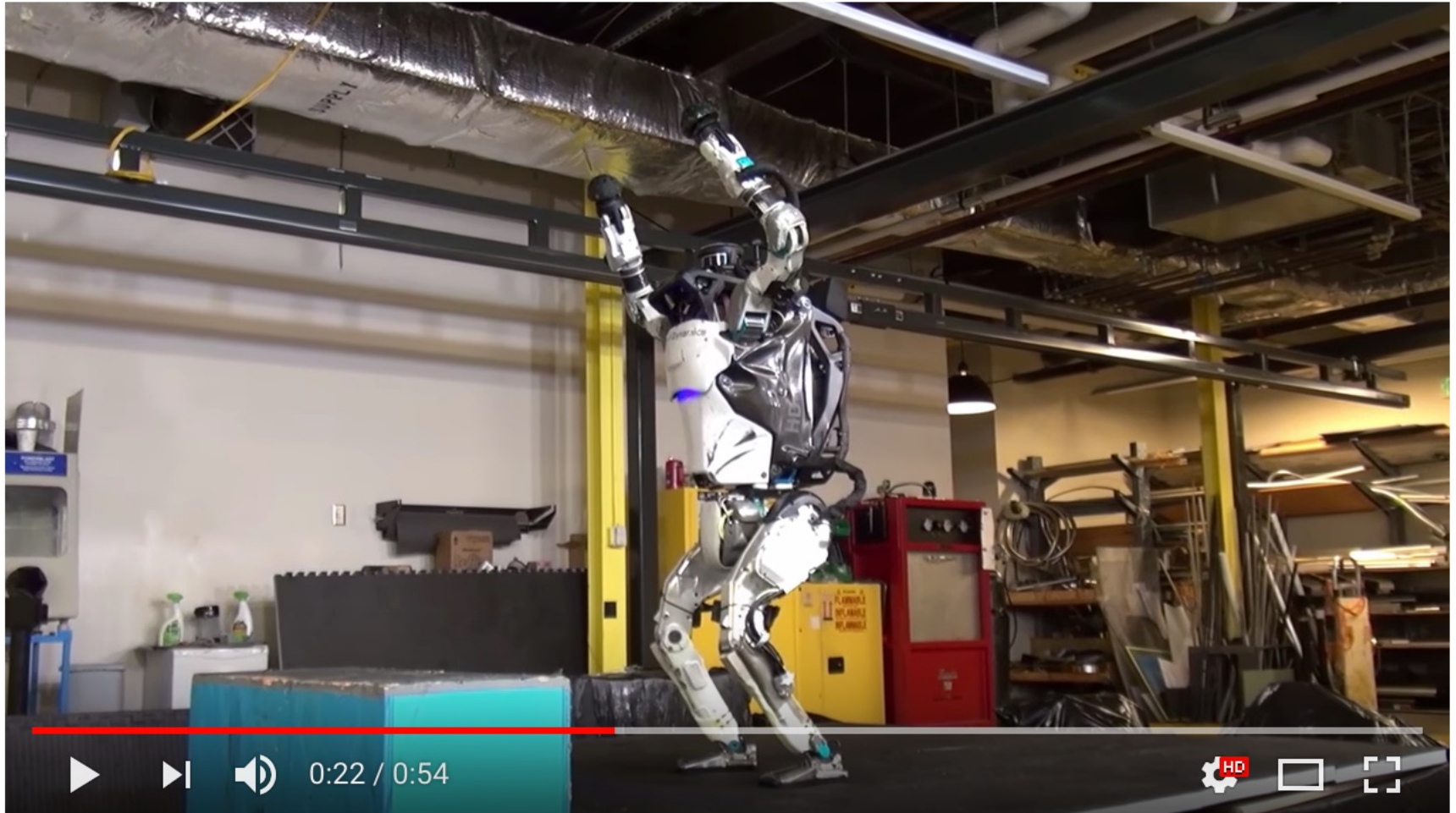
4 Approaches of AI

<p>2. Thinking Humanly: The Cognitive Modeling Approach</p>	<p>3. Thinking Rationally: The “Laws of Thought” Approach</p>
<p>1. Acting Humanly: The Turing Test Approach (1950)</p>	<p>4. Acting Rationally: The Rational Agent Approach</p>

AI Acting Humanly: The Turing Test Approach (Alan Turing, 1950)

- **Natural Language Processing (NLP)**
- **Knowledge Representation**
- **Automated Reasoning**
- **Machine Learning (ML)**
- **Computer Vision**
- **Robotics**

Boston Dynamics: Atlas



#13 ON TRENDING

What's new, Atlas?

<https://www.youtube.com/watch?v=fRj34o4hN4I>

Humanoid Robot: Sophia



<https://www.youtube.com/watch?v=S5t6K9iwcdw>

Can a robot pass a university entrance exam?

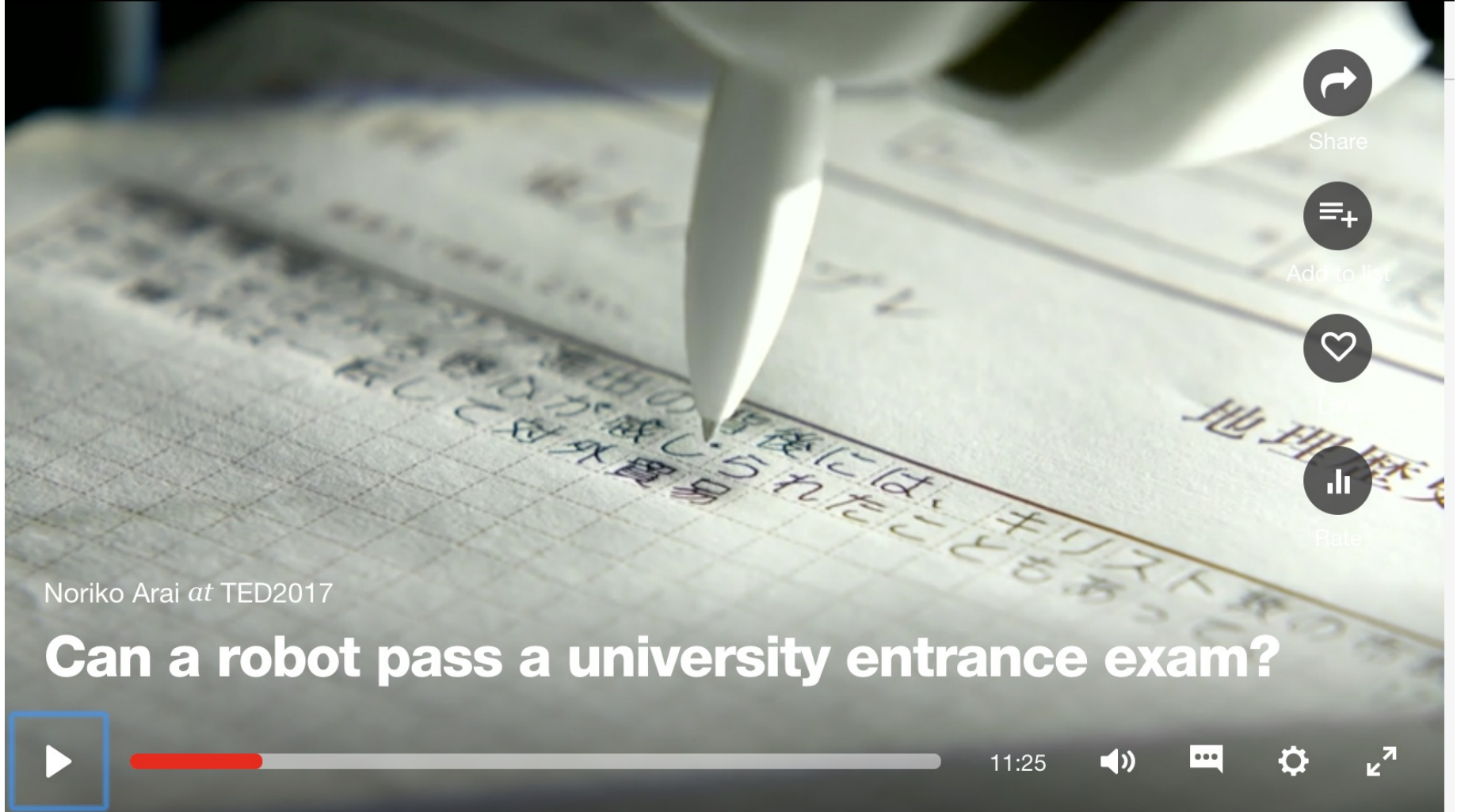
Noriko Arai at TED2017

TED Ideas worth spreading

WATCH

DISCOVER

ATT



Noriko Arai at TED2017

Can a robot pass a university entrance exam?

https://www.ted.com/talks/noriko_arai_can_a_robot_pass_a_university_entrance_exam

<https://www.youtube.com/watch?v=XQZjkPyJ8KU>

Artificial Intelligence (A.I.) Timeline

S/Z/Y/G/

A.I. TIMELINE

1950

TURING TEST

Computer scientist Alan Turing proposes a test for machine intelligence. If a machine can trick humans into thinking it is human, then it has intelligence



1961

UNIMATE

First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line



1964

ELIZA

Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans



1966

SHAKY

The 'first electronic person' from Stanford, Shakey is a general-purpose mobile robot that reasons about its own actions

A.I. WINTER

Many false starts and dead-ends leave A.I. out in the cold



1997

DEEP BLUE

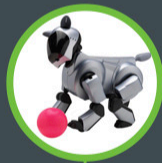
Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov



1998

KISMET

Cynthia Breazeal at MIT introduces Kismet, an emotionally intelligent robot insofar as it detects and responds to people's feelings



1999

AIBO

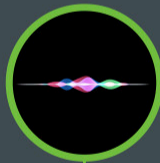
Sony launches first consumer robot pet dog AiBO (AI robot) with skills and personality that develop over time



2002

ROOMBA

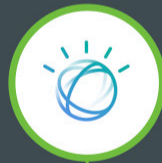
First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes



2011

SIRI

Apple integrates Siri, an intelligent virtual assistant with a voice interface, into the iPhone 4S



2011

WATSON

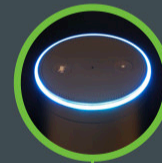
IBM's question answering computer Watson wins first place on popular \$1M prize television quiz show Jeopardy



2014

EUGENE

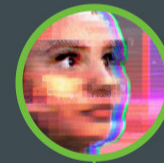
Eugene Goostman, a chatbot passes the Turing Test with a third of judges believing Eugene is human



2014

ALEXA

Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks



2016

TAY

Microsoft's chatbot Tay goes rogue on social media making inflammatory and offensive racist comments



2017

ALPHAGO

Google's A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number (2^{170}) of possible positions

Artificial Intelligence

Machine Learning & Deep Learning

ARTIFICIAL INTELLIGENCE

Early artificial intelligence stirs excitement.



MACHINE LEARNING

Machine learning begins to flourish.



DEEP LEARNING

Deep learning breakthroughs drive AI boom.



1950's

1960's

1970's

1980's

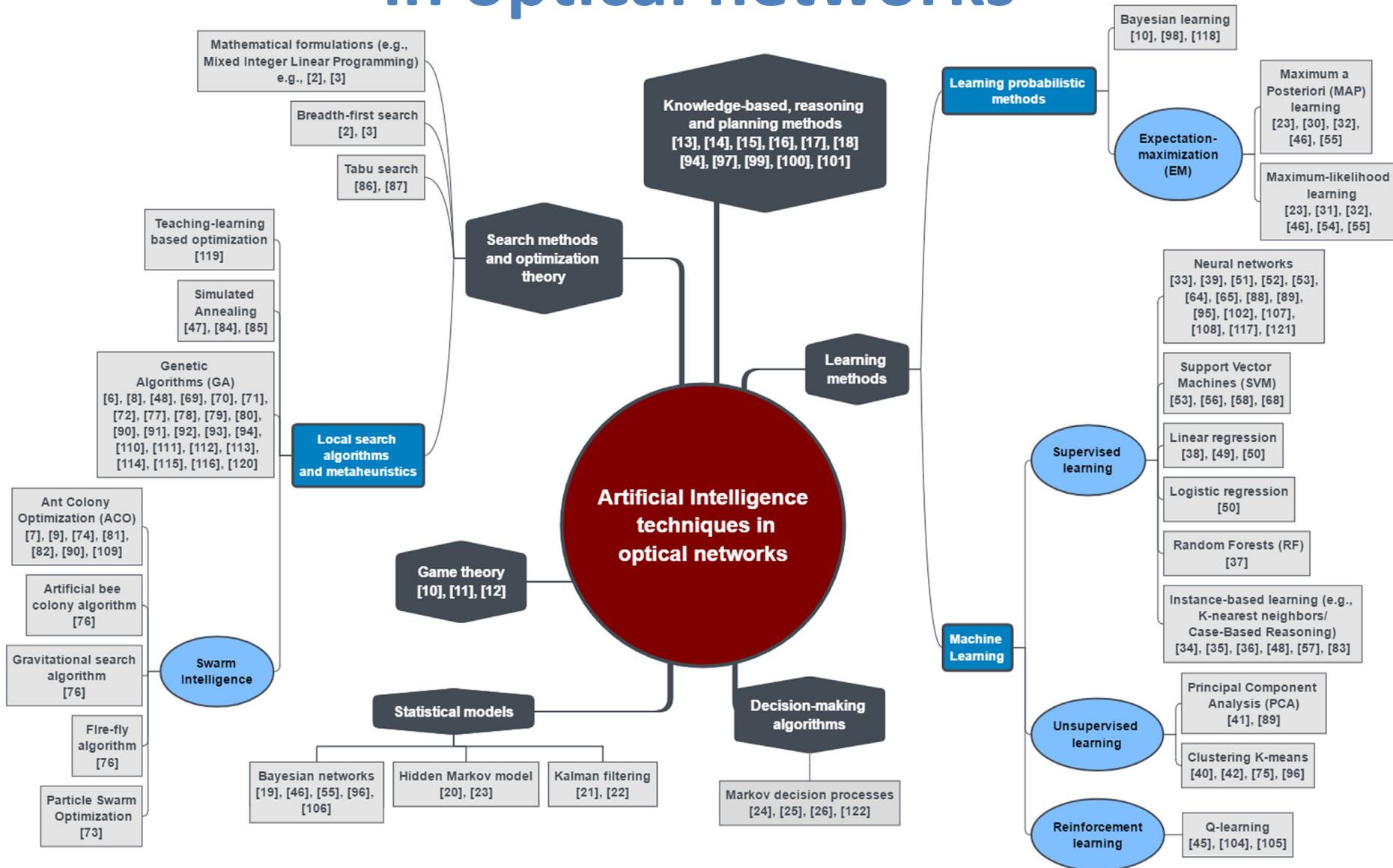
1990's

2000's

2010's

Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

Artificial intelligence (AI) in optical networks



Source: Javier Mata, Ignacio de Miguel, Ramón J. Durán, Noemí Merayo, Sandeep Kumar Singh, Admela Jukan, and Mohit Chamania (2018), "Artificial intelligence (AI) methods in optical networks: A comprehensive survey", *Optical Switching and Networking*, 28, pp. 43-57

