

# Measuring Financial Innovation and its Impact



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# MEASURING FINANCIAL INNOVATION AND ITS IMPACT: A REVIEW OF METHODS AND EMPIRICAL STUDIES

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## Executive Summary

Financial innovation has become a central driver of transformation in the financial services industry, propelled by rapid technological advancements such as fintech, mobile banking, digital payments, artificial intelligence, and open finance. While these innovations enhance efficiency, expand financial inclusion, and improve service delivery, they also introduce new risks, including financial fragility, cybersecurity threats, and regulatory challenges. Against this backdrop, there is a growing need for robust frameworks to measure the performance and impact of financial innovation.

This paper reviews the concept, drivers, and evolving landscape of financial innovation, highlighting both its benefits and potential drawbacks. It synthesises existing approaches used by central banks, academics, and industry practitioners to measure innovation inputs, processes, and outcomes, including indicators of firm-level innovativeness, financial performance, and user impact. In addition, the paper evaluates empirical evidence on the effects of financial innovation on bank stability, profitability, and customer welfare, with particular attention to emerging trends such as digital banking, neobanks, alternative finance, and digital payment systems.

By integrating theoretical perspectives with empirical findings, the study provides a comprehensive framework for assessing financial innovation and its implications for financial systems and end users. It also proposes a structured approach for financial regulators to monitor, evaluate, and report on innovation performance, supporting informed policy decisions that balance innovation with financial stability and consumer protection.

**Keywords:** financial innovation, FinTech, measurement, financial inclusion, performance, financial stability.

## 1. Introduction

Innovation has long been recognised as a pivotal driver of productivity and economic performance across various sectors, with the financial services industry being a prominent example. Financial innovation plays a crucial role in the evolution and transformation of financial systems, contributing significantly to economic growth and stability<sup>1,2</sup>. According to the World Economic Forum, innovation in finance, much like in other industries, is a fundamental source of long-term economic growth and improved living standards<sup>3</sup>. It enables the financial industry to adapt and respond to society's ever-changing needs, driven by social and technological advancements. Historical examples, such as annuities providing financial security for retirees, foreign exchange swaps facilitating risk management in globalised markets, and securitisation expanding credit access, underscore the transformative power of financial innovation. More recently, fintech-driven innovations—such as mobile banking, digital payment platforms, open banking systems, blockchain-based financial services, and artificial intelligence-enabled financial products—have emerged as powerful tools for expanding financial access, improving efficiency, and delivering financial services to previously underserved populations without the need for costly physical infrastructure<sup>4,5,6</sup>.

Given the undeniable significance of financial innovation, there is an increasing imperative for financial regulators and institutions worldwide to measure its performance and assess its multifaceted impact. Measuring innovation capabilities and outcomes, while challenging, offers substantial benefits. Firstly, it empowers financial institutions to comprehend their current innovation landscape, identify strengths, and pinpoint areas for strategic focus to maximize innovation success<sup>7</sup>. Secondly, it allows financial regulators to evaluate the propensity of financial firms to engage in product and process innovation, and to understand the factors that foster or impede successful innovation. This enables comparisons across firms and sectors regarding their innovative activity<sup>8</sup>. Thirdly, it assists regulators in achieving key policy objectives, such as fostering competition and reducing the cost of financial services, as financial innovation can narrow interest rate margins and stimulate broader economic growth<sup>9</sup>. Fourthly, policymakers can identify and mitigate barriers that stifle creativity and innovation. Fifthly, assessing process and product innovation helps gauge user satisfaction among customers, investors, and other market participants. Lastly, it facilitates the development of firm-level innovativeness indices for industry-wide benchmarking and promotes a culture of innovation within organizations<sup>10</sup>.

This article provides an updated and expanded review of the methods for measuring and reporting financial innovation and its impact. It examines the evolving features and dimensions of financial innovation, including its types, drivers, and potential pitfalls. It then delves into methods for measuring innovation inputs and outputs, and for analysing the likelihood and success of financial innovation. A significant portion is dedicated to exploring the impact of financial innovation on bank performance as well as on users of financial services. Finally, it offers a contemporary structure for financial innovation performance reports tailored for financial regulatory agencies.

## 2. Features and Dimensions of Financial Innovation

### 2.1. What is Financial Innovation?

Broadly defined, financial innovation refers to the creation, adoption, and diffusion of new financial instruments, technologies, institutions, and markets that improve the efficiency and accessibility of financial services<sup>11</sup>. Early research by Peter Tufano classified financial innovation into two main categories: **product innovation** and **process innovation**<sup>12</sup>.

**Product innovation** refers to the development of new financial instruments or services. Historically, this included instruments such as derivatives and securitised products. More recently, product innovation has expanded to include fintech-enabled services such as digital wallets, peer-to-peer lending platforms, robo-advisory services, insurtech and crypto-assets<sup>13</sup>.

**Process innovation** refers to improvements in the methods used to deliver financial services. Traditional examples include securitization, credit scoring techniques, new financial reporting standards (e.g., XBRL), and electronic payment technologies such as ATMs, internet banking, debit and credit cards, and electronic money. In the modern fintech era, process innovation increasingly involves digital technologies such as artificial intelligence-based credit assessment, cloud computing, application programming interfaces (APIs) supporting open banking, distributed ledger technology, and real-time digital payment systems<sup>14</sup>.

In addition to product and process innovation, financial institutions may also adopt **organisational innovation**, which involves changes in internal structures, management practices, or external partnerships to improve efficiency and support innovation. Examples include the creation of digital banking units, partnerships with fintech firms, and participation in regulatory sandboxes designed to encourage financial innovation while maintaining regulatory oversight.

Successful innovators, as Peat (2009) observed, leverage new environments to outpace competitors<sup>15</sup>. For financial innovation to be truly successful, it must create superior investment conditions for market participants (customers and investors) and lead to a more satisfactory achievement of financial objectives compared to traditional approaches<sup>16</sup>. Financial institutions pursue innovation for several strategic benefits: enhanced risk-sharing opportunities, regulatory and tax avoidance, reduced transaction costs, increased liquidity, lower agency costs, the capture of temporary profits, and price adjustments<sup>17</sup>.

Unlike industrial innovations, financial innovations often build upon existing institutions or instruments rather than introducing entirely new concepts. Modern financial products frequently emerge from modifying existing features or adding new ones<sup>18</sup>. Tarczyński and Zwolankowski (1999) highlighted key properties of financial market product and instrument innovation, including flexibility (e.g., secondary markets, adjustable-rate instruments), protection against market parameter variability (e.g., futures, OTC options), and the combination of diverse instruments (e.g., exotic options)<sup>19</sup>.

### 2.2. What Drives Financial Innovation?

Financial innovation does not occur randomly; rather, it is influenced by a variety of **supply-side and demand-side factors** that encourage financial institutions and markets to develop new products, technologies, and services. Research highlights several key drivers of financial innovation, including technological advances, regulation, market dynamics, macroeconomic

conditions, demographics, and the cumulative nature of innovation itself<sup>20,21</sup>. These drivers interact with each other and collectively shape the pace and direction of financial innovation.

