AI for Investment Analysis

AI 金融科技: 金融服務創新應用

(AI in FinTech: Financial Services Innovation and Application)

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MBA, IMTKU (M2399) (8409) (Spring 2020)
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副教授

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http://mail.tku.edu.tw/myday/
2020-03-11
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(Course Orientation on AI for Investment Analysis) |
| 2          | 2020/03/11  | AI 金融科技: 金融服務創新應用  
(AI in FinTech: Financial Services Innovation and Application) |
| 3          | 2020/03/18  | 機器人理財顧問與AI交談機器人  
(Robo-Advisors and AI Chatbots) |
| 4          | 2020/03/25  | 投資心理學與行為財務學  
(Investing Psychology and Behavioral Finance) |
| 5          | 2020/04/01  | 財務金融事件研究法  
(Event Studies in Finance) |
| 6          | 2020/04/08  | 人工智慧投資分析個案研究 I  
(Case Study on AI for Investment Analysis I) |
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<th>週次 (Week)</th>
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<tbody>
<tr>
<td>7</td>
<td>2020/04/15</td>
<td>Python AI投資分析基礎 (Foundations of AI Investment Analysis in Python)</td>
</tr>
<tr>
<td>8</td>
<td>2020/04/22</td>
<td>Python Pandas 量化投資分析 (Quantitative Investing with Pandas in Python)</td>
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<tr>
<td>9</td>
<td>2020/04/29</td>
<td>期中報告 (Midterm Project Report)</td>
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<tr>
<td>10</td>
<td>2020/05/06</td>
<td>Python Scikit-Learn 機器學習投資分析 (Machine Learning for Investment Analysis with Scikit-Learn In Python)</td>
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<td>11</td>
<td>2020/05/13</td>
<td>TensorFlow 深度學習投資分析 I (Deep Learning for Investment Analysis with TensorFlow I)</td>
</tr>
<tr>
<td>12</td>
<td>2020/05/20</td>
<td>TensorFlow 深度學習投資分析 II (Deep Learning for Investment Analysis with TensorFlow II)</td>
</tr>
</tbody>
</table>
週次 (Week) 日期 (Date) 內容 (Subject/Topics)
13 2020/05/27 人工智慧投資分析個案研究 II
(Case Study on Artificial Intelligence for Investment Analysis II)
14 2020/06/03 TensorFlow 深度學習投資分析 III
(Deep Learning for Investment Analysis with TensorFlow III)
15 2020/06/10 投資組合最佳化與程式交易
(Portfolio Optimization and Algorithmic Trading)
16 2020/06/17 期末報告 I (Final Project Presentation I)
17 2020/06/24 期末報告 II (Final Project Presentation II)
18 2020/07/01 教師彈性補充教學
AI in FinTech: Financial Services Innovation and Application
Paolo Sironi (2016)

**FinTech Innovation:**
From Robo-Advisors to Goal Based Investing and Gamification,
Wiley

Everett M. Rogers (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)

FinTech
Financial Technology
Financial Technology

FinTech

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

Source: https://www.fintechweekly.com/fintech-definition

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

Source: https://www.jacksonvillebarter.com/
Barter
Money

Bills

Gold Bullion Coin

Source: http://www.wpclipart.com/money/coins/American_buffalo_gold_bullion_coin_front.jpg.html
Gold Bullion Coin

Source: http://www.wpclipart.com/money/coins/American_buffalo_gold_bullion_coin_back.jpg.html
Coin US Penny

Source: http://www.wpclipart.com/money/coins/coin_US_penny_2.png.html
Gold Bricks

Financial Services
Financial Services
Financial Services
Treasure

Source: http://www.wpclipart.com/money/treasure/treasure_chest_3.png.html
Safe

Source: http://www.wpclipart.com/money/safe/steel_safe.png.html
Financial Services
Financial Services

Source: http://www.crackitt.com/7-reasons-why-your-fintech-startup-needs-visual-marketing/
Financial Revolution with Fintech

A financial services revolution
Consumer Trends

1. Simplification
2. Transparency
3. Analytics
4. Reduced Friction

Source: http://www.hedgethink.com/fintech/european-fintech-top-100/
FinTech: Financial Services Innovation

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

Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf
FinTech: Deposits & Lending

Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf
FinTech: Capital Raising

Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf
FinTech: Investment Management

Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf
FinTech: Market Provisioning

Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf
The Economics of Money, Banking and Financial Markets


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?