FinTech

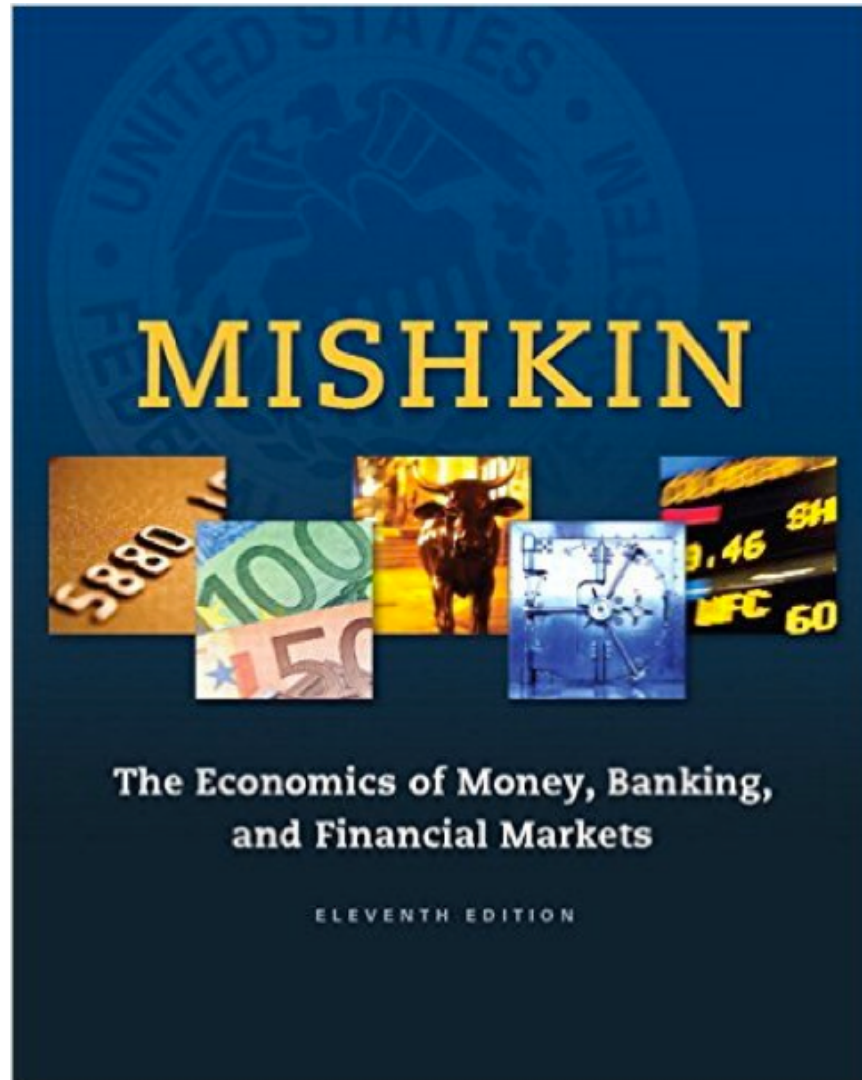
Financial Technology

Financial Technology

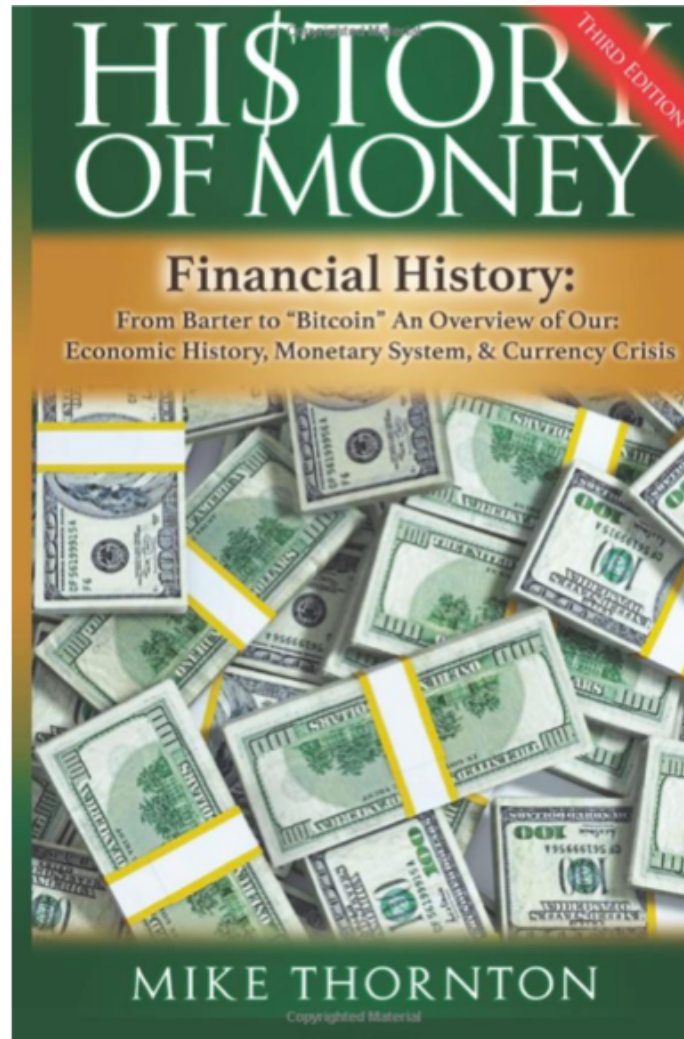
FinTech

“providing
financial services
by making use of
software and
modern technology”

**Frederic S. Mishkin (2015),
The Economics of Money, Banking and Financial Markets,
11th Edition, Pearson**



**Mike Thornton (2016),
History of Money: Financial History:
From Barter to Bitcoin - An Overview of Our Economic History, Monetary System &
Currency Crisis, CreateSpace Independent Publishing Platform**



Money and Financial History

- Why is a printed piece of paper worth anything?
- How can a coin be worth more or even less than the number stamped on it?
- Why is digital money real money?
- How can money be worth more or less than it was yesterday?