One of the most significant drivers of financial innovation is **technological advancement**. Improvements in information and communication technologies have enabled financial institutions to design new products and improve the delivery of financial services<sup>22,23</sup>. For example, the development of automated teller machines (ATMs) in the late 1960s transformed retail banking by allowing customers to access cash outside traditional banking hours<sup>24</sup>. Subsequent technological developments have led to innovations such as internet banking, mobile payments, high-frequency trading, and digital financial platforms. Advances in data processing and analytics have also enabled the development of credit scoring models, which allow lenders to evaluate borrower risk more efficiently and expand lending to geographically distant customers. Technology has also reshaped the competitive landscape by enabling non-bank firms to offer services traditionally provided by banks through digital platforms and online marketplaces<sup>25,26</sup>. In recent years, technologies such as artificial intelligence, big data analytics, and distributed ledger technology have further accelerated financial innovation and financial service delivery by improving risk management, transaction processing, competition and financial inclusion<sup>27,28,29</sup>.

Another important driver of financial innovation is **regulation**. Financial regulations often influence innovation by either creating incentives for new financial products or encouraging institutions to find ways to reduce regulatory costs. In some cases, innovation emerges as a response to regulatory constraints, a phenomenon sometimes referred to as regulatory arbitrage. For example, money market mutual funds were developed partly as a response to regulatory limits on interest rates that banks could pay on deposits under Regulation Q in the United States. By offering market-based returns through investments in short-term securities, these funds allowed investors to circumvent interest rate ceilings<sup>30</sup>. Similarly, new financial instruments such as collateralised commercial paper and callable commercial paper have been developed to address regulatory requirements related to liquidity and funding structures<sup>31</sup>. While regulatory-driven innovation can increase efficiency and competition, it can also raise concerns about financial stability if institutions use innovation to bypass prudential safeguards.

**Macroeconomic and financial market conditions** also play a crucial role in driving financial innovation. Changes in economic conditions often create new financial needs or opportunities that lead to innovative financial solutions. For instance, following the collapse of the housing market during the global financial crisis, financial institutions began securitizing rental income streams from real estate assets they had acquired, illustrating how unusual economic circumstances can stimulate financial innovation<sup>32</sup>. Similarly, periods of low interest rates or changes in capital market conditions can encourage the development of new financial instruments designed to meet investor demand.

Another key driver is the **cumulative or evolutionary nature of innovation**, sometimes referred to as an “innovation spiral.” According to Schindler (2017), financial innovations often build upon previous innovations, meaning that one development can create the foundation for subsequent innovations. For example, the creation of credit default swaps eventually enabled the development of more complex products such as collateralised debt obligations and synthetic derivatives. This sequential process highlights how financial innovation tends to expand as financial markets become more sophisticated<sup>33</sup>.

Finally, **demand-side factors**, including demographics and consumer preferences, also influence financial innovation. Younger generations, who are more comfortable with digital technologies, have been major drivers of the adoption of mobile banking, digital payments, and other fintech services<sup>34</sup>. Financial institutions respond to these changing preferences by developing new digital products and services that meet the needs of technologically savvy consumers.

In summary, financial innovation is driven by a combination of technological progress, regulatory frameworks, macroeconomic conditions, cumulative innovation processes, and evolving consumer demands. These factors interact to shape the development and diffusion of new financial products and services across financial systems.

### 2.3. The Pitfalls of Financial Innovation

Despite its numerous advantages, financial innovation carries inherent risks and has, at times, been associated with significant economic instability. The global financial crisis that began in 2007 starkly highlighted the dangers of excessive risk-taking linked to complex and opaque innovative products, such as intricately structured securitised assets and derivatives based on risky mortgages<sup>35</sup>. These products were often poorly designed by financial institutions and inadequately understood by investors, leading to severe economic consequences. Critics argue that an excessive growth of the financial economy can be detrimental to the real economy<sup>36,37</sup>.

Innovation, therefore, presents a double-edged sword: the right kind of innovation, coupled with favourable conditions, can spur investment in new technologies, enabling the financial system to fulfil its functions and drive economic growth. Conversely, poorly managed or excessive innovation can have severe repercussions for the broader economy<sup>38</sup>. While the financial crisis underscored the harmful potential of certain innovations, it is crucial to recognise that many innovative financial products, business models, processes, and technologies have been invaluable and necessary for the financial sector to keep pace with evolving social and economic trends<sup>39</sup>. The World Economic Forum advocates for understanding and preserving the benefits of innovation while mitigating attributes that could prove harmful<sup>40</sup>.

In the current FinTech era, new pitfalls have emerged. The rapid pace of technological change can outstrip regulatory capacity, leading to regulatory arbitrage and systemic risks from novel, untested financial products and services. Cybersecurity risks are amplified with increased digitalisation, and data privacy concerns are paramount. The concentration of power in a few large technology firms, the potential for algorithmic bias in lending and investment decisions, and the speculative nature of certain digital assets (e.g., some cryptocurrencies) also represent significant challenges that require careful monitoring and robust regulatory responses.

## 3. Measuring Financial Innovation Components

Innovation involves the transformation of inputs into new products, processes, or services. In the financial sector, innovation is particularly complex because it combines technological capabilities, organizational knowledge, and market needs to produce new financial solutions. Innovation typically involves a combination of resources, capabilities, and knowledge that are mobilized to produce new outputs or improvements to existing services<sup>41</sup>. Measuring financial innovation therefore requires identifying both the **inputs** that

enable innovation and the **outputs** that result from innovative activity. This section reviews commonly used indicators for measuring financial innovation inputs and outputs in financial institutions.

### 3.1. Financial Innovation Inputs

Financial innovation inputs refer to the resources and assets used in the innovation process. These inputs may be tangible, such as technology infrastructure and financial investments, or intangible, such as knowledge, human expertise, and organisational capabilities<sup>42</sup>. Tangible inputs involve physical assets or expenditures with measurable costs, while intangible inputs, often described as knowledge or intellectual assets, represent accumulated expertise and information that support innovation activities. Knowledge is particularly important because innovation depends on the application of technical expertise, market understanding, and technological capabilities to develop new financial solutions.

Several indicators are commonly used to measure innovation inputs in the financial sector. One key measure is **financial R&D intensity**, typically calculated as research and development expenditure relative to total operating costs. Investment in R&D supports the development of new financial products, services, and processes. Although banks historically spend less on formal R&D than manufacturing firms, increasing investments in financial technology and digital platforms have made R&D a more relevant indicator of innovation capacity<sup>43,44</sup>.

Another important input is **human capital**, referring to the skills and expertise of employees involved in innovation activities. Highly trained professionals, particularly information technology specialists, data scientists, and financial engineers, play a critical role in developing new financial services and improving risk management systems. Human capital can be measured by indicators such as the share of technical staff in total employment or staff training expenditure as a proportion of operating costs<sup>45</sup>.