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
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

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

**Indirect Finance**

- **Funds**
  - **Lender-Savers**
    1. Households
    2. Business firms
    3. Government
    4. Foreigners
  - **Borrower-Senders**
    1. Business firms
    2. Government
    3. Households
    4. Foreigners

**Direct Finance**

- **Funds**
  - **Financial Intermediaries**
  - **Financial Markets**

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.

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

Interest rate, \( i \)

Output (Income), \( Y \)

Demand

D

Price ($p$)

Quantity ($q$)

$P^*$

$Q^*$

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

Output (Income), $Y$

Interest rate, $i$

Supply and Demand

Quantity ($q$) vs Price ($p$)

Equilibrium:
- Price ($P^*$)
- Quantity ($Q^*$)

Demand ($D$)
Supply ($S$)

Artificial Intelligence and Deep Learning for Fintech
From Algorithmic Trading to Personal Finance Bots: 41 Startups Bringing AI to Fintech

Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/
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
- AYASDI
- KENSHEC
- DataRobot
- Nervana Systems
- turi
- Sentient Technologies
- Alpaca
- Clay Algo
- Numenta
- Clasys

Market Research & Sentiment Analysis
- indico
- acuity
- Lucena Quantitative Analytics
- Numerai
- Dataminr
- TypeScore
- ADF

Search Engine
- alphasense

Quantitative Trading
- H2O
- SIIC
- Penny
- SURE.

AI Assistants/Bots
- Clone Algo
- TRIM
- Insurify
- Cleo
- FinGenius

Blockchain
- Skry
- EUKlid
- Crem Finance

Debt Collection
- Feedzai
- TrueAccord

Credit Scoring
- Kasist
- Wecash

Fraud Detection
- Biocatch

Personal Banking
- Personetics
- SBDA Group

Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/
Artificial Intelligence (AI) in Fintech

General Purpose/ Predictive Analytics

AYASDI  Digital Reasoning  context relevant  H₂O
KENSHE  Cortical.io  Numenta  turi
DataRobot  nervana systems

Market Research & Sentiment Analysis

Indico  Acuity Trading  Lucena Quantitative Analytics  Numerai
Dataminr

Search Engine

Alphasense

Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/
Artificial Intelligence (AI) in Fintech

Quantitative Trading
- sentient technologies
- CLONE ALGO
- Walnut Algorithms
- Alpaca

AI Assistants/Bots
- KASISTA
- TRIM
- Penny
- INSURIFY
- SURE.

Credit Scoring
- TypeScore
- aire
- creditvidya
- zestfinance
- ADF
- Applied Data Finance
- Wecash

Personal Banking
- personetics
- SBDA group

Blockchain
- Skry
- EUKLID

Debt Collection
- TrueAccord

Fraud Detection
- feedzai
- Biocatch
- Less Friction. Less Fraud.

Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/
Wealthfront Robo Advisor

Source: https://www.wealthfront.com/
Financial Services
Technology
Innovation
Innovation
Innovation: a new idea, method, or device

Source: https://www.merriam-webster.com/dictionary/innovation
Innovation: something new

Source: https://www.merriam-webster.com/dictionary/innovation
Novelty:

something new or unusual

the novelty of a self-driving car

Source: https://www.merriam-webster.com/dictionary/novelty
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

Innovation Research in Economics, Sociology and Technology Management

Innovation Research in Economics, Sociology and Technology Management

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

Business, Innovation, and Knowledge Ecosystems

Business, Innovation, and Knowledge Ecosystems

Innovation Ecosystems
integrate exploration (knowledge) and exploitation (business) ecosystems

Knowledge Ecosystems
focus on generating new knowledge and technologies

Business Ecosystems
focus on creating customer value

Focal Company or Platform

## Innovation Ecosystems

### Characteristics

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

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

Initiation  Adoption Decision  Implementation

Innovation Adoption Process

Initiation → Adoption Decision → Implementation

- Environmental Characteristics
- Organizational Characteristics
- Top Managers Characteristics
- Innovation Characteristics
- User Acceptance Attributes

RBV = Resource-Based View
DOI = Diffusion of Innovation Theory
TAM = Technology Acceptance Model

Innovation Adoption Process

Innovation Adoption Process

1. **Initiation**
   - Recognition of a need
   - Knowledge acquisition
   - Initial attitude formation
   - Innovation selection

2. **Adoption Decision**
   - Adoption decision
   - Strategic, financial and technological evaluation

3. **Implementation**
   - Innovation modification
   - Trials for confirmation
   - User acceptance
   - General use of innovation