Money

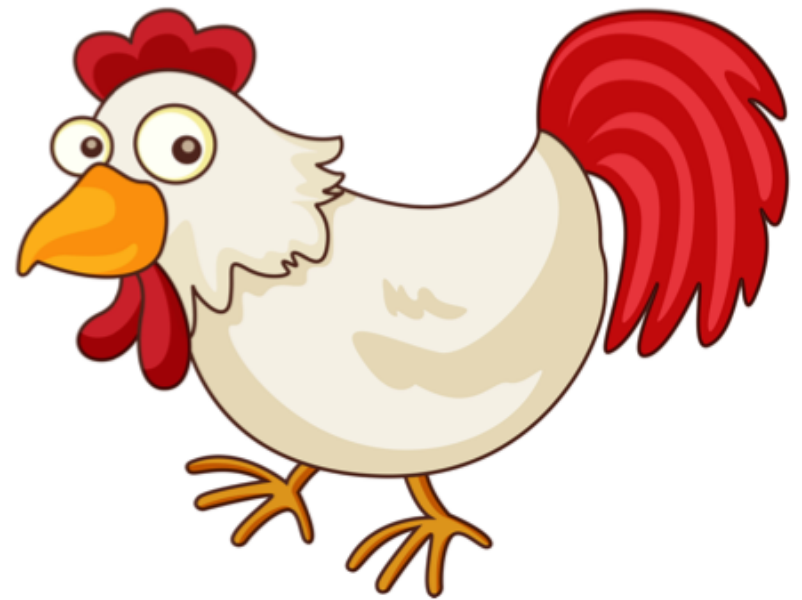
Exchange

Barter

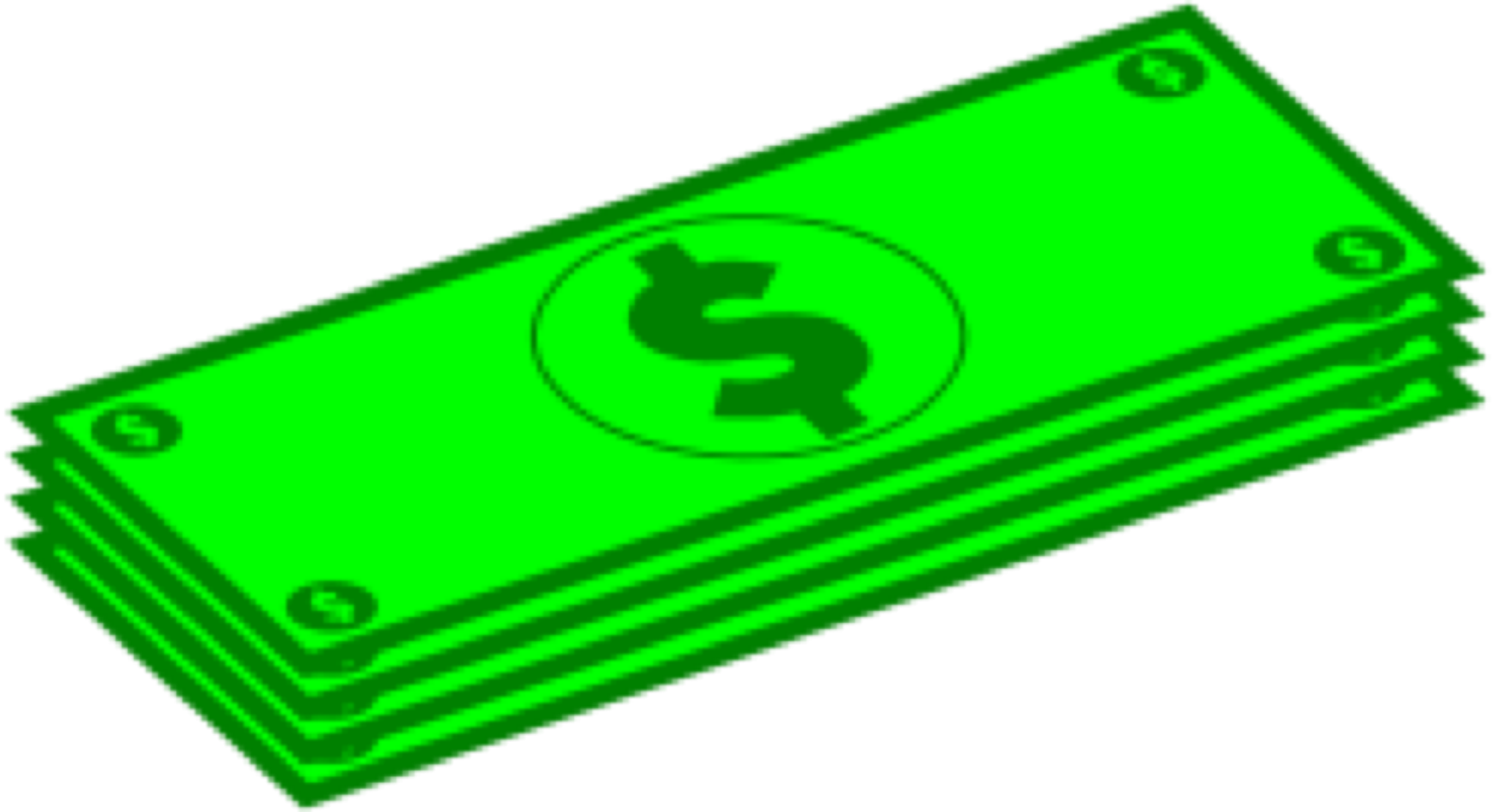
Barter



Barter



Money



Bills



Gold Bullion Coin



Gold Bullion Coin



Coin US Penny



Gold Bricks



Financial Services

Financial Services



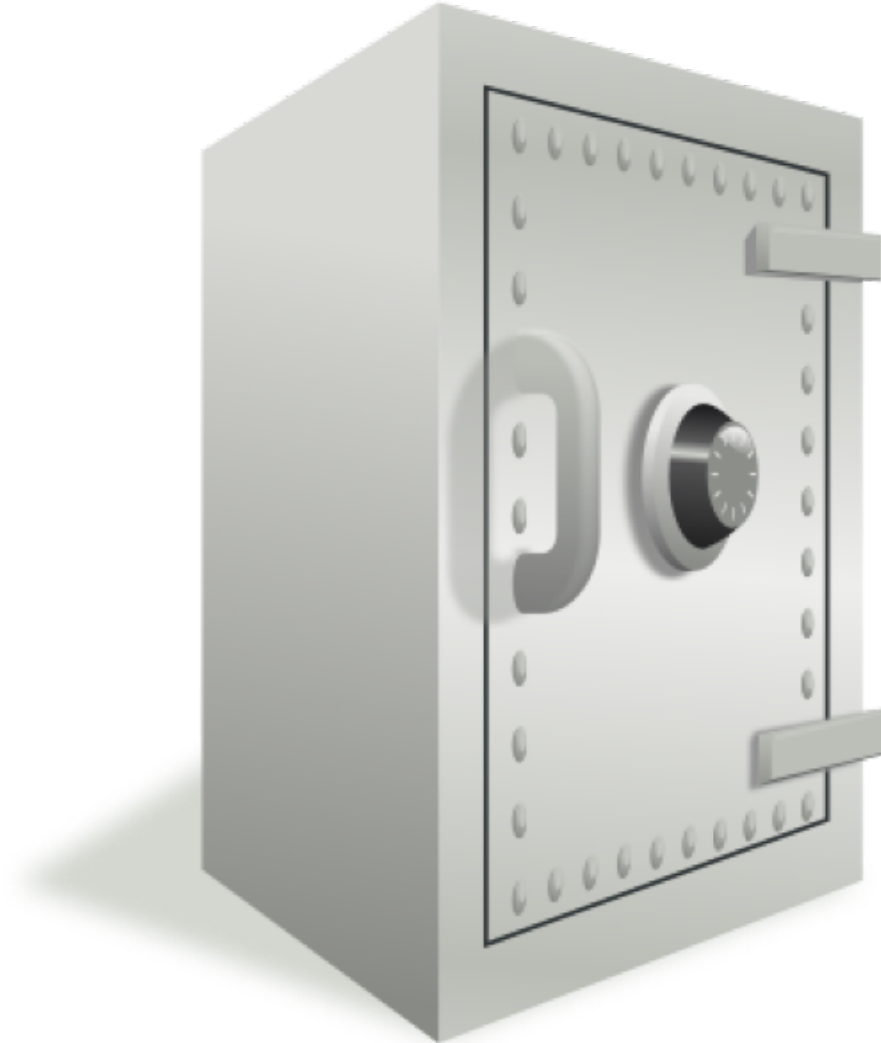
Financial Services



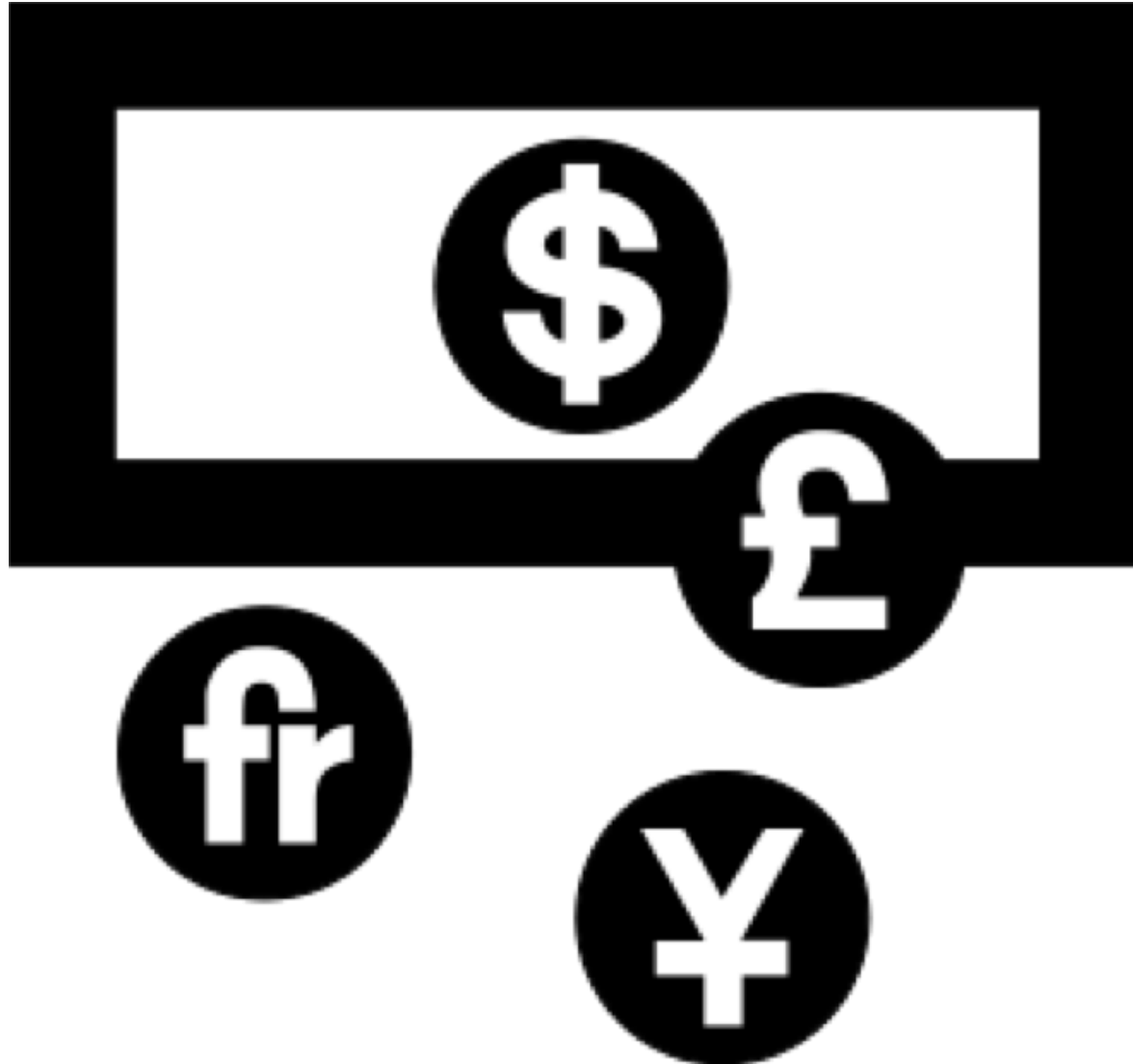
Treasure



Safe



Currency Exchange



Market

Financial Services

Financial Services



Financial Revolution with Fintech

A financial services revolution

Consumer Trends



1. Simplification



2. Transparency



3. Analytics



4. Reduced Friction

FinTech: Financial Services Innovation



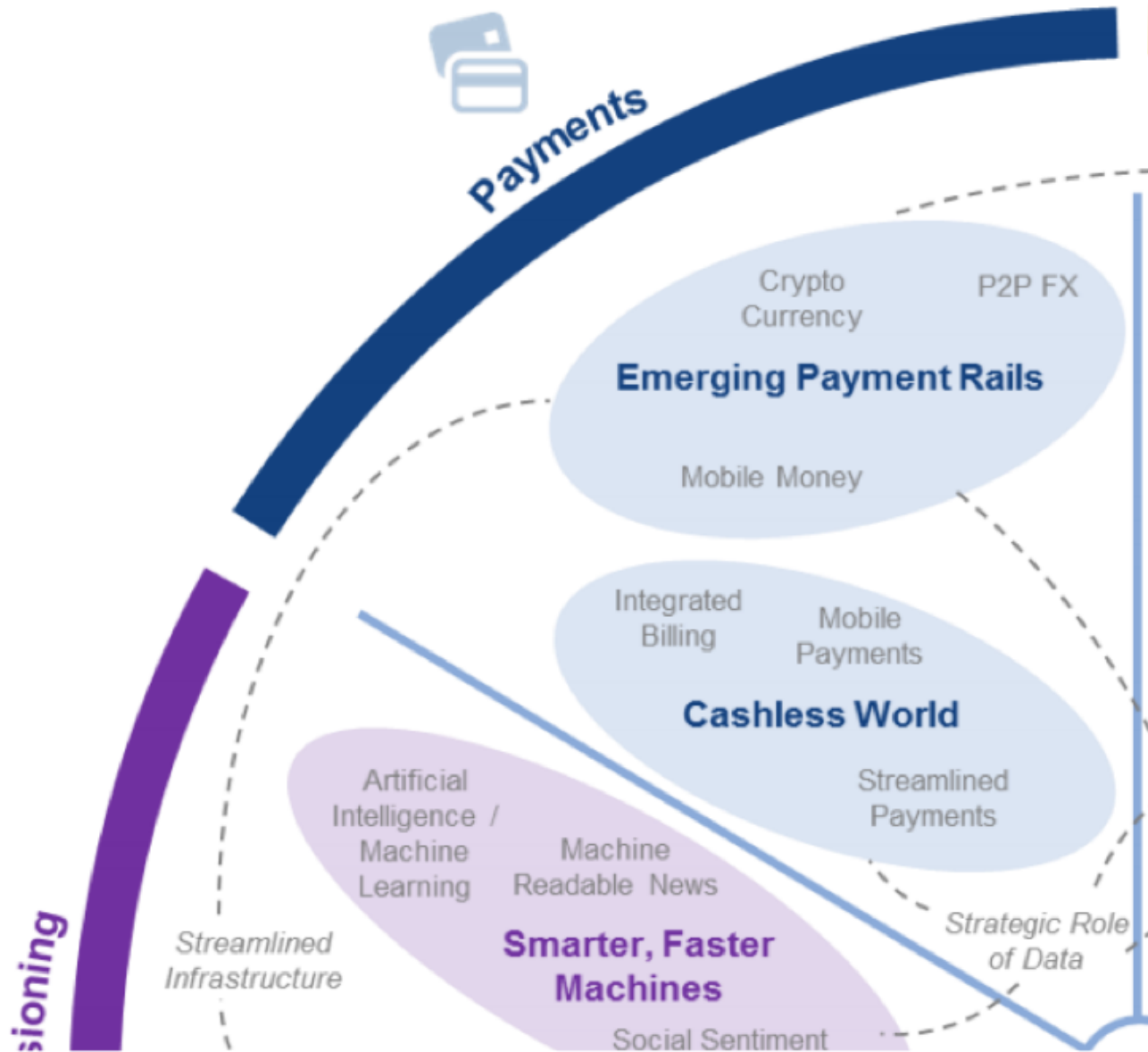
FinTech:

Financial Services Innovation

- 1. Payments**
- 2. Insurance**
- 3. Deposits & Lending**
- 4. Capital Raising**
- 5. Investment Management**
- 6. Market Provisioning**