**Information technology (IT) capital** is also a key driver of financial innovation. Advances in information systems enable financial institutions to collect, process, and analyse large volumes of data required for credit assessment, financial modelling, and transaction processing. Technological innovations in banking have evolved from automated teller machines (ATMs) and electronic payments to more advanced technologies such as cloud computing, big data analytics, and artificial intelligence<sup>46</sup>. IT capital can therefore be measured using IT expenditure relative to total operating costs.

Because these inputs are complementary, researchers often use a **composite innovation input measure** combining R&D expenditure, IT investment, and human capital development. This provides a broader indicator of the resources devoted to innovation activities.

However, measuring innovation inputs in financial services remains challenging. Banks are often not the sole developers of financial innovations and frequently adopt technologies developed by external partners such as fintech firms or software providers<sup>47</sup>. In addition, innovation in banking tends to occur incrementally across various business units rather than through formal R&D departments. As a result, traditional R&D indicators may not fully capture the innovation process in financial institutions<sup>48</sup>.

### 3.2. Financial Innovation Outputs

Financial innovation outputs refer to the results or outcomes of innovative activities. These outputs may include new financial products, improved service delivery channels, technological platforms, or changes in organizational processes. Common indicators used to measure innovation outputs include the number of new products and processes introduced, the number of patents related to financial services, scientific publications, growth in workforce expertise, and qualitative changes in organizational structures or business models<sup>49</sup>.

Knowledge creation is also an important output of innovation. Every new product, service, or process reflects the knowledge accumulated by the organization regarding technologies, markets, and consumer needs. Innovation outputs therefore represent both tangible outcomes, such as digital banking platforms, and intangible outcomes, such as improved expertise in financial risk modelling or data analytics.

In the financial services industry, many innovation outputs are driven by digital technologies and electronic finance (e-finance). These innovations can be categorized according to the different business segments of the financial sector.

In **retail banking**, innovations include internet banking platforms, automated teller machines, mobile banking applications, online payment systems, and agent banking networks. These technologies have expanded access to financial services and improved the convenience and efficiency of banking operations.

In **investment banking and capital markets**, innovation outputs include online securities trading platforms, electronic exchanges, and digital investment management tools. These technologies have improved market efficiency by enabling faster execution of trades and providing investors with broader access to financial markets.

The **insurance sector** has also experienced significant technological innovation. Examples include online quotation systems, digital claim management platforms, and automated underwriting systems that streamline insurance services and improve customer experience.

In **SME and consumer lending**, innovations include credit scoring systems, psychometric assessment tools, and peer-to-peer lending platforms that expand access to credit for borrowers who may lack traditional credit histories. These technologies rely heavily on data analytics and alternative data sources to evaluate credit risk.

Finally, innovations in **financial information services** include electronic bank statements, digital alerts, online accounting services, payroll processing systems, and personal financial management tools. These services enhance transparency, improve financial management for individuals and businesses, and support the broader digitalization of financial services.

Despite these measurable outputs, innovation outcomes remain inherently uncertain and difficult to predict. Innovation processes are complex, nonlinear, and influenced by changing technological and market conditions. While inputs such as financial investment, human capital, and technology can be identified relatively easily, the resulting outputs may vary widely depending on organisational capabilities, market demand, and external opportunities<sup>50</sup>. In many cases, innovation also involves experimentation and trial-and-error processes, meaning that not all innovation inputs result in successful outputs.

In summary, measuring financial innovation requires a multidimensional approach that captures both the resources devoted to innovation and the outcomes generated by those resources. By analysing indicators related to innovation inputs and outputs, policymakers and financial institutions can better assess innovation performance and understand how technological and organizational capabilities contribute to the evolution of financial services.

## 4. Analysing Financial Innovation Activity

Analysing financial innovation requires systematic collection and evaluation of data on innovative activities within financial institutions. Because innovation in financial services often occurs incrementally and across multiple functions, researchers and regulators typically rely on several complementary data sources. These include financial innovation surveys, bank annual reports, media reports, and digital information sources such as bank websites. Together, these sources provide both quantitative and qualitative evidence on the nature, extent, and determinants of financial innovation.

### 4.1. Sources of Innovation Performance Data

#### 4.1.1 Financial Innovation Surveys

Innovation surveys are among the most reliable tools for gathering structured information on innovation activities. Large-scale surveys, such as the UK Innovation Survey and the OECD-wide Community Innovation Survey (CIS), are conducted periodically to monitor innovation performance across industries, including financial services<sup>51</sup>. Similar survey approaches can be applied specifically to financial institutions, including banks, insurance companies, pension funds, asset managers, and securities firms, to evaluate innovation performance within the financial sector.

A financial innovation survey typically collects information on several dimensions of innovation activity. These include whether institutions have introduced product or process innovations, the resources devoted to innovation (such as R&D or technology investment), the factors that encourage or hinder innovation, and the extent of collaboration with external partners. Surveys may also gather information on sources of knowledge used in innovation activities and the impact of innovation on firm performance, operational efficiency, or financial inclusion. Because surveys collect standardized responses from multiple firms, they allow researchers and regulators to compare innovation behaviour across institutions and over time.

In recent years, surveys have also begun to incorporate questions related to digital innovation, fintech adoption, and data analytics capabilities, reflecting the growing importance of technological change in financial services<sup>52</sup>.

#### 4.1.2. Bank Annual Reports

Another important source of innovation data is **bank annual reports**, which provide detailed information about a bank's strategy, operations, and technological developments. Annual reports are the primary official documents through which firms communicate with investors, regulators, and other stakeholders. Improvements in disclosure requirements and financial reporting standards have significantly increased the amount of information available on banks' strategic initiatives, including innovation activities. Arnaboldi and Rossignoli (2015) propose a methodology for measuring financial innovation using information extracted from bank annual reports. Their study analysed more than 450 annual reports from 81 banks listed

on major international stock exchanges—including the New York Stock Exchange, the London Stock Exchange, Borsa Italiana, and Euronext—between 2005 and 2008. By systematically examining descriptions of new initiatives and strategic developments, they were able to convert qualitative information into a quantitative dataset on banking innovation.

The primary technique used to analyse annual reports is **content analysis**, defined as a systematic and replicable method for compressing large volumes of text into structured categories based on explicit coding rules<sup>53</sup>. Through this method, qualitative statements in reports can be categorised and analysed statistically.

Innovation activities identified through content analysis are typically classified into several categories:

- **Group organisational model:** Changes in the structure of banking groups, such as acquisitions of new financial service companies or the establishment of new subsidiaries to enter new markets.
- **Organisational structure:** Internal restructuring of management systems or business units that alters how the institution operates.
- **Operating systems:** Improvements in internal processes, operational systems, or control frameworks that enhance efficiency or service delivery.
- **Information and communication technology (ICT):** Technological innovations such as new digital platforms, automated customer interfaces, or advanced data systems.
- **Delivery channels:** Introduction of new service channels, including online banking, mobile applications, or digital customer platforms.
- **Product innovation:** Launch of new financial products or services, such as new mortgage products, savings instruments, or digital payment solutions.