**Environmental Characteristics**
- Dynamism
- Hostility
- Complexity

**Organizational Characteristics**
- Specialization
- Horizontal differentiation
- Vertical differentiation
- Centralization
- Formalization
- Human resources
- Financial resources

**RBV** = Resource-Based View

**Top Managers Characteristics**
- Attitudes toward innovation
- Demographic characteristics

**DOI** = Diffusion of Innovation Theory

**Innovation Characteristics**
- Relative advantage
- Compatibility
- Complexity
- Trialability
- Observability

**TAM** = Technology Acceptance Model
- Usefulness
- Ease of use

**Source:** Pichlak, Magdalena.
# Innovation Adoption Process

<table>
<thead>
<tr>
<th>Factors</th>
<th>Initiation</th>
<th>Adoption decision</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Me</td>
<td>Q3</td>
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<tr>
<td>Environmental characteristics</td>
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<tr>
<td>Dynamism</td>
<td>3.4</td>
<td>3</td>
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<tr>
<td>Hostility</td>
<td>3.3</td>
<td>3</td>
<td>4.25</td>
</tr>
<tr>
<td>Complexity</td>
<td>4.5</td>
<td>5</td>
<td>5</td>
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<tr>
<td>Organizational characteristics</td>
<td></td>
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<tr>
<td>Specialization</td>
<td>3.8</td>
<td>4</td>
<td>4.25</td>
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<tr>
<td>Horizontal differentiation</td>
<td>2.8</td>
<td>3</td>
<td>3.75</td>
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<tr>
<td>Vertical differentiation</td>
<td>2.1</td>
<td>2</td>
<td>3.25</td>
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<tr>
<td>Centralization</td>
<td>2</td>
<td>2</td>
<td>3.25</td>
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<tr>
<td>Formalization</td>
<td>2.1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>Human resources</td>
<td>4.9</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Financial resources</td>
<td>3.2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Top managers characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top managers attitude towards innovation</td>
<td>4.1</td>
<td>4</td>
<td>4.5</td>
</tr>
<tr>
<td>Top managers demographic characteristics</td>
<td>2.3</td>
<td>2</td>
<td>3.25</td>
</tr>
<tr>
<td>Innovation characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative advantage</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Compatibility</td>
<td>2.8</td>
<td>3</td>
<td>3.5</td>
</tr>
<tr>
<td>Complexity</td>
<td>3.6</td>
<td>4</td>
<td>4.25</td>
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<tr>
<td>Trialability</td>
<td>3.2</td>
<td>3</td>
<td>4</td>
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<tr>
<td>Observability</td>
<td>3.4</td>
<td>3.5</td>
<td>4.25</td>
</tr>
<tr>
<td>User acceptance attributes</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Usefulness</td>
<td>3.2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Ease of use</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

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

# Innovation Adoption Process

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Round 1</th>
<th>Round 2</th>
<th>Adoption decision</th>
<th>Round 1</th>
<th>Round 2</th>
<th>Implementation</th>
<th>Round 1</th>
<th>Round 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity in the environment</td>
<td>4.5</td>
<td>4.2</td>
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<td>Financial resources</td>
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<td>Top managers attitude towards innovation</td>
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<td>Relative advantage</td>
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<td>Innovation compatibility</td>
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FinTech Innovation

FinTech high-level classification

Lending  Payments  Robo Advisors  Analytics  Others

Profile  Advice  Re-Balance  Indexing

Brett King (2014),

**Breaking Banks: The Innovators, Rogues, and Strategists Rebooting Banking**

*Wiley*

Source: https://www.amazon.com/Breaking-Banks-Innovators-Strategists-Rebooting/dp/1118900146
“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)

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

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

Source: https://www.cbinsights.com/blog/industry-market-map-landscape/
Fintech: Unbundling the Bank

Source: https://www.cbinsights.com/blog/disrupting-banking-fintech-startups-2016/
Fintech: Unbundling the Bank

Wealth Management: Wealthfront
Fintech: Financial Technology

Disrupting European Banking: The FinTech Startups That Are Unbundling HSBC, Santander, and BNP

Source: https://www.cbinsights.com/blog/industry-market-map-landscape/
Unbundling of a European Bank

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 be subject to agency and/or beneficiary bank fees.

Find out more

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

Source: http://www.venturescanner.com/financial-technology
References

• Brett King (2012), “Bank 3.0: Why banking is no longer somewhere you go, but something you do”, John Wiley & Sons