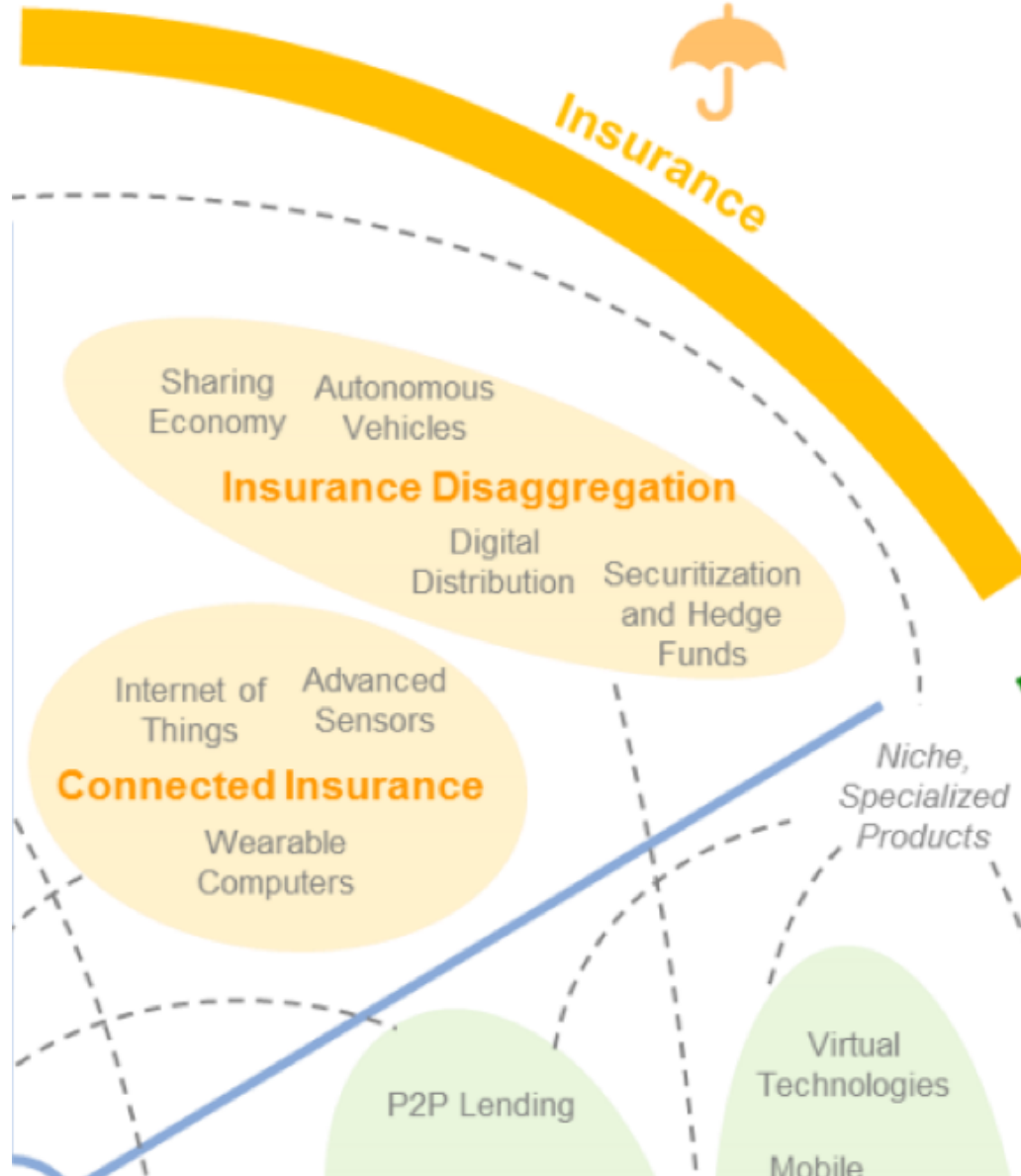
1

FinTech: Payment



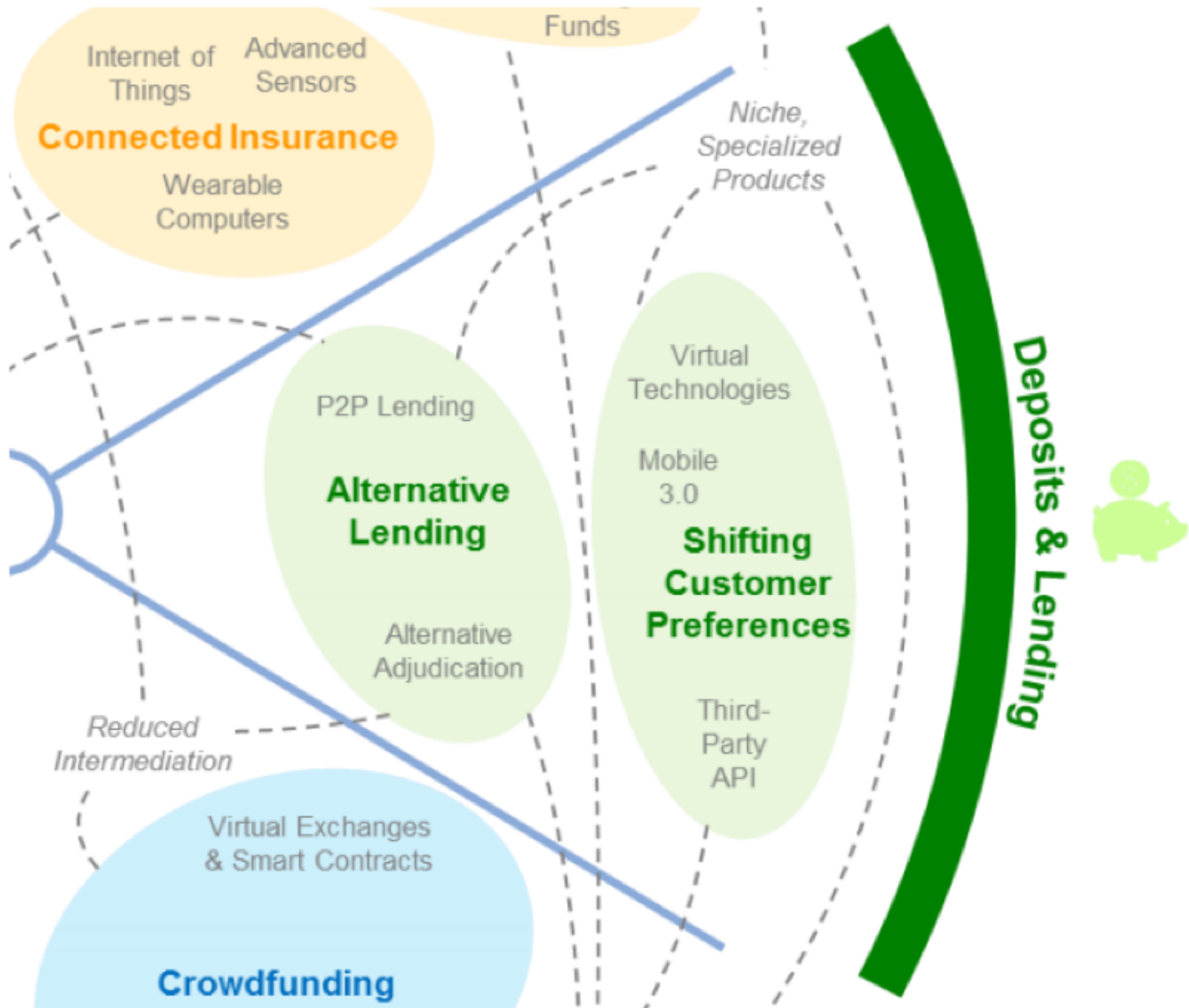
2

FinTech: Insurance



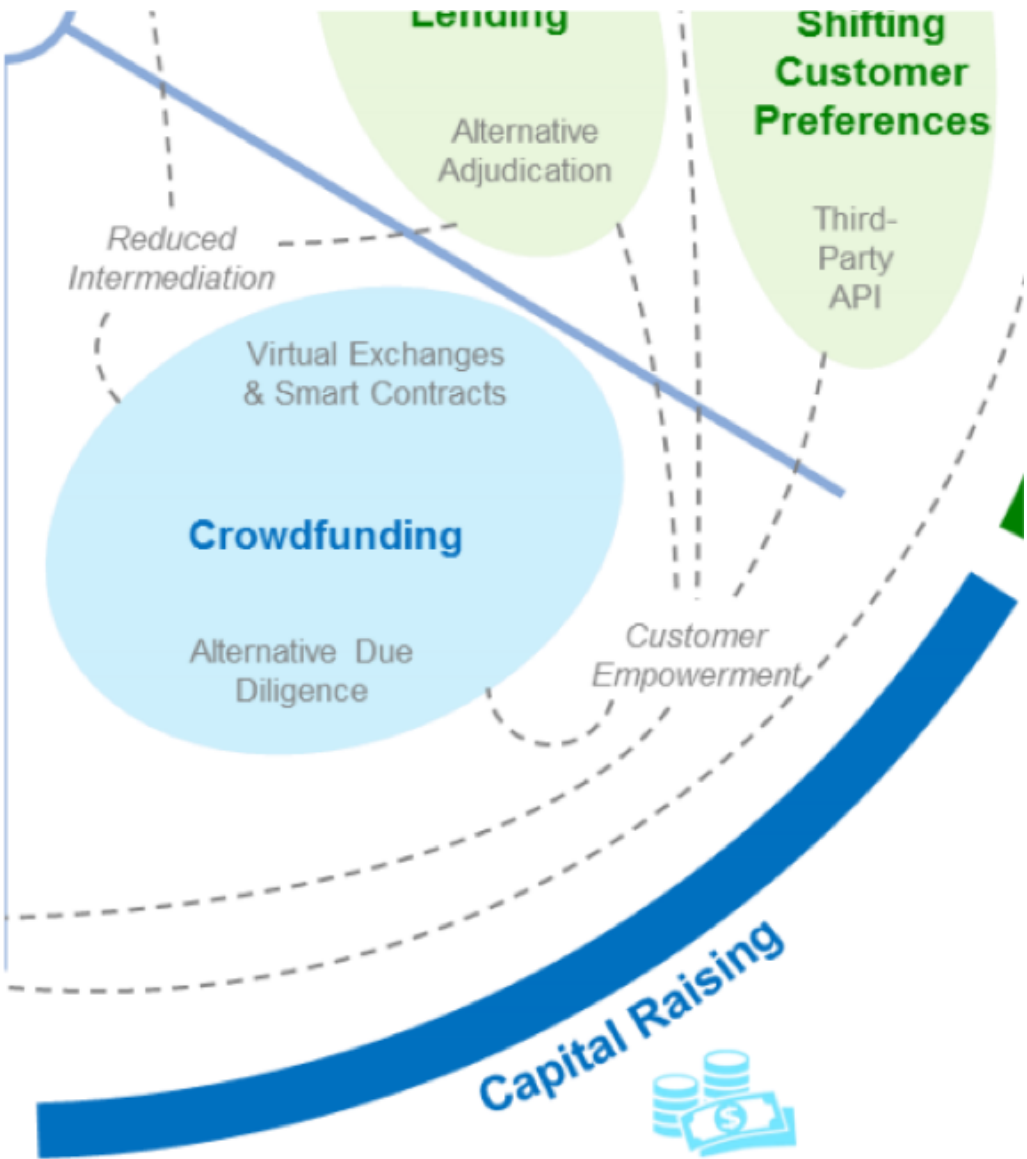
3

FinTech: Deposits & Lending



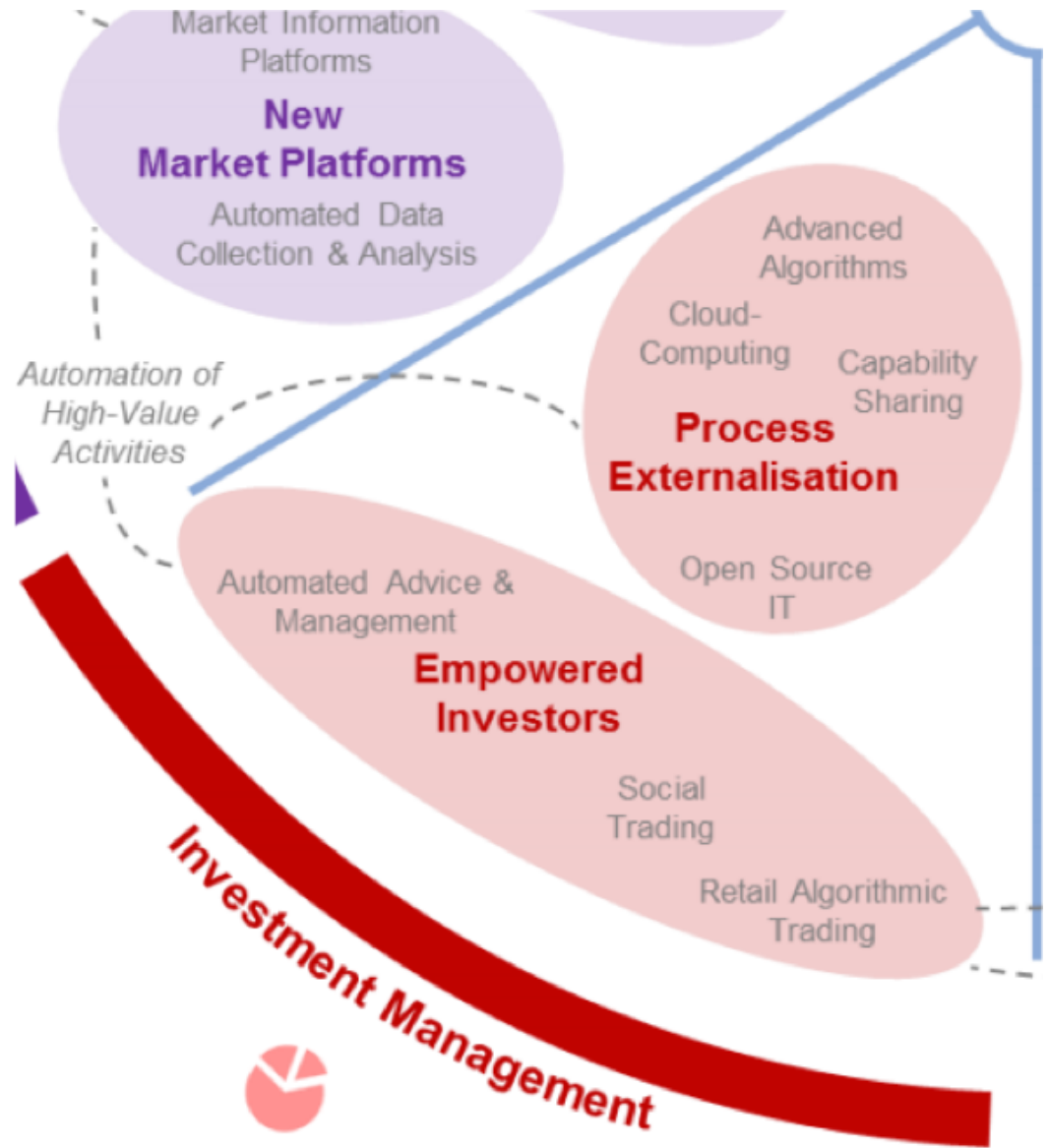
4

FinTech: Capital Raising



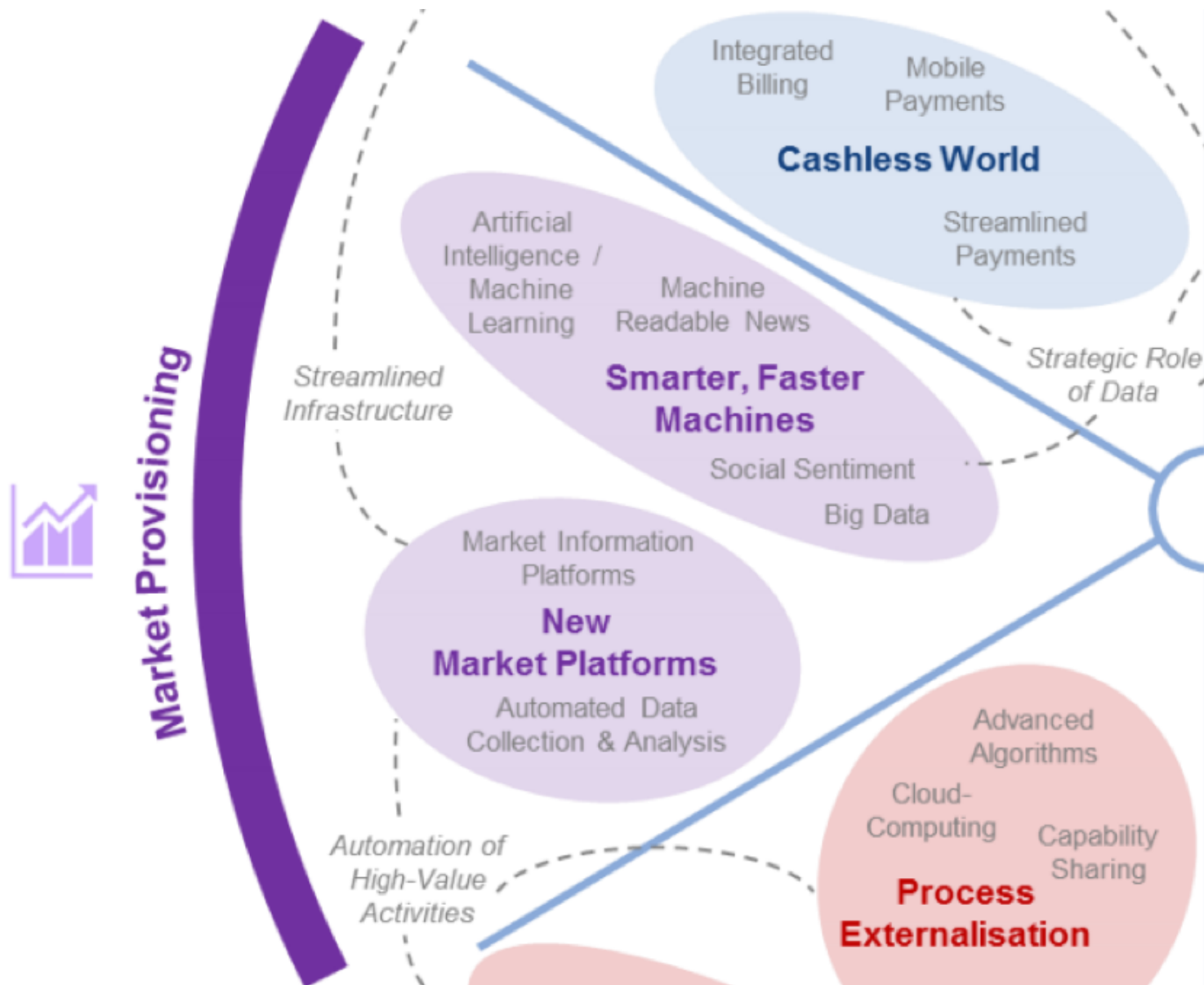
5

FinTech: Investment Management



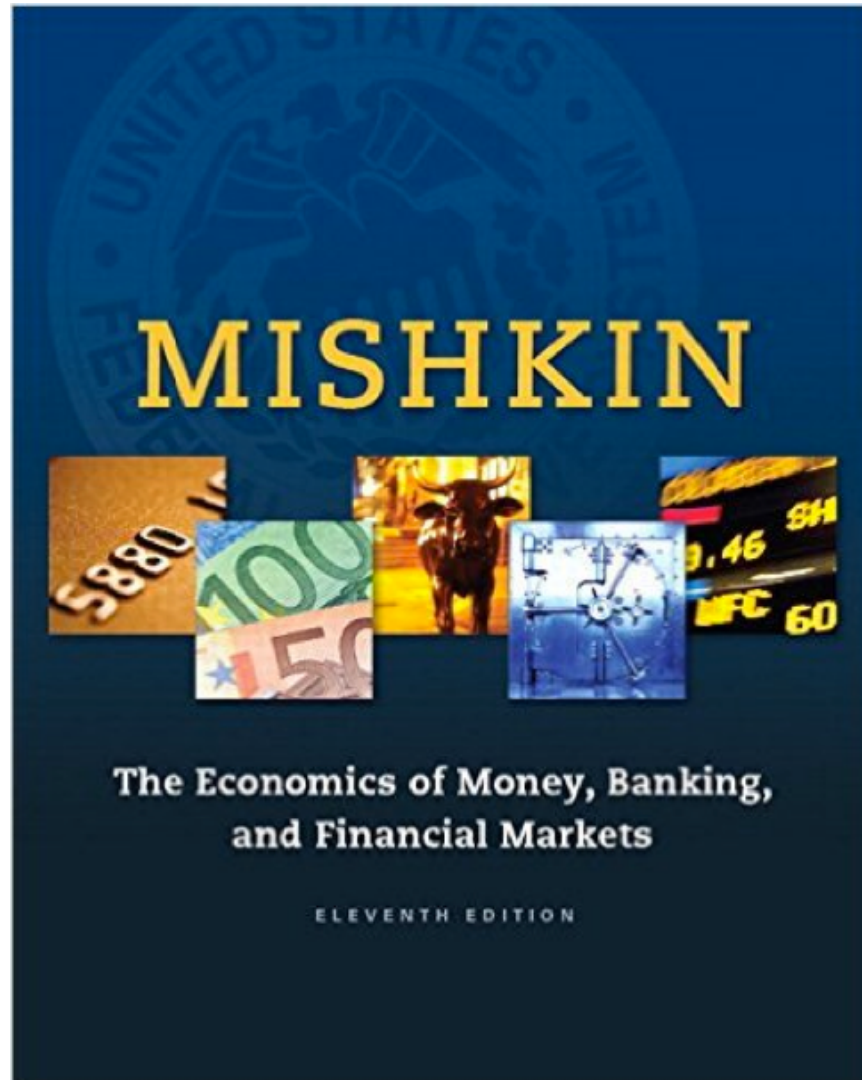
6

FinTech: Market Provisioning



The Economics of Money, Banking and Financial Markets

**Frederic S. Mishkin (2015),
The Economics of Money, Banking and Financial Markets,
11th Edition, Pearson**



Economics of Money, Banking and Financial Markets

1. **Money**, Banking, and Financial System
2. Financial Markets
3. Financial Institutions
4. Central Banking and the Conduct of Monetary Policy
5. International Finance and Monetary Policy
6. Monetary Theory
7. **Financial Services** Industry

INTRODUCTION

1. Why Study Money, Banking, and Financial Markets?
2. An Overview of the Financial System
3. What Is Money?

FINANCIAL MARKETS

4. Understanding Interest Rates
5. The Behavior of Interest Rates
6. The Risk and Term Structure of Interest Rates
7. The Stock Market, the Theory of Rational Expectations, and the Efficient Market Hypothesis

FINANCIAL INSTITUTIONS

8. An Economic Analysis of Financial Structure
9. Banking and the Management of Financial Institutions
10. Economic Analysis of Financial Regulation
11. Banking Industry: Structure and Competition
12. Financial Crises

CENTRAL BANKING AND THE CONDUCT OF MONETARY POLICY

13. Central Banks and the Federal Reserve System

14. The Money Supply Process

15. The Tools of Monetary Policy

16. The Conduct of Monetary Policy: Strategy and Tactics

MONETARY THEORY

19. Quantity Theory, Inflation, and the Demand for Money

20. The IS Curve

21. The Monetary Policy and Aggregate Demand Curves

22. Aggregate Demand and Supply Analysis

23. Monetary Policy Theory

24. The Role of Expectations in Monetary Policy

25. Transmission Mechanisms of Monetary Policy

Financial Services Industry

- 26. Financial Crises in Emerging Market Economies
- 27. The ISLM Model
- 28. Nonbank Finance
- 29. Financial Derivatives
- 30. Conflicts of Interest in the Financial Services Industry

Why Study Money, Banking, and Financial Markets?

Why Study Money, Banking, and Financial Markets?

- To examine how **financial markets** such as **bond**, **stock** and **foreign exchange** markets work
- To examine how **financial institutions** such as **banks** and **insurance companies** work
- To examine the **role of money** in the **economy**

Financial Markets

- Markets in which funds are transferred from people who have an excess of available funds to people who have a shortage of funds
 - Bond market
 - Stock market
 - Foreign exchange market

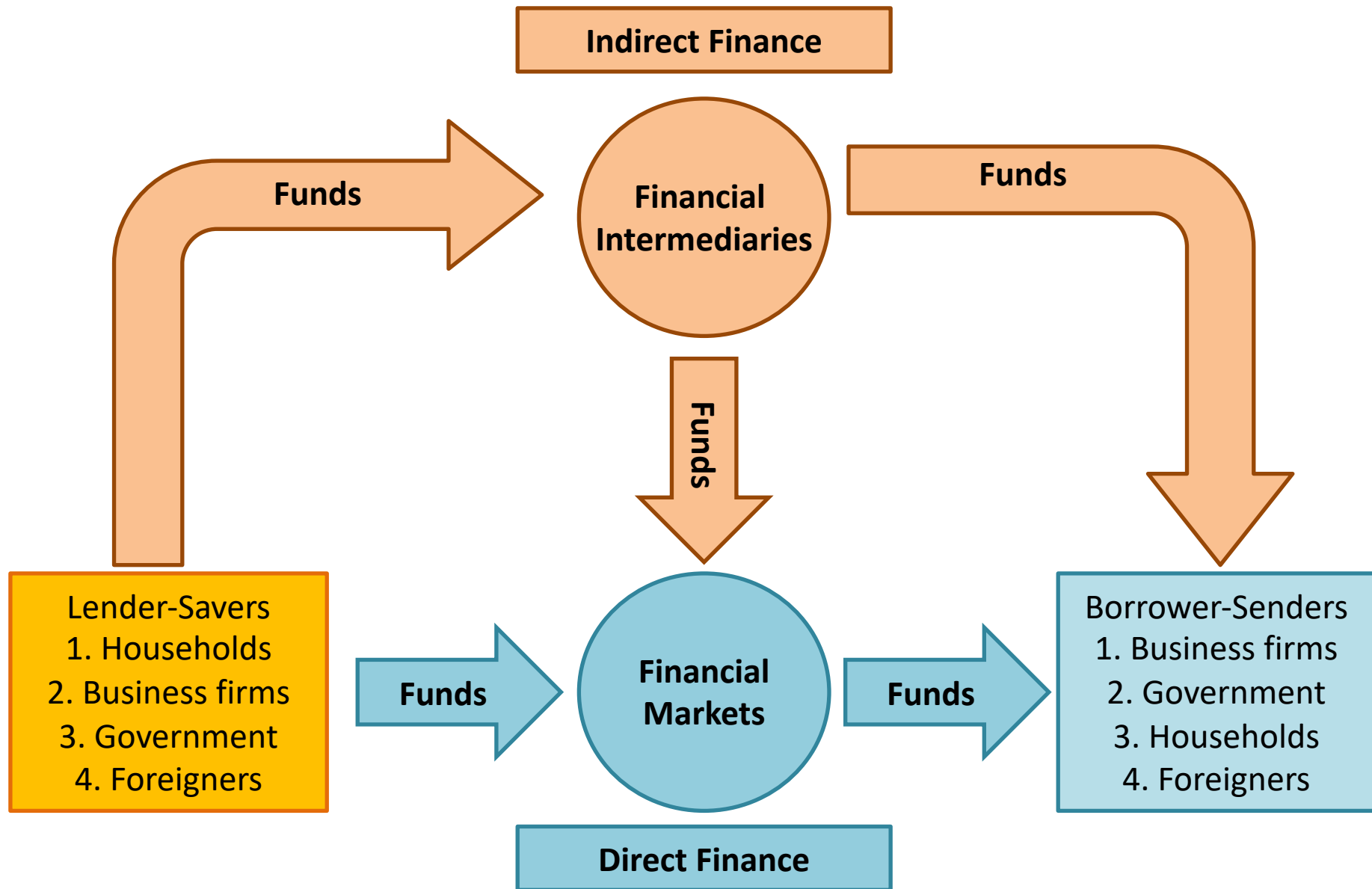
Financial Institutions

- Financial Intermediaries: institutions that borrow funds from people who have saved and make loans to other people:
 - **Banks**: accept deposits and make loans
 - Other Financial Institutions: **insurance companies, finance companies, pension funds, mutual funds and investment banks**
- **Financial Innovation**: the advent of the information age and e-finance