This approach enables researchers to systematically track innovation activities across institutions and evaluate how strategic initiatives evolve over time.

#### 4.1.3 Financial Press, Bank Websites and Other Sources

Additional information on financial innovation can be obtained from **financial media, bank websites, and other publicly available sources**. Studies such as Lerner (2006) have constructed measures of financial innovation using reports published in major financial newspapers and magazines, including the *Financial Times*, *Wall Street Journal*, *Bloomberg Businessweek*, and *The Economist*<sup>54</sup>. These sources frequently report the introduction of new financial products, technological platforms, and institutional developments. However, reliance on media sources has limitations. Some innovations, particularly those involving internal processes or operational improvements, may not receive media coverage because they have limited public visibility. Consequently, media-based measures may capture only the most prominent innovations.

Bank websites and digital communication platforms have become increasingly important sources of innovation data. Financial institutions often announce new products, service enhancements, or digital initiatives through their websites, mobile applications, and investor communications. With the growth of digital banking and fintech ecosystems, these sources now provide valuable real-time information about innovation activities within financial institutions<sup>55</sup>.

## 4.2 Determinants of Financial Innovation

Beyond documenting innovation activities, researchers often seek to identify the **determinants of financial innovation**. Using survey data from over 1,100 British financial firms, Heffernan, Fu and Fu (2013) identified several factors that influence the likelihood that financial institutions engage in innovation<sup>56</sup>. One key determinant is **firm size**, which reflects the capacity to absorb the fixed costs associated with research, technology investment, and product development. Larger institutions may benefit from economies of scale and scope when introducing new financial services. Another factor is **firm age**, which captures the role of accumulated experience and “learning by doing.” Older institutions may possess greater institutional knowledge and customer relationships that support innovation.

Innovation is also influenced by the availability of **innovation inputs**, including R&D investment, human capital, and technological infrastructure. Institutions with stronger technical capabilities and skilled workforces are generally better positioned to develop innovative financial products and services. **Collaboration and cooperation** with external partners also play an important role. Financial innovation often emerges from partnerships with technology providers, fintech firms, customers, and other financial institutions, enabling knowledge transfer and shared development of new technologies<sup>57</sup>. Another important determinant is **appropriability**, which refers to the ability of firms to protect innovations from imitation. Because many financial innovations are difficult to patent or protect legally, knowledge spillovers across institutions can both stimulate and hinder innovation<sup>58</sup>.

Finally, innovation may be influenced by **financial constraints and regulatory conditions**. The availability of internal capital, profitability, and access to external finance can affect an institution’s willingness to invest in innovation. At the same time, financial regulation may either constrain or stimulate innovation depending on the regulatory environment and the level of market competition.

Following the empirical framework developed by Heffernan et al. (2013), the **Binary Logit Model** can be used to estimate the determinants of a firm’s probability of engaging in financial innovation. This approach is widely applied in innovation studies where the outcome of interest—whether a firm innovates or not—is represented by a binary variable. The model estimates the likelihood that a financial institution undertakes innovation as a function of firm-specific and sectoral characteristics.

Formally, the probability that firm  $i$  engages in financial innovation can be expressed as:

$$FI_i = \alpha + \beta X_i + \varepsilon_i \quad (1)$$

Where:

- $FI_i$  represents financial innovation and is defined as a **binary variable** equal to 1 if financial institution  $i$  reports that it has introduced an innovation, and 0 otherwise;
- $\alpha$  is the constant term;
- $X_i$  is a vector of explanatory variables capturing firm- and sector-specific characteristics that influence the probability of innovation, including measures of innovation inputs, firm size, collaboration, and financial constraints;
- $\varepsilon_i$  is the error term.

This specification can also be applied to examine the determinants of different types of financial innovation, particularly product innovation (PI) and process innovation (PSI). Product innovation refers to the introduction of new or significantly improved financial products or services, while process innovation involves the implementation of new or improved methods for delivering financial services, such as digital platforms, automated risk assessment tools, or new payment technologies. Organisational or managerial changes are typically excluded from this definition to maintain consistency with the standard innovation taxonomy proposed in the innovation literature<sup>59,60</sup>.

The estimated coefficients from the logit model can be used to construct an **innovation index** that measures the relative innovation performance of firms in the sample. This index transforms predicted probabilities of innovation into a standardized score:

$$Innovation\ Index_i = f(\hat{\beta}X_i) \quad (2)$$

The index is typically expressed as a **percentage ranging from 0 to 100**, where higher values indicate a greater likelihood that a firm engages in innovation relative to other firms in the dataset. Such indices allow regulators and researchers to benchmark innovation performance across institutions and track changes over time.

Empirical evidence suggests that several firm characteristics significantly influence the probability of financial innovation. Heffernan, Fu and Fu (2013) find that larger financial institutions are more likely to innovate, reflecting their ability to absorb the fixed costs associated with research, technology investment, and product development. Innovation is also positively associated with employee education levels, research and development (R&D) expenditure, access to financial resources, and collaboration with external partners. Similar findings have been reported in more recent studies, which emphasize the growing importance of technological capabilities, fintech partnerships, and data analytics infrastructure in driving financial innovation<sup>61</sup>.

## 5. Analysing Financial Innovation Impact

Financial innovations are strategic tools for banks to gain competitive advantage and improve performance<sup>62</sup>. Continuous innovation is essential for sustained success. This section examines methods for estimating the impact of financial innovation on sales, bank performance, efficiency, and fragility. It also assesses the effects of financial innovation on users of financial services, including on service quality, efficiency and financial inclusion.

### 5.1. Measuring Financial Innovation Success (Innovation Sales)

The success of financial innovation, as in any other innovation activity, is often first observed in the financial institution's topline performance. While the logit model presented in section 4 can estimate the likelihood that firms engage in innovation, a separate econometric approach is needed to assess the **success of innovation outcomes**. Heffernan et al. (2013) propose the use of the **innovation sales ratio** as a measure of innovation success. The innovation sales ratio represents the proportion of a firm's total revenue that is generated from new or significantly improved products or services. This metric highlights the firm's commercial success in turning R&D and innovative ideas into market-ready, revenue-generating solutions.

Because this variable is bounded and often contains a large number of zero observations (firms with no innovation-related sales), the **Generalized Two-Stage Tobit Model** is commonly used. The Tobit model is appropriate for situations where the dependent variable is censored or limited in range.

*First Stage: Probability of Successful Innovation*

In the first stage, the model estimates the probability that a firm successfully commercializes an innovation:

$$SI_j = \alpha + \beta Z_j + \varepsilon_j \quad (3)$$

where:

- $SI_j$  is a binary variable representing **successful innovation** for firm  $j$ , equal to 1 if the firm reports positive sales from innovative products or services and 0 otherwise;
- $\alpha$  is the constant term;
- $Z_j$  is a vector of firm-specific and sector-specific variables influencing innovation success (excluding constraint variables used in the earlier innovation probability model);
- $\varepsilon_j$  is the error term.

To distinguish between different forms of innovation outcomes, successful innovation may also be classified into two categories:

- **New-to-the-firm innovations (SI+NF)**: products or processes adopted by a firm but already available elsewhere in the market;
- **New-to-the-market innovations (SI+NM)**: genuinely novel innovations introduced for the first time in the market.

These categories allow researchers to distinguish between **innovators** and **imitators**, a distinction that is widely recognized in the financial innovation literature<sup>63</sup>.

*Second Stage: Magnitude of Innovation Success*

The second stage of the Tobit model estimates the **extent to which innovation contributes to firm revenue**, measured by the innovation sales ratio:

$$ISR_j = \alpha + \beta W_j + \varepsilon_j \quad (4)$$

where:

- $ISR_j$  represents the **innovation sales ratio**, defined as the share of revenue derived from new or significantly improved products introduced during the period;
- $\alpha$  is the constant term;
- $W_j$  is a vector of firm and sector-specific variables affecting the share of innovation-related sales;
- $\varepsilon_j$  is the error term.

The explanatory variables included in this model typically reflect the key drivers of innovation identified earlier, including firm size, R&D investment, technological capabilities, human capital, and collaboration with external partners.

Empirical results from Heffernan et al. (2013) show that R&D investment, cooperation with other firms, and the ability to appropriate returns from innovation are among the most important determinants of innovation success. Firms that invest more heavily in research and technological development and that engage in collaborative innovation networks tend to achieve higher innovation sales ratios<sup>64</sup>.

More recent research confirms these findings, highlighting the growing role of digital capabilities, fintech partnerships, and data-driven innovation in determining the commercial success of financial innovation<sup>65</sup>. In particular, collaboration between traditional financial institutions and fintech firms has become a significant factor in the successful commercialization of new digital financial services.

Overall, combining **logit models for innovation likelihood** with **Tobit models for innovation success** provides a comprehensive econometric framework for analysing both the determinants and outcomes of financial innovation.

## 5.2. Financial Innovation and Bank Performance

The impact of financial innovation can be measured using various indicators of commercial banks' financial performance, such as gross and net profit margins, Return on Assets (ROA), and Return on Equity (ROE). A 2014 study on Kenyan Commercial Banks, for example, have shown that financial innovations like credit cards, mobile banking, internet banking, and agency banking have a positive impact on financial performance<sup>66</sup>. Recent research continues to affirm this positive relationship. A systematic literature review by Xu et al. (2025) found a consistently positive and statistically significant impact of FinTech on bank performance, particularly in lower-performing banks<sup>67</sup>. Sadraoui (2025) also revealed a robust positive impact of financial innovation on bank performance in the long run, especially in more concentrated market settings<sup>68</sup>. These studies often employ regression models to analyse the relationship between innovation adoption and financial metrics.

Financial innovation also affects bank market performance indicators, such as market share and volatility in returns. Arnaboldi and Rossignoli (2015) found that banks with higher market share in less concentrated and more efficient banking systems exhibit stronger innovation<sup>69</sup>. Furthermore, banks with less volatile returns and a lower quality of loan portfolio tend to have higher levels of innovation, especially during financial crises<sup>70</sup>.

## 5.3. Measuring Innovation Efficiency

Given the substantial capital invested in innovation, measuring its efficiency is crucial. Prasad and Harker (1997) used a Cobb-Douglas production function to assess the impact of IT investment on productivity in the US retail banking industry<sup>71</sup>. Their findings suggested that while IT labour was profitable, IT capital might have been over-invested, highlighting the importance of managing the human capital aspect of technological innovation<sup>72</sup>. In the contemporary FinTech landscape, efficiency gains are a primary driver of innovation. Digital channels significantly reduce the cost of transactions compared to traditional methods. Empirical research show that serving customers through branches can be up to 45 times more expensive than through mobile banking and about 10 times more costly than ATM transactions, highlighting the efficiency benefits of mobile and online banking<sup>73,74</sup>. This perspective underscores that while initial IT capital investments can be substantial, the long-term operational efficiencies, particularly through digital channels, are significant. The focus has shifted from mere IT expenditure to strategic deployment of technology combined with skilled human capital to optimise delivery systems.

## 5.4. Financial Innovation and Bank Fragility

While financial innovation offers economic advantages, it can also contribute to bank fragility or instability. The 2007-08 global financial crisis served as a stark reminder of how complex and opaque innovative products, driven by the search for yield, can introduce systemic risks<sup>75</sup>. The proliferation of new financial instruments and banking models, often spurred by globalization and technological progress, has implications for the riskiness of banks and overall financial stability<sup>76</sup>. Research by Beck et al. (2012) employed the Z-score to examine the relationship between financial innovation and bank fragility, finding that banks in more financially innovative environments tend to be closer to insolvency<sup>77</sup>. The Z-score is defined as:

$$Z = \frac{ROA + CAR}{\sigma(ROA)}$$

where ROA represents return on assets, CAR is the capital-to-asset ratio, and  $\sigma(ROA)$  is the standard deviation of ROA. This metric captures a bank's distance from insolvency and is widely used as an indicator of bank stability<sup>78</sup>. Their results show a significant negative relationship between financial R&D intensity and bank stability, implying that innovation, if poorly managed or regulated, may increase systemic risk<sup>79</sup>. This finding is corroborated by Gennaioli et al. (2012) who found that financial innovation often drives financial fragility by creating complex, "safe" securities (like mortgage-backed securities) that mask underlying risks, leading to over-issuance and market instability when those risks are realized. Driven by investor demand for safety and "neglected risk," this process creates excessive, under-collateralized claims, causing sharp price declines when investors rush for safety<sup>80</sup>.

## 5.5. Effects of Financial Innovation on Users of Financial Services

Beyond its impact on banks, financial innovation also impacts on users of financial services. Financial innovation has significantly transformed the experience of users of financial services by improving efficiency, accessibility, and service quality. Innovations such as mobile banking, neobanks, alternative finance, and digital payments have collectively enhanced customer convenience while expanding financial inclusion. At a fundamental level, financial innovation aims to reduce costs and risks while improving service delivery, thereby increasing customer satisfaction and loyalty<sup>81</sup>

Mobile and digital banking have played a central role in this transformation. By enabling users to perform transactions, transfers, and financial management remotely, mobile banking reduces reliance on physical branches and lowers transaction costs<sup>82</sup>. Evidence from African markets shows that while traditional banking channels remain relevant, alternative channels such as ATMs and mobile platforms are increasingly improving access to financial services<sup>83</sup>. A notable example is Kenya's M-Pesa, which significantly expanded financial inclusion and contributed to poverty reduction, lifting approximately 194,000 households out of extreme poverty and increasing female labour participation<sup>84</sup>. Overall, these innovations provide faster transactions, greater convenience, and improved financial transparency, although they also introduce risks such as cybersecurity threats and digital literacy challenges.