Money and Business Cycles

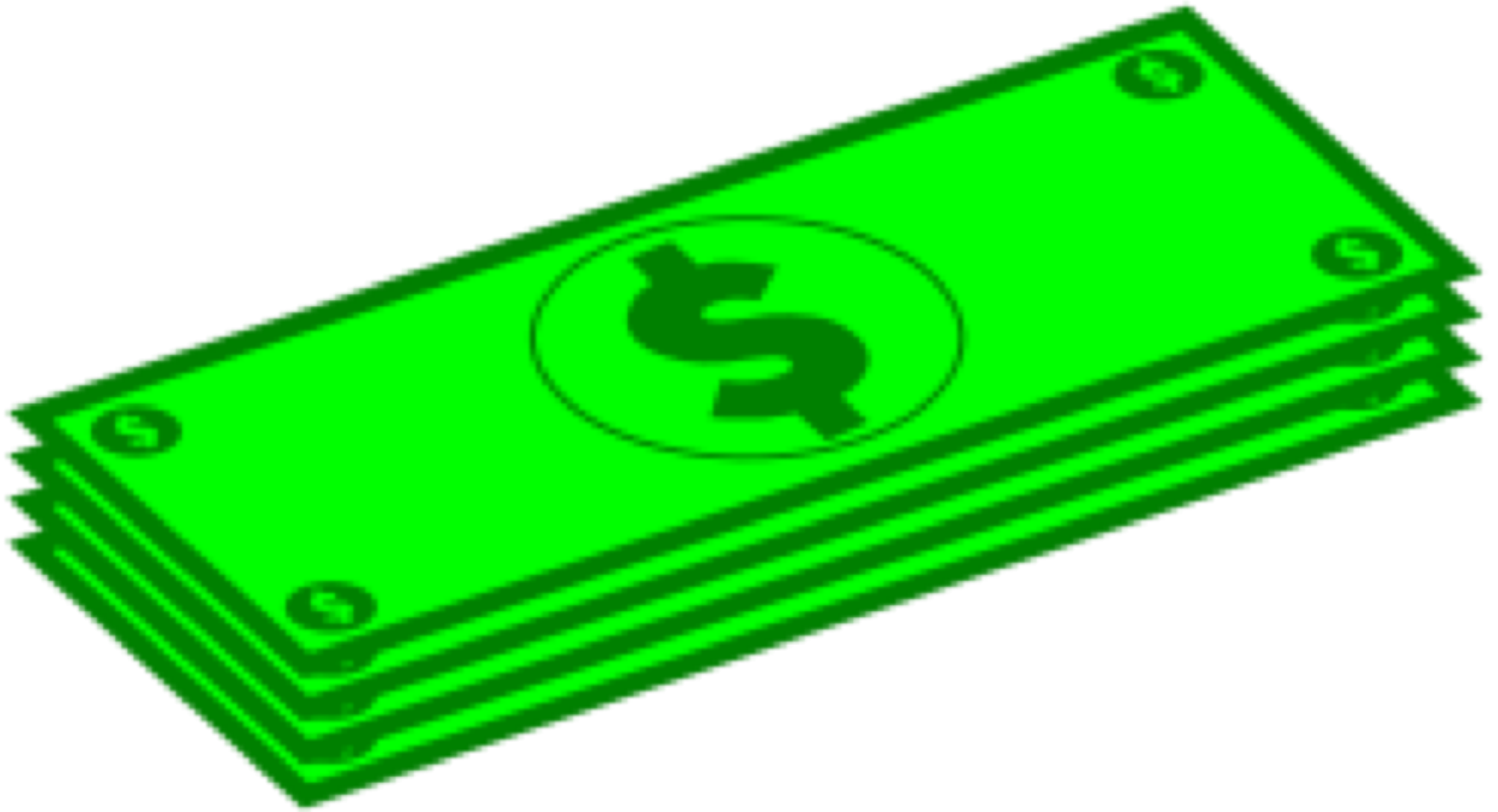
- Money plays an important role in generating business cycles
- Recessions (unemployment) and expansions affect all of us
- Monetary Theory ties changes in the money supply to changes in aggregate economic activity and the price level

Overview of the Financial System



What is Money?

Money



Bills



Meaning of Money

- **Money (=money supply)** any vehicle used as a means of **exchange** to pay for goods, services or debts.
- In today's society, any **asset** that can quickly be transferred into cash is considered money.
- The more **liquid** an asset is, the closer it is to money.
- In economics, **money** does not mean **wealth** nor does it mean **income**.

Functions of Money

- Medium of Exchange
- Unit of Account
- Store of Value

Medium of Exchange

- By eliminating **barter**, this function of money increases **efficiency** in a society.
- As human societies started to engage in exchange money had to be invented.
- Any **technological change** that reduces transaction costs increases the **wealth** of the society.
- Any **technological change** that allows people to specialize also **increases wealth**.

Unit of Account

- We use money to measure the value of goods and services.
- Suppose we had 4 goods and no money. How do we measure the price of each good?
 - A in terms of B
 - B in terms of C
 - C in terms of D
 - A in terms of C
 - A in terms of D
 - B in terms of D
- Money allows to quote prices in terms of currency only.

$$N!/2(N-2)!$$

Store of Value

- All **assets** are stored value.
- Money, although without any return, is still desirable to hold because it allows purchases immediately.
- Other assets take time (transaction costs) to use as a payment for purchases.
- The more liquid an asset is, the less transaction cost it carries.
- Inflation erodes the value of money.

Evolution of the Payments System

- **Commodity Money:**
 - valuable, easily standardized and divisible commodities
(e.g. precious metals, cigarettes).
- **Fiat Money:**
 - paper money decreed by governments as legal tender.

Electronic Money

- Debit Cards
 - Instant transfer from your checking account to merchant's checking account.
- Stored Value Card
 - Gift cards.
- Electronic Cash
 - Account set up on a person's PC from her bank whereby she can buy products over the Internet.
- Electronic Checks
 - Checks written on PC and sent through the Internet.

Benefits of Paper Checks

- Cheaper than telecommunications network.
- Provide receipts.
- Allow float.
- May be more secure; avoid hacker problems.
- Do not leave a wealth of information trail.

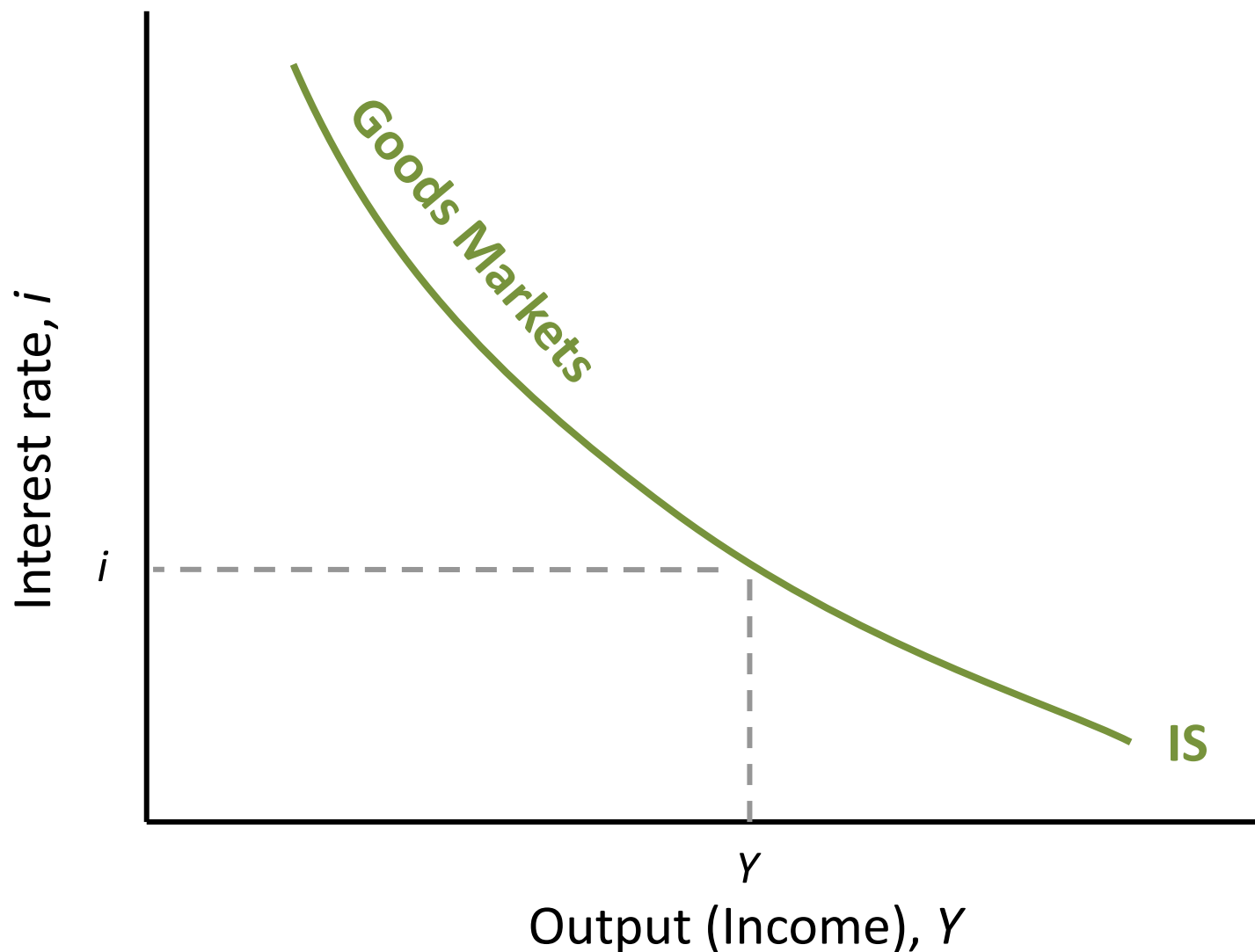
Measuring Money

- M1:
 - Currency, demand deposits, travelers checks.
- M2:
 - M1, saving deposits, small time deposits, retail MMMF.
- M3:
 - M2, large time deposits, repos, Eurodollar deposits, institutional MMMF.
- MZM:
 - M2, institutional MMMF minus small time deposits.
- Growth rates of these aggregates do not always go hand in hand, making monetary policy difficult since signals are conflicting.

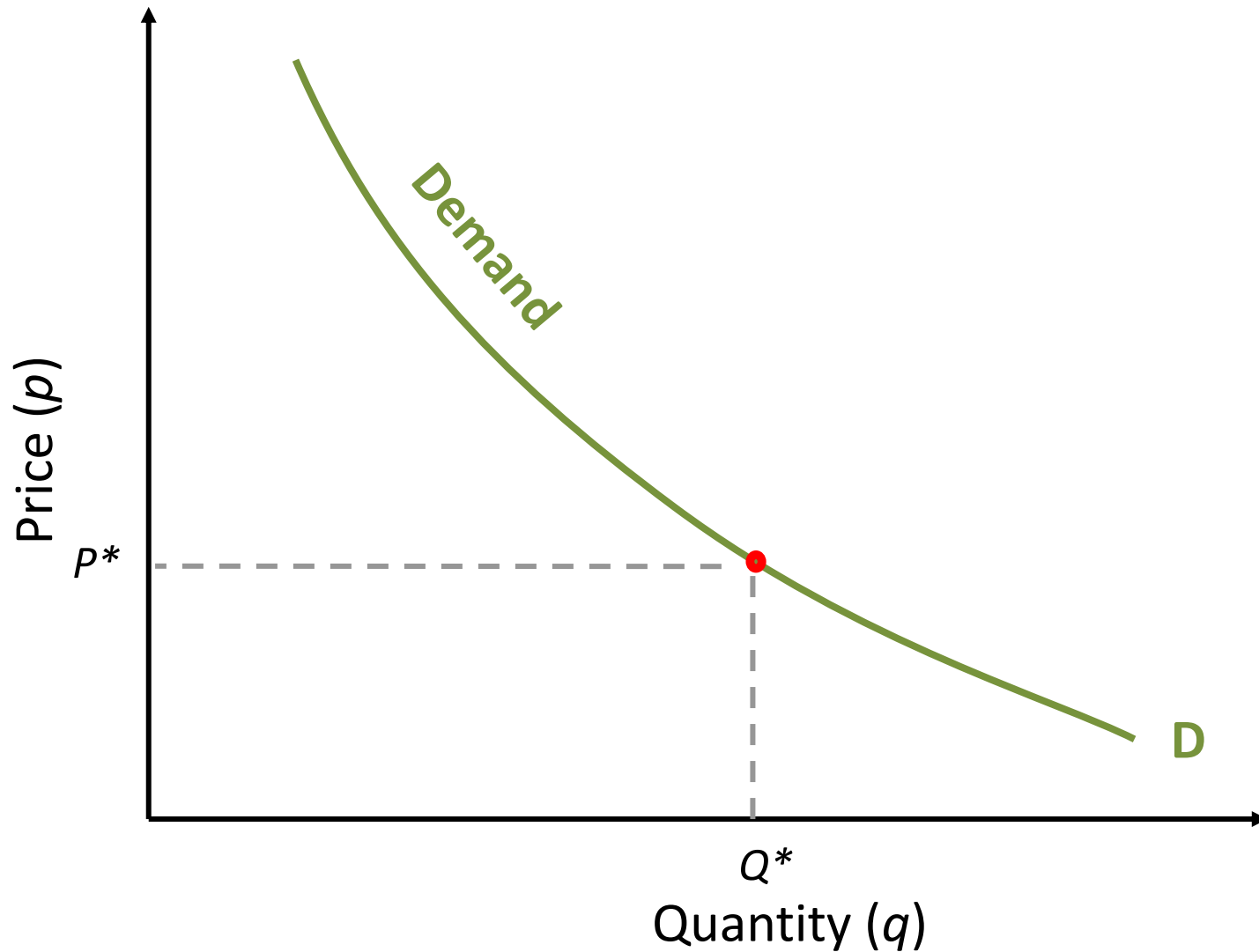
The IS Curve

The IS (Investment/Saving) Curve

The IS (Investment/Saving) Curve



Demand



The ISLM Model

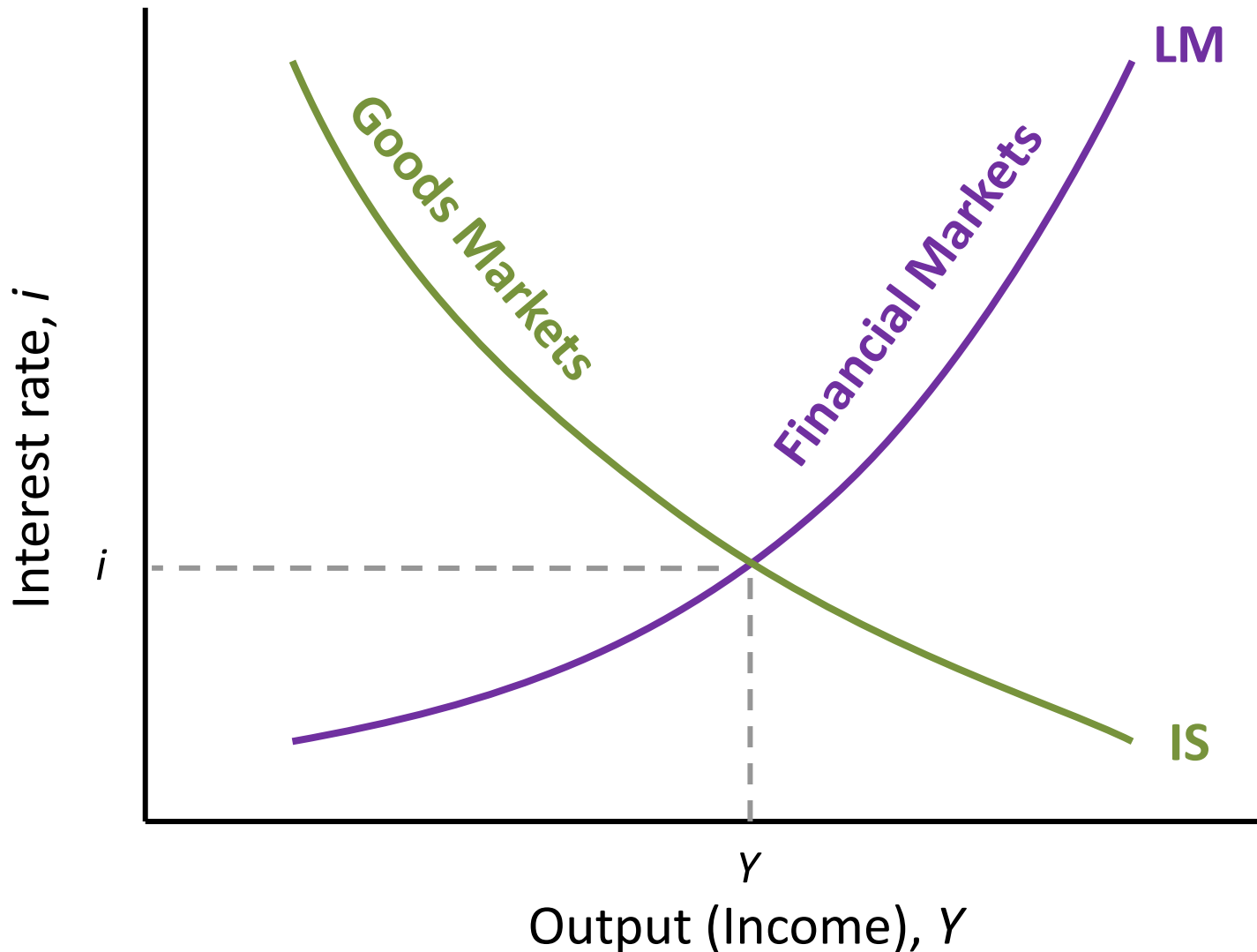
Goods and Financial Markets:

The ISLM Model

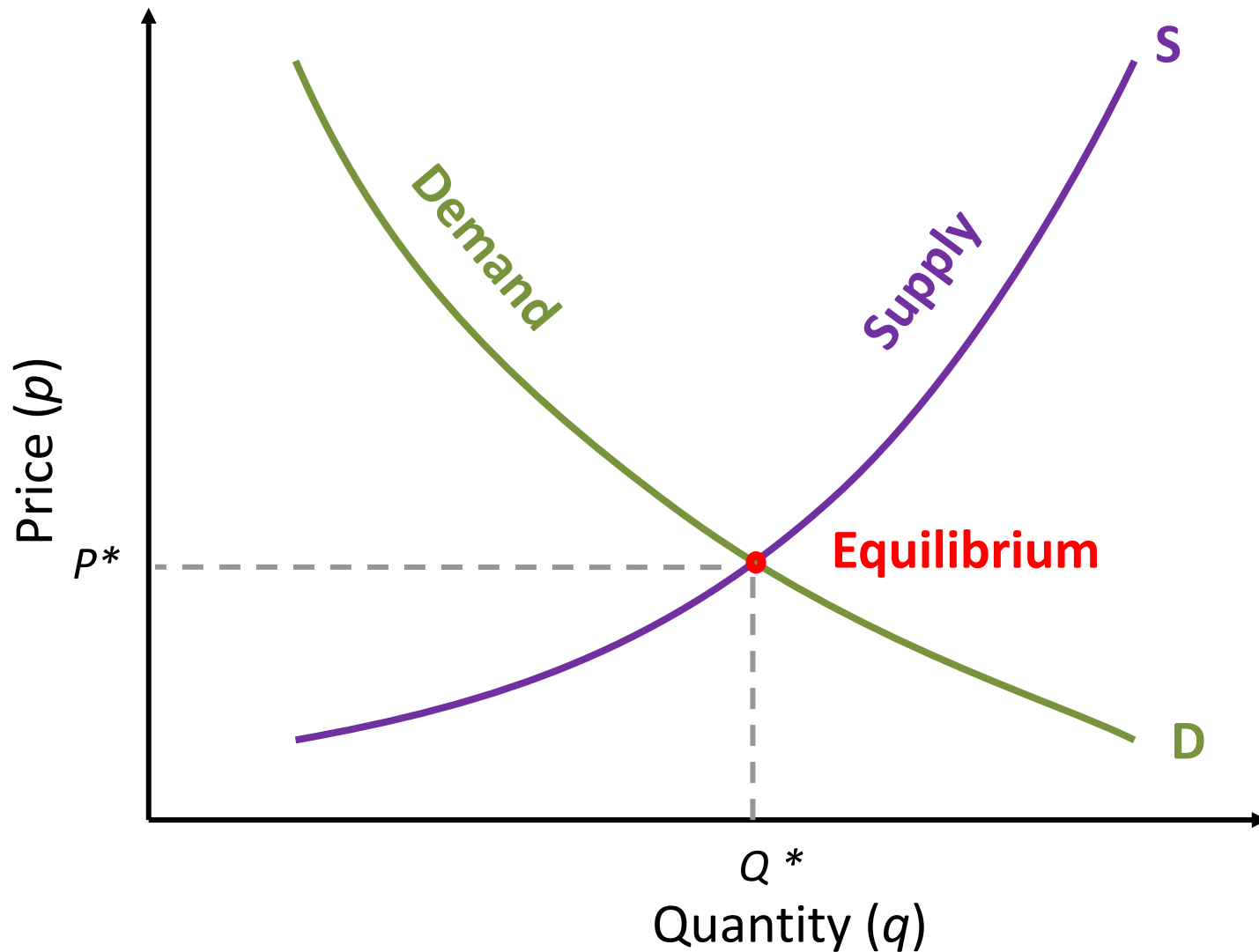
**(Investment Saving –
Liquidity Preference Money
Supply)
model**

The ISLM Model

(Investment Saving – Liquidity Preference Money Supply) model



Supply and Demand



**Artificial Intelligence
and
Deep Learning
for
Fintech**

**From Algorithmic Trading
to Personal Finance Bots:
41 Startups Bringing
AI to Fintech**

From Algorithmic Trading To Personal Finance Bots: 41 Startups Bringing AI To Fintech

AI in Fintech

41 Startups Bringing Artificial Intelligence To Fintech

General Purpose/ Predictive Analytics



Market Research & Sentiment Analysis



Search Engine



Quantitative Trading



Blockchain



Debt Collection



AI Assistants/Bots



Fraud Detection



Credit Scoring



Personal Banking



Artificial Intelligence (AI) in Fintech

General Purpose/ Predictive Analytics



Market Research & Sentiment Analysis



Search Engine



Artificial Intelligence (AI) in Fintech

Quantitative Trading



Blockchain



Debt Collection



AI Assistants/Bots



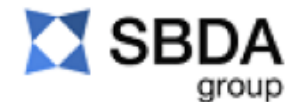
Fraud Detection



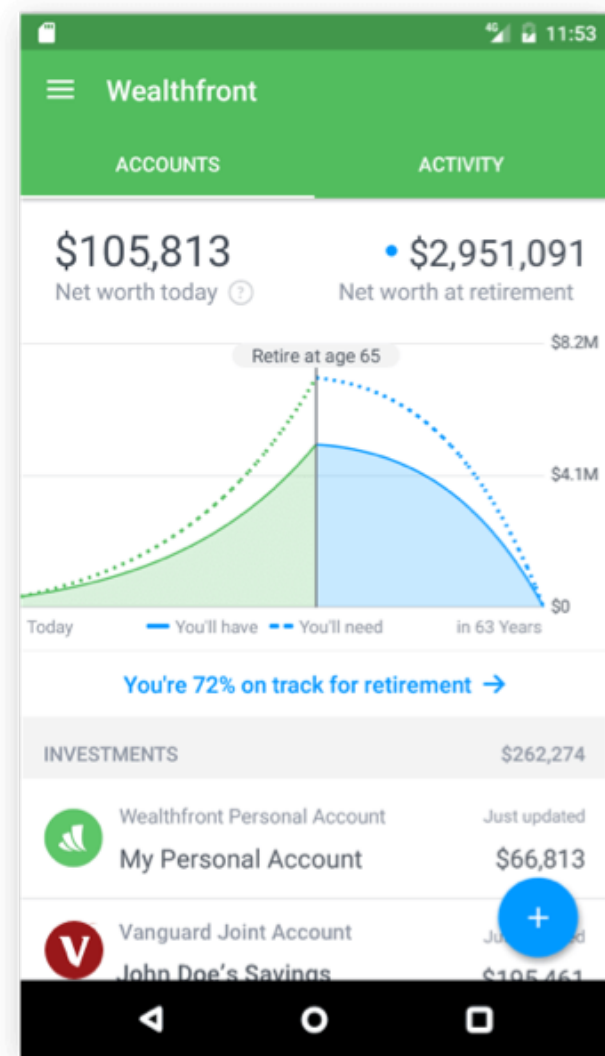
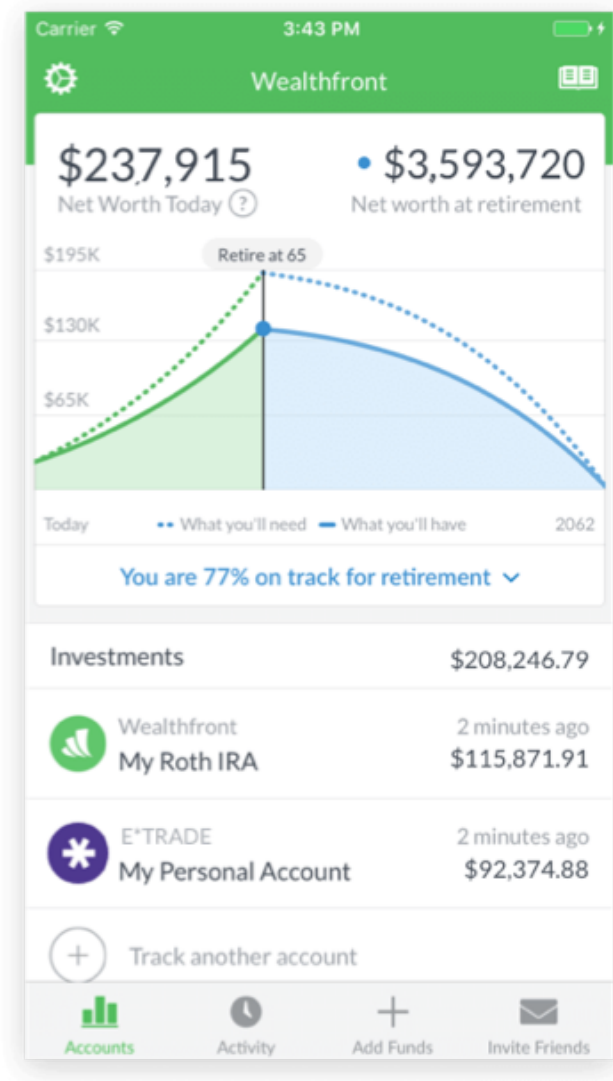
Credit Scoring



Personal Banking



Wealthfront Robo Advisor



Financial Services

Technology Innovation

Innovation

Innovation:

a new idea,

method, or

device

Innovation:

something

new

Novelty :

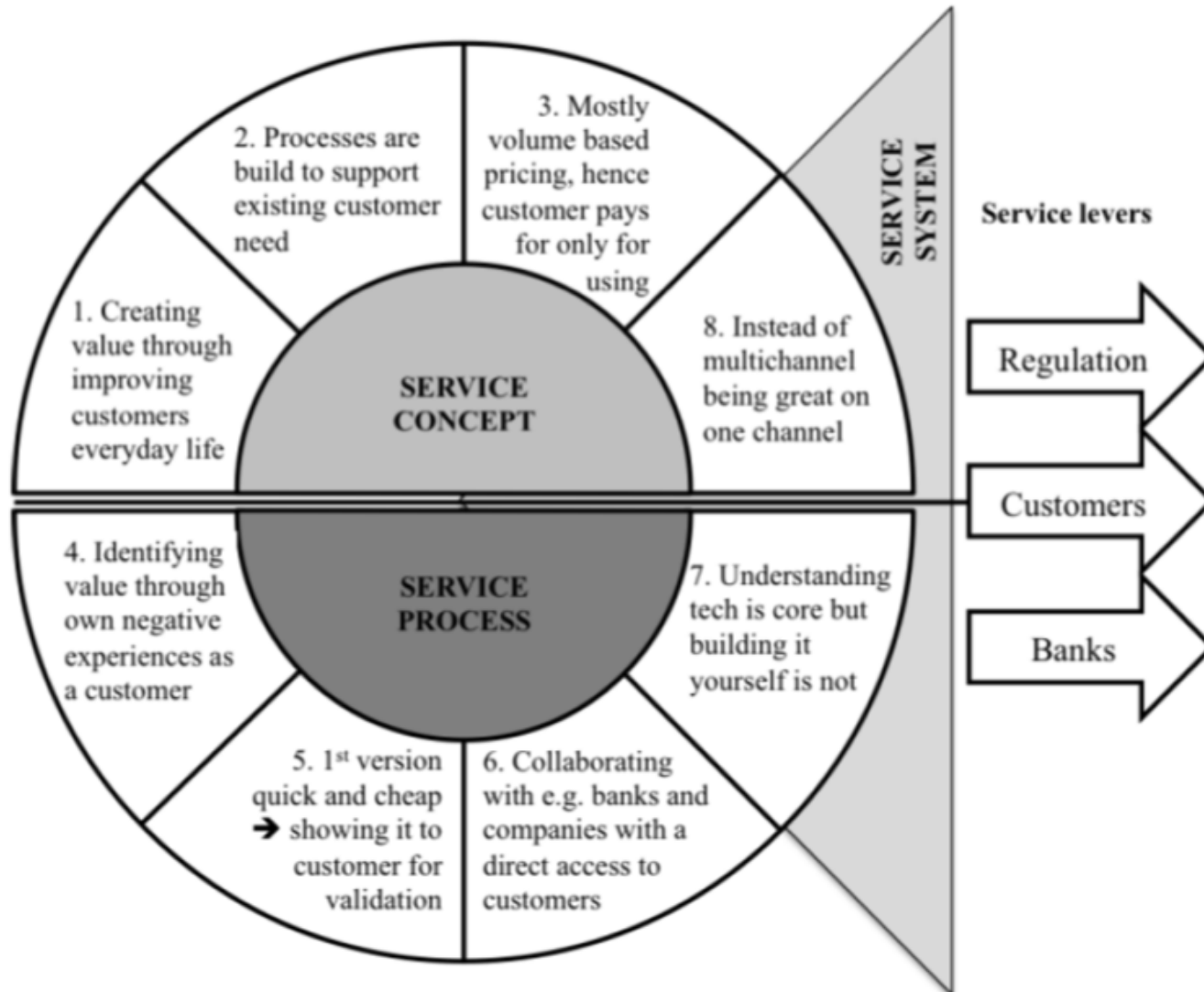
something new or unusual

the novelty of a self-driving car

**Creativity is not a
new Idea.**

**Creativity is
an old belief
you leave behind**

FinTechs as Service Innovators: Analysing Components of Innovation



Innovation

“a process of
searching and recombining
existing knowledge
elements”

Search and recombination process to innovate: A review of the empirical evidence and a research agenda



Source: Savino, Tommaso, Antonio Messeni Petruzzelli, and Vito Albino. "Search and recombination process to innovate: A review of the empirical evidence and a research agenda." *International Journal of Management Reviews* (2017).

Innovation Research in Economics, Sociology and Technology Management

Source: Gopalakrishnan, Shanti, and Fariborz Damanpour.

"A review of innovation research in economics, sociology and technology management." *Omega* 25, no. 1 (1997): 15-28.