Neobanks further enhance user experience by offering fully digital, user-friendly banking services. Features such as instant onboarding, low or zero fees, integrated budgeting tools, and faster payments cater especially to digitally native users and underserved groups, including freelancers and gig-economy workers. By lowering barriers to entry, neobanks contribute to broader financial inclusion, particularly in emerging markets<sup>85</sup>.

Alternative finance, including crowdfunding and peer-to-peer (P2P) lending, has expanded access to capital for individuals and small businesses that may struggle to obtain traditional bank financing. These platforms enable users to raise funds from a wide pool of investors while offering investors opportunities for portfolio diversification and potentially higher returns<sup>86,87</sup>. However, such investments carry significant risks, including high failure rates, limited liquidity, and the absence of deposit protection<sup>88,89</sup>.

Finally, digital and P2P payment systems have revolutionised everyday financial transactions by enabling instant, low-cost transfers. These systems enhance convenience and play a crucial role in promoting financial inclusion by integrating unbanked populations into the formal financial system<sup>90</sup>. Overall, while financial innovation delivers substantial benefits to users, it also introduces new risks that require careful management and regulation.

## 6. Reporting Financial Innovation

Financial innovation plays a central role in shaping the efficiency, competitiveness, and stability of modern financial systems. For regulators and supervisors, the ability to systematically monitor and evaluate innovation within financial institutions is therefore essential. Data on financial innovation can be obtained from multiple sources, including bank regulatory returns, audited financial statements, annual reports, innovation surveys conducted by supervisory authorities, as well as information from the press and other market intelligence channels. Once collected, these data should be analysed and presented in a structured **financial innovation performance report** that enables regulators to evaluate innovation trends within individual institutions and across the financial system.

An effective report should also incorporate **peer group comparisons** across key innovation indicators, allowing supervisors to benchmark institutions of similar size, specialization, or market focus. Such benchmarking helps identify leaders and laggards in innovation performance while providing insights into the relationship between innovation, competitiveness, and financial stability. A comprehensive financial innovation performance report can be organised into the following eight sections, covering the full lifecycle of innovation—from inputs and collaboration to outcomes, impacts, and risk management.

### 6.1. Types of Financial Innovation

The first section of the report should evaluate the **nature and types of innovation activities** undertaken by financial institutions. Innovation in financial services typically takes several forms, most notably product innovation and process innovation, though marketing and organizational innovation are also increasingly relevant.

**Product innovation** refers to significant improvements in financial goods or services. These improvements may involve enhanced technical specifications, improved functionality, better user interfaces, new digital features, or the integration of advanced software. Reporting should capture:

- New financial products or services introduced during the reporting period
- Improvements made to existing financial products
- The development process used to create these innovations
- Whether the innovation is new to the institution, the domestic market, or the global market

**Process innovation** concerns changes in the methods used to deliver financial services. This includes new production techniques, upgraded equipment, digital platforms, or improved operational software that enhance service delivery or reduce operational costs. Regulators should document:

- The adoption of new service delivery technologies
- Automation of banking processes
- Improvements aimed at reducing transaction costs or improving efficiency

In addition to these core categories, regulators may also report on:

- **Marketing innovation**, which includes new approaches to product promotion, pricing strategies, customer engagement, branding, or distribution channels.
- **Organizational innovation**, which refers to structural changes within financial institutions such as reorganizing management functions, introducing new business models, or restructuring internal workflows to support innovation and improve performance.

Together, these categories provide a comprehensive picture of how financial institutions innovate across products, operations, customer engagement, and internal management.

## 6.2. Assessment of Innovation Inputs

The second section focuses on the **resources and capabilities that financial institutions invest in innovation**. These inputs may include both tangible investments, such as technology infrastructure, and intangible assets, such as knowledge and human capital. Key indicators that regulators may collect include:

- **Financial R&D Intensity**
  - Measured as research and development expenditure relative to total operating costs.
  - This metric indicates the financial commitment institutions make toward developing new products and services.
- **Human Capital**
  - Measured by the share of research or technical staff relative to total staff.
  - Alternatively measured by staff education and training expenditure as a proportion of operating costs.
- **Information Technology (IT) Capital**
  - Measured by IT expenditure relative to total operating costs.
  - This reflects the level of investment in digital infrastructure and technological capabilities.
- **Composite Innovation Input Indicator**
  - A combined measure consisting of R&D expenditure, IT investment, and staff training expenditure relative to operating costs.
  - This provides a more holistic measure of innovation capacity.
- **Acquisition of Knowledge and Technology**
  - Includes licensing patents, purchasing technical know-how, acquiring software platforms, or collaborating with external technology providers.

Assessing innovation inputs enables regulators to evaluate the **innovation capacity** of financial institutions and understand how resources are allocated toward future development.

### 6.3. Assessment of Innovation Outputs

While inputs measure resources devoted to innovation, the third section evaluates the **tangible results of innovative activities**. Regulators should track indicators that capture both the quantity and quality of innovation outcomes.

Examples of innovation output indicators include:

- The **number of new or significantly improved financial products and processes** introduced
- The **number of patents or intellectual property filings** related to financial services
- The **number of research publications or technical reports** produced by financial institutions
- **Growth in workforce expertise**, including increases in specialized technical or research staff
- **Digitalization metrics**: Adoption rates of digital channels (e.g., internet banking users/total customers, mobile banking users/total customers).
- **Organizational changes**, such as new business units or shifts in operational structures designed to support innovation

These indicators provide insights into how effectively financial institutions convert innovation inputs into meaningful outputs.

### 6.4. Determinants of Financial Innovation

This section examines the **factors that influence a financial institution's ability to innovate**. Understanding these determinants allows regulators to identify structural drivers and barriers to innovation within the financial sector.

Important determinants include:

- **Firm Size** – Larger institutions may benefit from economies of scale that enable greater investment in innovation.
- **Firm Age** – Older institutions may accumulate experience and knowledge through learning-by-doing.
- **Innovation Inputs** – The availability of financial resources, skilled labour, and technological infrastructure.
- **Collaboration and Cooperation** – Partnerships with other firms or research institutions can enhance innovation capacity.
- **Appropriability and Knowledge Spillovers** – The ability to protect innovations through intellectual property rights.
- **Financial and Cost Constraints** – High innovation costs, economic risks, or limited access to finance may hinder innovation.
- **Regulatory Environment** – Regulations may either facilitate innovation through supportive frameworks or hinder it through compliance burdens.
- **Market Competition and Specialization** – Market share, competition levels, and specialization within financial services can influence innovation incentives.

## 6.5. Innovative Collaborations

Innovation increasingly depends on **collaborative networks** rather than isolated internal efforts. This section evaluates the sources of information and cooperation that financial institutions use to support innovation.

Two broad categories of collaboration can be distinguished:

### Internal sources (intramural innovation):

- In-house research and development
- Internal innovation teams
- Cross-departmental collaboration within the institution

### External sources (extramural innovation):

- Market-based partners such as software vendors, consultants, competitors, and clients
- Institutional sources such as universities, research centers, and government agencies
- Industry platforms including conferences, exhibitions, trade fairs, and professional associations

Monitoring these collaborations helps regulators understand how financial institutions access knowledge, technology, and expertise beyond their organizational boundaries.

## 6.6 Effects or Results of Financial Innovation

This section evaluates the **direct outcomes of innovation**, particularly in terms of business performance and financial inclusion.

### Business Performance

Innovation can enhance the competitiveness and efficiency of financial institutions in several ways, including:

- Expanding the range of financial products and services
- Entering new markets and increasing market share
- Improving service quality and customer experience
- Increasing operational flexibility and service capacity
- Raising value added through new revenue streams

Additional indicators may include:

- **Innovation sales ratio**, measuring revenue generated from innovative products relative to total sales
- **Cost reductions**, especially through digital delivery channels
- **Environmental and sustainability improvements**
- **Compliance with regulatory requirements**

Cost efficiency can also be assessed through **delivery channel cost metrics**, such as the average cost per transaction on internet banking, mobile banking, ATMs, point-of-sale systems, or call centers.

### Financial Inclusion

Innovation can also expand access to financial services. Regulators should therefore monitor indicators that measure the **usage of innovative financial channels**, such as:

- Internet banking users relative to total customers

- Mobile banking users relative to total customers
- ATM usage rates
- Online payment adoption
- Agent banking usage in rural areas

User cost indicators—such as the average cost per transaction across channels—can further reveal whether innovation is reducing financial service costs for consumers.

## 6.7. Impact of Financial Innovation

Beyond immediate outcomes, financial innovation can have broader **microeconomic and macroeconomic impacts**<sup>91</sup>.

### Bank Performance

Key indicators include:

- Bank output measures such as loans and deposits
- Return on assets (ROA) and return on equity (ROE)
- Non-performing loan ratios (NPLs)
- Market share and profitability indicators
- Share price volatility and other measures of market risk
- Bank fragility indicators such as the Z-score

### Financial Stability

Financial innovation can also introduce systemic risks. Regulators should therefore monitor indicators across several sectors:

- **Real sector:** GDP growth, inflation, and fiscal balance
- **Corporate sector:** leverage ratios, debt servicing capacity, and corporate defaults
- **Household sector:** household assets, liabilities, and disposable income
- **External sector:** exchange rates, foreign reserves, and capital flows
- **Financial sector:** credit growth, capital adequacy, liquidity ratios, and leverage
- **Financial markets:** equity indices, bond spreads, liquidity premia, and asset price volatility

## 6.8. Financial Innovation and Risk Management Practices

The final section addresses **how financial institutions manage the risks associated with innovation**. Because new financial products, technologies, and markets can introduce operational and systemic risks, effective risk management frameworks are critical. Regulators may gather this information through dedicated surveys or supervisory reviews.

Key questions may include:

- Whether the institution has a **comprehensive risk management framework**
- Whether there is an **independent risk review function**
- Which risk assessment tools are used, such as
  - Value at Risk (VaR)
  - Earnings at Risk
  - Basic risk metrics

Institutions may also be asked to identify **barriers to effective risk management**, such as limited technological infrastructure, lack of analytical tools, or high implementation costs<sup>92</sup>.

## 7. Conclusion

This article has provided a comprehensive update and enhancement of the understanding, measurement, and impact of financial innovation, integrating latest developments since the past decade. Financial innovation, defined as the creation and popularization of new financial products, services, instruments, technologies, institutions, and markets, continues to be a critical driver of economic performance and financial system transformation. Its evolution is shaped by a combination of demand and supply factors, including rapid technological progress, regulation, market dynamics, and macroeconomic conditions.

Measuring financial innovation involves assessing both inputs (e.g., R&D, human capital, IT capital) and outputs (e.g., new products, patents, knowledge). Data sources range from innovation surveys and bank annual reports to financial press and websites. Methodologies for analysing the likelihood and success of innovation include binary logit models and two-stage Tobit models, which consistently show that factors like firm size, R&D, collaboration, and financial resources drive innovation success. The impact of innovation extends to improved customer satisfaction, enhanced financial inclusion, and positive effects on bank financial and market performance (e.g., ROA, ROE, market share). While financial innovation undeniably boosts efficiency, as evidenced by the significantly lower transaction costs of digital channels compared to traditional ones, it also presents challenges related to bank fragility and systemic risk, necessitating robust regulatory oversight.

In conclusion, financial innovation remains a double-edged sword, offering immense potential for economic growth and societal benefit while also posing risks that require careful management. For financial regulators, continuous monitoring of innovation inputs, outputs, and impacts—both at the micro and macro levels—along with vigilant oversight of risk management practices, is paramount. The structured reporting of financial innovation performance, incorporating the latest FinTech developments and their implications, is essential to harness the benefits of innovation while safeguarding financial stability in an increasingly dynamic global landscape.