Innovation Research in Economics, Sociology and Technology Management

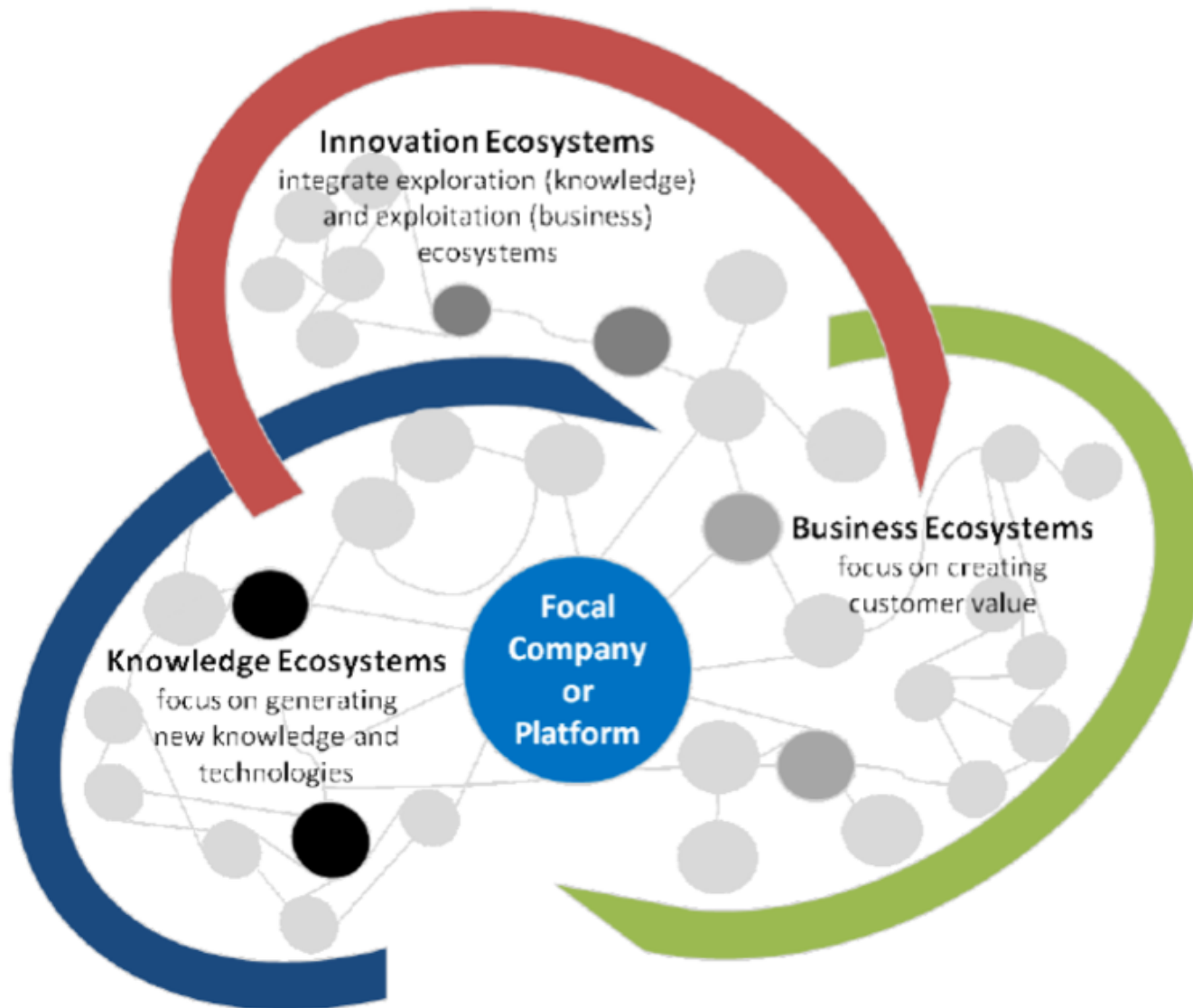
	Stage of process	Level of study	Type of innovation
<i>Economists</i>	Generation Idea generation Project definition	Industry	Product and process Only technical Only radical
<i>Technologists</i>			
Contextual technologists	Generation Commercialization and marketing Diffusion	Innovation (in the industry context)	Product and process Only technical Radical and incremental
Organizational technologists	Generation Idea generation Problem solving adoption Adoption Initiation	Organizational Sub-system	Product and process Only technical Radical and incremental
<i>Sociologists</i>			
Variance sociologists	Adoption Initiation Implementation	Organization	Product and process Technical and administrative Radical and incremental
Process sociologists	Adoption Initiation Implementation	Innovation (at the organizational level)	Product and process Technical and administrative Radical and incremental

Source: Gopalakrishnan, Shanti, and Fariborz Damanpour.

"A review of innovation research in economics, sociology and technology management." *Omega* 25, no. 1 (1997): 15-28.

Business, Innovation, and Knowledge Ecosystems

Business, Innovation, and Knowledge Ecosystems



Source: Valkokari, Katri. "Business, innovation, and knowledge ecosystems: how they differ and how to survive and thrive within them." *Technology Innovation Management Review* 5, no. 8 (2015).

Innovation Ecosystems

Characteristics

	Business Ecosystems	Innovation Ecosystems	Knowledge Ecosystems
Baseline of Ecosystem	Resource exploitation for customer value	Co-creation of innovation	Knowledge exploration
Relationships and Connectivity	Global business relationships both competitive and co-operative	Geographically clustered actors, different levels of collaboration and openness	Decentralized and disturbed knowledge nodes, synergies through knowledge exchange
Actors and Roles	Suppliers, customers, and focal companies as a core, other actors more loosely involved	Innovation policymakers, local intermediators, innovation brokers, and funding organizations	Research institutes, innovators, and technology entrepreneurs serve as knowledge nodes
Logic of Action	A main actor that operates as a platform sharing resources, assets, and benefits or aggregates other actors together in the networked business operations	Geographically proximate actors interacting around hubs facilitated by intermediating actors	A large number of actors that are grouped around knowledge exchange or a central non-proprietary resource for the benefit of all actors

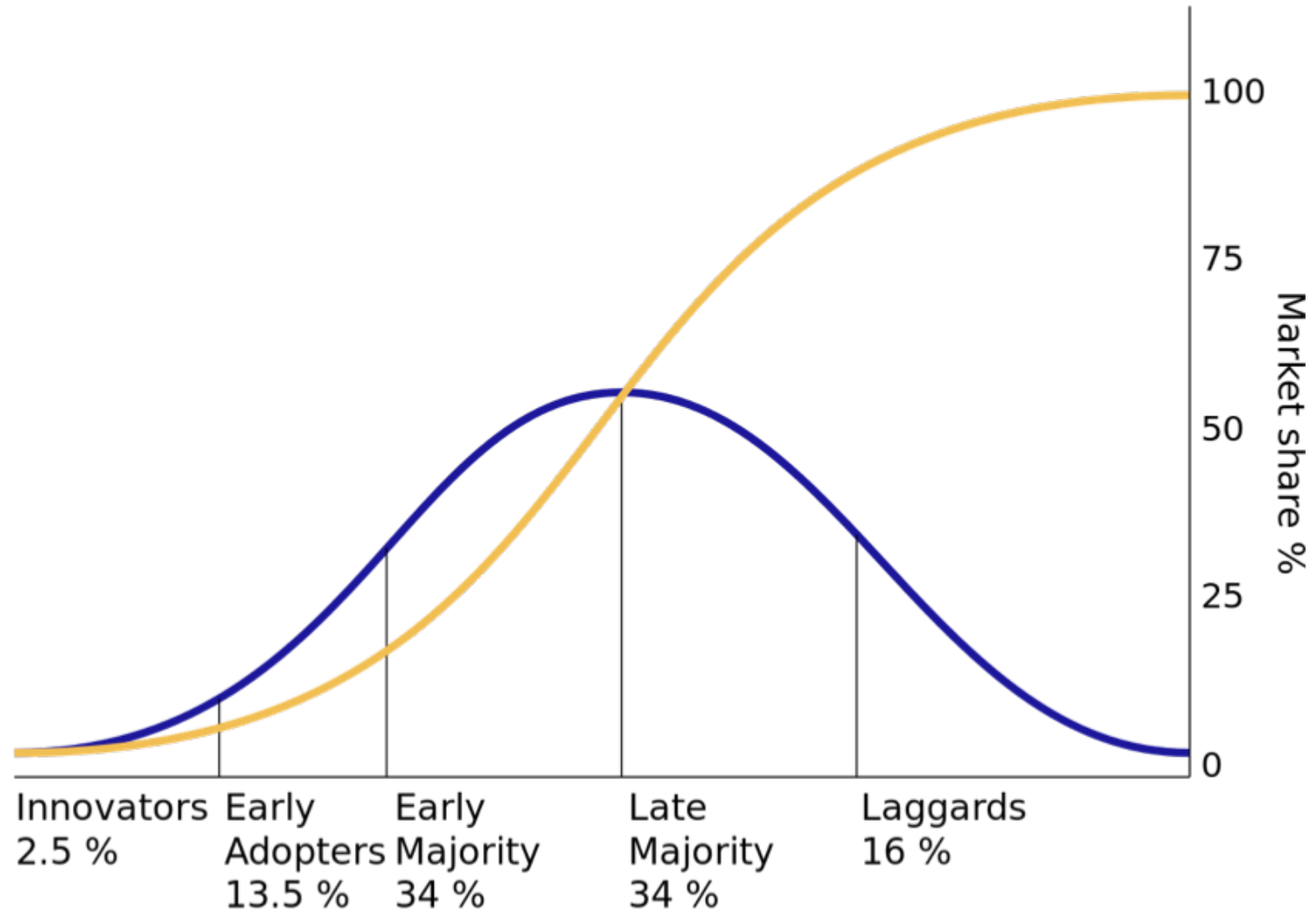
Diffusion of Innovation Theory (DOI)

Innovation

(Diffusion of Innovation)

1. Relative advantage
2. Compatibility
3. Complexity
4. Trialability
5. Observability

Diffusion of Innovation



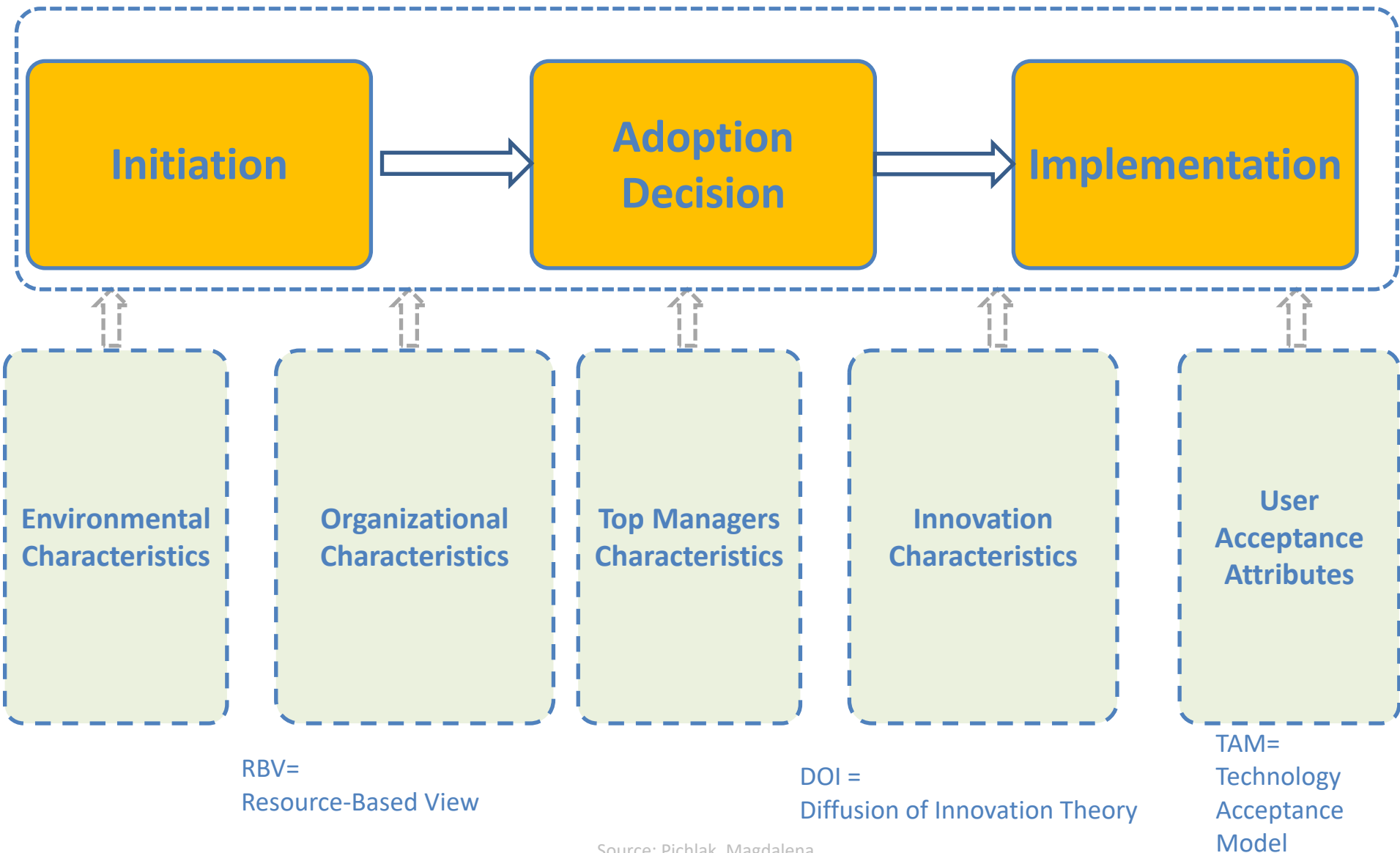
Innovation Adoption Process



Source: Pichlak, Magdalena.

"The innovation adoption process: A multidimensional approach." Journal of Management and Organization 22, no. 4 (2016): 476.

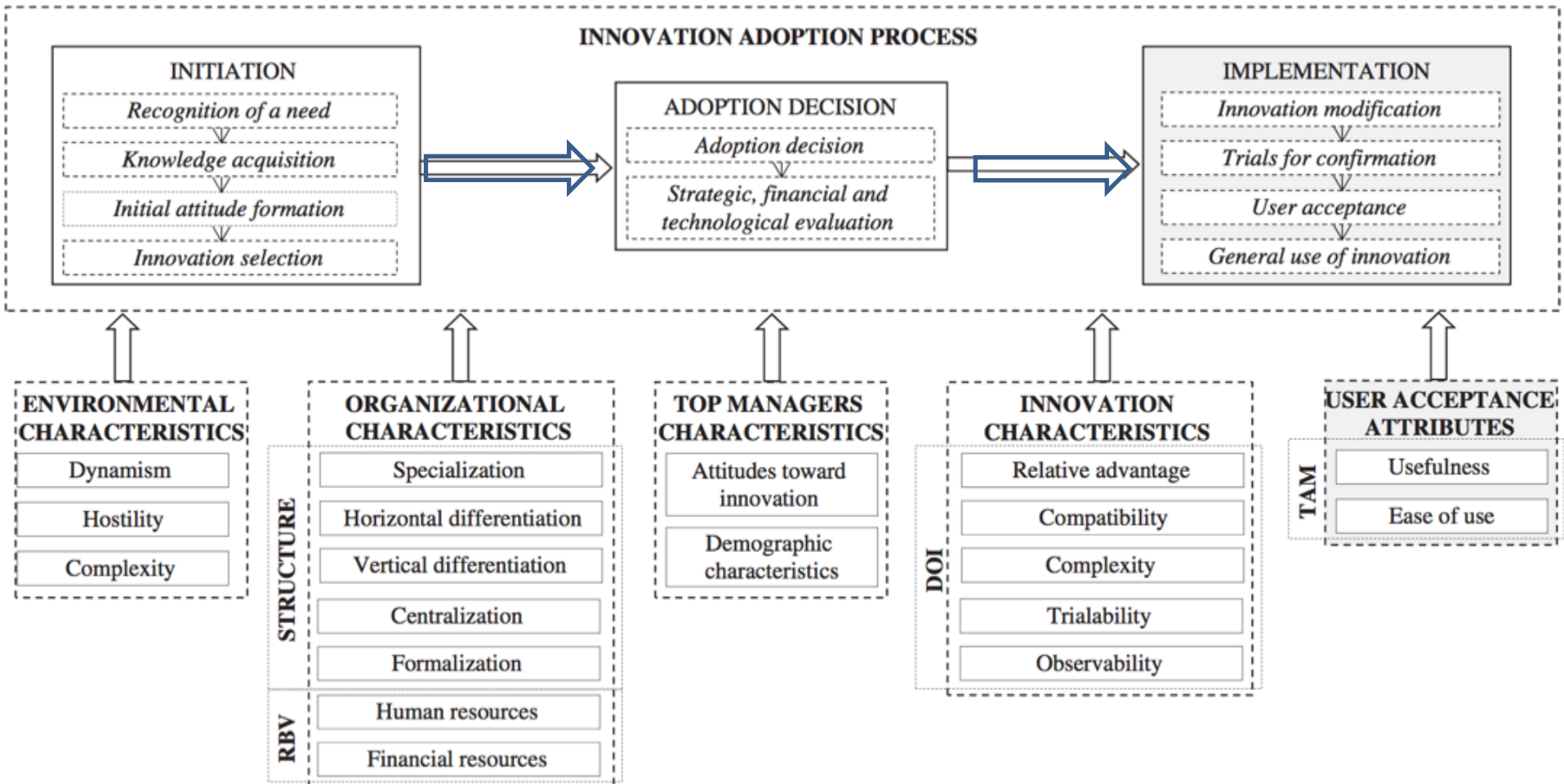
Innovation Adoption Process



Source: Pichlak, Magdalena.

"The innovation adoption process: A multidimensional approach." Journal of Management and Organization 22, no. 4 (2016): 476.

Innovation Adoption Process



RBV=
Resource-Based View

DOI =
Diffusion of Innovation Theory

TAM=
Technology
Acceptance
Model

Source: Pichlak, Magdalena.

"The innovation adoption process: A multidimensional approach." Journal of Management and Organization 22, no. 4 (2016): 476.

Innovation Adoption Process

Factors	Initiation					Adoption decision					Implementation					
	Mean	Me	Q3	Q1	QD	Mean	Me	Q3	Q1	QD	Mean	Me	Q3	Q1	QD	
Environmental characteristics	Dynamism	3.4	3	4	2.75	0.625	3.6	4	4	3	0.5	4	4	5	4	0.5
	Hostility	3.3	3	4.25	3	0.625	3.9	4	4.25	3.75	0.25	3.7	4	4.5	3.5	0.5
	Complexity	4.5	5	5	4	0.5	3.2	3	4	2.75	0.625	3.3	3	4.25	3	0.625
Organizational characteristics	Specialization	3.8	4	4.25	3.75	0.25	2.9	3	4	2	1	2	2	3.25	2	0.625
	Horizontal differentiation	2.8	3	3.75	2.75	0.5	2.7	3	3.5	2	0.75	2	2	3.5	2	0.75
	Vertical differentiation	2.1	2	3.25	2	0.625	3.3	3	4	2.5	0.75	3.1	3	4	2.75	0.625
	Centralization	2	2	3.25	2	0.625	3.8	4	4.25	3.75	0.25	3.9	4	4.25	3.75	0.25
	Formalization	2.1	2	3	1.75	0.625	3	3	4.25	3	0.625	3.3	3	4	3	0.5
	Human resources	4.9	5	5	4.5	0.25	4	4	5	4	0.5	4.1	4	5	4	0.5
Top managers characteristics	Financial resources	3.2	3	4	2.5	0.75	4.1	4	4.25	3.75	0.25	4.8	5	5	4	0.5
	Top managers attitude towards innovation	4.1	4	4.5	4	0.25	3.9	4	4.25	3.75	0.25	4	4	4.5	3.5	0.5
	Top managers demographic characteristics	2.3	2	3.25	1.75	0.75	2	2.5	3	1	1	2.2	2	3	1.5	0.75
Innovation characteristics	Relative advantage	3	3	4	2.75	0.625	4.4	4.5	5	4	0.5	3.1	3	4	2.75	0.625
	Compatibility	2.8	3	3.5	2	0.75	3.9	4	4.25	3.75	0.25	3.9	4	4.25	3.75	0.25
	Complexity	3.6	4	4.25	3.75	0.25	3.8	4	4	3.75	0.125	3.9	4	4.25	3.75	0.25
	Trialability	3.2	3	4	2.75	0.625	3.1	3	4	2.5	0.75	4.1	4	5	4	0.5
	Observability	3.4	3.5	4.25	3	0.625	3.1	3.5	4	2	1	3.3	3	4.25	3	0.625
User acceptance attributes	Usefulness										3.2	3	4	2	1	
	Ease of use										4	4	5	4	0.5	

Note.
Me = median; Q = quartile; QD = quartile deviation.

Source: Pichlak, Magdalena.

"The innovation adoption process: A multidimensional approach." Journal of Management and Organization 22, no. 4 (2016): 476.

Innovation Adoption Process

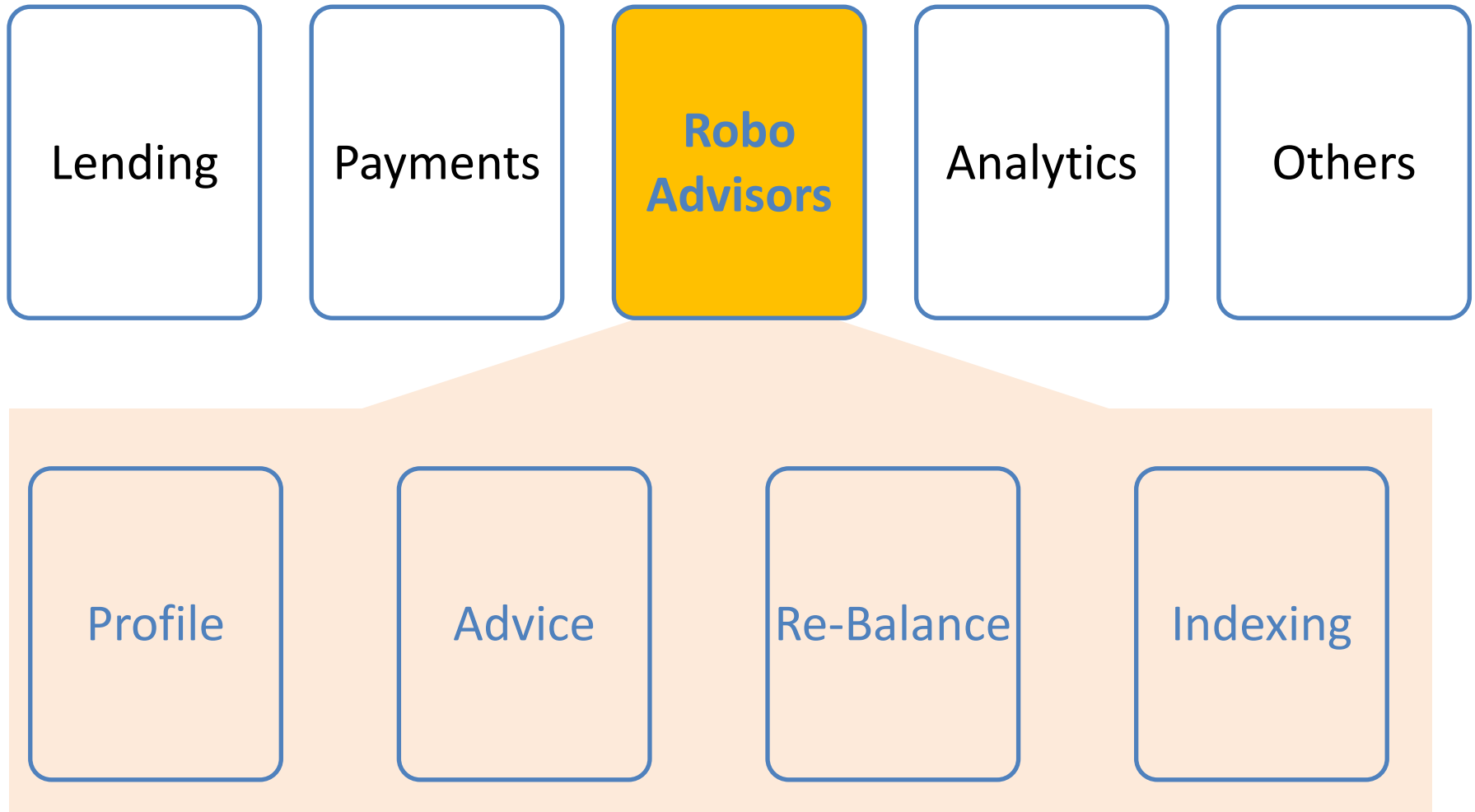
<i>Initiation</i>			<i>Adoption decision</i>			<i>Implementation</i>		
<i>Factors</i>	<i>Round 1</i>	<i>Round 2</i>	<i>Factors</i>	<i>Round 1</i>	<i>Round 2</i>	<i>Factors</i>	<i>Round 1</i>	<i>Round 2</i>
Complexity in the environment	4.5	4.2	Dynamism in the environment	3.6	3.4	Dynamism in the environment	4.0	3.8
Specialization	3.8	3.4	Hostility in the environment	3.9	4.0	Hostility in the environment	3.7	3.4
Horizontal differentiation	2.8	3.1	Centralization	3.8	3.8	Centralization	3.9	3.8
Human resources	4.9	5.0	Human resources	4.0	4.2	Formalization	3.3	3.2
Top managers attitude towards innovation	4.1	4.3	Financial resources	4.1	4.4	Human resources	4.1	4.4
Innovation complexity	3.6	3.3	Top managers attitude towards innovation	3.9	4.0	Financial resources	4.8	5.0
			Relative advantage	4.4	4.1	Top managers attitude towards innovation	4.0	4.4
			Innovation compatibility	3.9	3.6	Innovation compatibility	3.9	3.8
			Innovation complexity	3.8	3.8	Innovation complexity	3.9	3.9
						Innovation trialability	4.1	3.9
						Ease of use	4.0	4.2

Source: Pichlak, Magdalena.

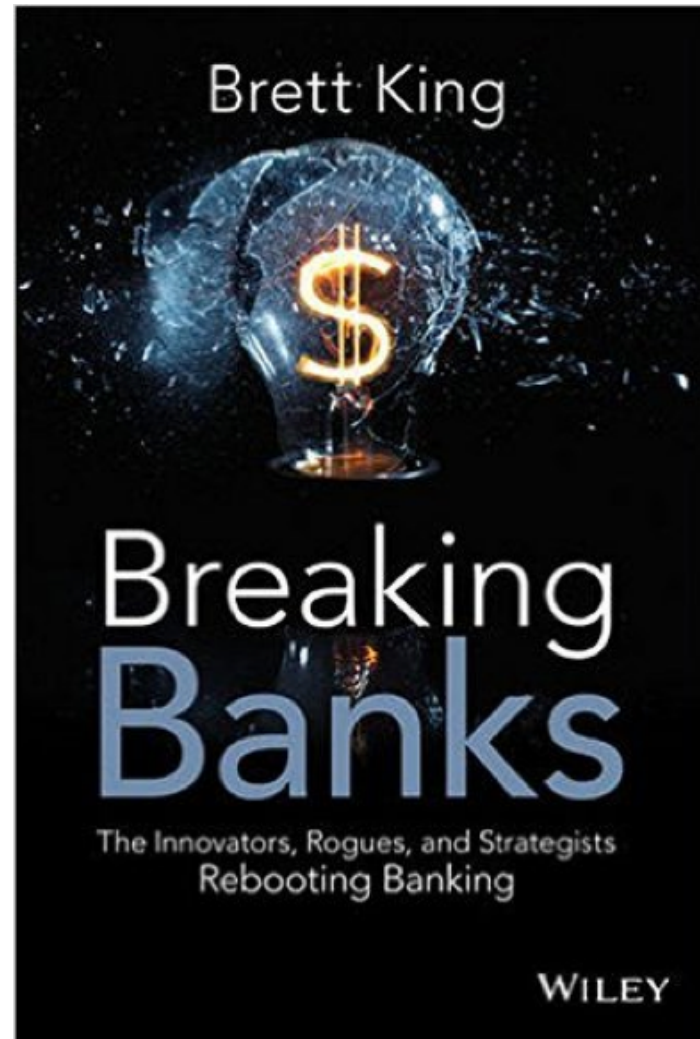
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FinTech Innovation

FinTech high-level classification



Brett King (2014),
Breaking Banks:
The Innovators, Rogues, and Strategists Rebooting Banking
Wiley



**“In the next 10 years,
we'll see more
disruption and changes
to the banking and
financial industry
than we've seen in the
preceding 100 years.”**

(Brett King, 2014)

Fintech: Financial Technology

Disrupting Banking: **The Fintech Startups** **That Are Unbundling** **Wells Fargo, Citi and** **Bank of America**

Fintech: Unbundling the Bank

Unbundling of a Bank



Fintech: Unbundling the Bank

Wealth Management: Wealthfront



Fintech: Financial Technology

Disrupting

European Banking:

The FinTech Startups

That Are Unbundling

HSBC, Santander, and

BNP

Unbundling of a European Bank

The image illustrates the unbundling of a European bank into various fintech services. The central focus is the HSBC Business Banking website, which is surrounded by numerous fintech logos. Arrows indicate the mapping of these services to specific features on the HSBC website.

HSBC Business Banking Website Content:

- Navigation:** Personal, Business, Search, Internet Banking, Log on, Register.
- Service Categories:** Everyday banking (Accounts & services), Borrowing (Loans & mortgages), Investing (Products & analysis), Insurance (Property & family), Planning (for now & the future).
- Main Offerings:**
 - Send money overseas in a few clicks (It's secure, quick and easy. See just how much we could save you. Fees may apply. Payments may also incur agency and/or beneficiary bank fees. Find out more)
 - Find a mortgage
 - Our lowest ever loan rate
 - Save Together offer
 - International money transfer
- Business Banking Section:**
 - Business Banking (Turnover up to £2m)
 - Commercial Banking (Turnover £2m to £30m)
 - Corporate Banking (Turnover in excess of £30m)
 - International Business
 - Online Services
- CBINSIGHTS Section:**
 - Every business has its own story (We create different business bank accounts to suit different needs)
 - Discover products and services for your banking needs:
 - Community account
 - Other accounts
 - Finance & borrowing
 - Credit cards & debit cards
 - Payment services
 - Business insurance policies
 - Business savings & investments
 - Ways to Bank
 - International business
 - Pensions
 - Get in touch: Have a query? There are lots of ways we can help you feel you're making the right choice. Call us on 0800 731 8904. Find a branch and book an appointment. Retrieve application (Retrieve an online application you have already started)

Fintech Logos and Services:

- SavingGlobal**
- borro**
- Bondora**
- zopa**
- LENDING WORKS**
- prêt d'union**
- Lendico**
- fruitful**
- LANDBAY**
- Property Partner**
- wonga**
- Spotcap**
- Funding Circle**
- FINEXKAP**
- fleximize**
- iwoca**
- capiota**
- HOLVI**
- Trade River**
- Ebury**
- Lydia**
- jusp**
- ensygnio**
- payleven**
- ffrees**
- osper**
- CENTRALWAY**
- SQUIRREL**
- nutmeg**
- wikifolio**
- etoro**
- tink**
- CAPITAL**
- Money Dashboard**
- môni**
- transferGo**
- worldremit**
- azimo**
- CurrencyFair**
- Klarna**
- adyen**
- sum up**
- iZettle**
- BILLPAY**
- GOCARDLESS**
- PAYMILL**

Unbundling of a European Bank

The image illustrates the unbundling of a European bank into various fintech services. The central focus is the HSBC website, with yellow arrows pointing from various fintech logos to specific sections of the website.

Logos on the left side: SavingGlobal, borro, Bondora, zopa, LENDING WORKS, prêt d'union, Lendico, fruitful, LANDBAY, Property Partner, wonga.

Logos at the top: ffrees, osper, CENTRALWAY, SQUIRREL, nutmeg, wikifolio, eToro.

Logos on the right side: tink, CAPITAL, Money Dashboard, moni, transferGo, worldremit, azimo, CurrencyFair, Klarna, adyen.

Website Screenshot (Top): HSBC Personal | Business | Search | Internet Banking | Log on | Register > | Everyday banking | Borrowing | Investing | Insurance | Planning

Website Screenshot (Middle): Send money overseas in a few clicks. It's secure, quick and easy. See just how much we could save you. Find out more.

Website Screenshot (Bottom): Find a mortgage | Our lowest ever loan rate | Save Together offer | International money transfer

Logos at the bottom: LendInvest, auxmoney, lendstar, TransferWise, the currency cloud, HSBC United Kingdom | Site map | Contact us | HSBC Group | Business Banking | Commercial Banking | Corporate Banking | International Business | Online Services | CBINSIGHTS | About Business Internet Banking | LOG ON

Text at the bottom: Every business has its own story

Financial Technology (Fintech) Categories

1. Banking Infrastructure
2. Business Lending
3. Consumer and Commercial Banking
4. Consumer Lending
5. Consumer Payments
6. Crowdfunding
7. Equity Financing
8. Financial Research and Data
9. Financial Transaction Security
10. Institutional Investing
11. International Money Transfer
12. Payments Backend and Infrastructure
13. Personal Finance
14. Point of Sale Payments
15. Retail Investing
16. Small and Medium Business Tools

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