## Endnotes

- <sup>1</sup> Levine, R. (1997). "Financial development and economic growth." *Journal of Economic Perspectives*, 35: 688–726.
- <sup>2</sup> Lerner, J., & Tufano, P. (2011). "The Consequences of Financial Innovation: A Counterfactual Research Agenda" *NBER Working Paper 16780*.
- <sup>3</sup> World Economic Forum. (2015). *The Future of Financial Services: How disruptive innovations are reshaping the way financial services are structured, provisioned and consumed*. World Economic Forum
- <sup>4</sup> Heffernan, S., Fu, X.M., & Fu, X. (2008). "Financial Innovation in the UK." *Working Paper, Cass Business School, City University, London*.
- <sup>5</sup> Liu, Z., Li, X. & Li, Z. (2024) Inclusive FinTech, open banking, and bank performance: evidence from China. *Financial Innovation* 10 (149). <https://doi.org/10.1186/s40854-024-00679-3>
- <sup>6</sup> Feyen, E. Frost, J., Gambacorta, L. Natarajan, H. and Saal, M. (2021). Fintech and the Digital Transformation of Financial Services: Implications for Market Structure and Public Policy. *BIS Papers No 117*. Bank for International Settlements
- <sup>7</sup> Heffernan, et al. (2008), op. cit.
- <sup>8</sup> *ibid*
- <sup>9</sup> King, R., & Levine, R. (1993). "Finance, entrepreneurship, and growth: Theory and evidence." *Journal of Monetary Economics*, 32: 514–542.
- <sup>10</sup> Heffernan, et al. (2008), op. cit.
- <sup>11</sup> Beck, T., Chen, T., Lin, C. and Song, F.M. (2016). Financial innovation: The bright and the dark sides. *Journal of Banking & Finance*, 72, pp.28–51.
- <sup>12</sup> Tufano, P. (2003). "Financial Innovation." In G. M. Constantinides, M. Harris, & R. M. Stulz (Eds.), *Handbook of the Economics of Finance* (Vol. 1, pp. 307–332). Elsevier.
- <sup>13</sup> Feyen, et al. (2021), op. cit.
- <sup>14</sup> *ibid*.
- <sup>15</sup> Peat, M. (2009). "Financial Innovation: The New World." *Journal of Applied Finance*, 19(1): 5-18.
- <sup>16</sup> Frame, S.W. and White, L.J. (2012). Technological change, financial innovation, and diffusion in banking. In: Berger, A., Molyneux, P. and Wilson, J. (eds.) *The Oxford Handbook of Banking*. Oxford: Oxford University Press.
- <sup>17</sup> See Peat (2009) and Allen, F., & Gale, D. (1994). *Financial Innovation and Risk Sharing*. MIT Press
- <sup>18</sup> Goel, Anand M. (2019) What Do We Know About Financial Innovation?. Available at SSRN: <https://ssrn.com/abstract=3392434> or <http://dx.doi.org/10.2139/ssrn.3392434>
- <sup>19</sup> Tarczynski, W. and M. Zwolankowski (1999). *Financial engineering*, Placet Publishing Agency, Warsaw
- <sup>20</sup> Schindler, J. (2017). *FinTech and Financial Innovation: Drivers and Depth*. Finance and Economics Discussion Series 2017-081. Washington: Board of Governors of the Federal Reserve System.
- <sup>21</sup> Wall, L.D. (2014). *Two Drivers of Financial Innovation*. Center for Financial Innovation and Stability, Federal Reserve Bank of Atlanta.
- <sup>22</sup> Berger, A. N. (2003). "The economic effects of technological progress: Evidence from the banking industry." *Journal of Money, Credit and Banking*, 35(2): 141-176
- <sup>23</sup> Frame and White (2012).
- <sup>24</sup> Wall (2014), op. cit.
- <sup>25</sup> Claessens, S., Glaessner, T., & Klingebriel, D. (2002). "Electronic Finance: Reshaping the Financial Landscape Around the World." *Journal of Financial Services Research*, 22(1/2): 29-61.
- <sup>26</sup> Allen, F., McAndrews, J., & Strahan, P. (2002). "E-Finance: An Introduction." *Journal of Financial Services Research*, 22(1/2): 5-27.
- <sup>27</sup> Schindler, J. (2017). *FinTech and Financial Innovation: Drivers and Depth*. Finance and Economics Discussion Series 2017-081. Washington: Board of Governors of the Federal Reserve System.
- <sup>28</sup> Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S. and Hess, J., (2018). *The Global Findex Database 2017: Measuring financial inclusion and the fintech revolution*. Washington DC: World Bank
- <sup>29</sup> Frost, J., Gambacorta, L., Huang, Y., Shin, H.S. and Zbinden, P. (2019). BigTech and the changing structure of financial intermediation. *Economic Policy*, 34(100), pp.761–799.
- <sup>30</sup> See Wall (2014), op. cit.
- <sup>31</sup> Schindler (2017), op. cit.
- <sup>32</sup> *ibid*
- <sup>33</sup> *ibid*
- <sup>34</sup> *ibid*
- <sup>35</sup> Johnson, S., & Kwak, J. (2012). "Is Financial Innovation Good For The Economy?" In J. Lerner & S. Stern (Eds.), *Innovation Policy and the Economy* (Vol. 12, pp. 1-15). University of Chicago Press.

- <sup>36</sup> Levine, R. (2005). "Finance and Growth: Theory and Evidence." In P. Aghion & S. Durlauf (Eds.), *Handbook of Economic Growth*. Elsevier.
- <sup>37</sup> Rajan, R.G. (2006), Has Finance Made the World Riskier?. *European Financial Management*, 12: 499-533.
- <sup>38</sup> For example, Beck, et al. (2016) finds that different measures of financial innovation were associated with faster bank growth, but also higher bank fragility and worse bank performance during the global financial crisis.
- <sup>39</sup> See World Economic Forum (2015).
- <sup>40</sup> World Economic Forum (2012) *Rethinking Financial Innovation: Reducing Negative Outcomes While Retaining The Benefits*. A World Economic Forum Report in collaboration with Oliver Wyman.
- <sup>41</sup> Taques, F.H., López, M.G., Basso, L.F. and Areal, N. (2021). Indicators used to measure service innovation and manufacturing innovation. *Journal of Innovation & Knowledge*, 6 (1), pp.11–26.
- <sup>42</sup> Gamal, D. (2011). *How to Measure Organization Innovativeness? An Overview of Innovation Measurement Frameworks and Innovation Audit/Management Tools*. Technology Innovation and Entrepreneurship Center.
- <sup>43</sup> Heffernan, S., Fu, X. and Fu, M. (2013). Financial innovation in the UK. *Applied Economics*, 45(24), pp.3400–3411.
- <sup>44</sup> See also Frame and White (2012), op. cit.
- <sup>45</sup> Heffernan, et al. (2013), op. cit.
- <sup>46</sup> See Frame and White (2012), op. cit. and Arner, D.W., Barberis, J. and Buckley, R.P. (2016). The evolution of Fintech: A new post-crisis paradigm? *Georgetown Journal of International Law*, 47(4), pp.1271–1319.
- <sup>47</sup> Arnaboldi, F. and Rossignoli, B. (2015). *Financial Innovation in Banking*. Department of Law Working Paper, University of Milan.
- <sup>48</sup> Frei, F.X., Harker, P.T. and Hunter, L.W. (1997). *Innovation in Retail Banking*. Financial Institutions Center Working Paper 97-48-B, Wharton School, University of Pennsylvania.
- <sup>49</sup> Gamal (2011), op. cit.
- <sup>50</sup> Taques et al. (2021), op. cit.
- <sup>51</sup> Heffernan, et al. (2013), op. cit.
- <sup>52</sup> Arner et al. (2016), op. cit. and Frost et al. (2019), op. cit
- <sup>53</sup> Stemler, S. (2001). An overview of content analysis. *Practical Assessment, Research & Evaluation*, 7(17).
- <sup>54</sup> Lerner, J., 2006. The new new financial thing: The origins of financial innovations. *Journal of Financial Economics*, 79(2), pp.223–255.
- <sup>55</sup> Frost et al. (2019), op. cit
- <sup>56</sup> Heffernan, et al. (2013), op. cit.
- <sup>57</sup> Arner et al. (2016), op. cit
- <sup>58</sup> Tufano (2003), op. cit
- <sup>59</sup> Tufano (2003), op. cit
- <sup>60</sup> OECD/Eurostat (2018). *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation*. 4th ed. Paris: OECD Publishing.
- <sup>61</sup> See for example, Arner et al. (2016), op. cit; Frost et al. (2019), op. cit and Philippon, T. (2020). On fintech and financial inclusion. *BIS Working Papers* No 841
- <sup>62</sup> Roberts, P. W., & Amit, R. (2003). "The Dynamics of Innovative Activity and Competitive Advantage: The Case of the U.S. Retail Banking Industry." *Strategic Management Journal*, 24(10): 979-994.
- <sup>63</sup> Tufano (2003), op. cit
- <sup>64</sup> Heffernan, et al. (2013), op. cit.
- <sup>65</sup> See for example, Frost et al. (2019), op. cit, Philippon, op. cit (2020) and Thakor, A.V. (2020). Fintech and banking: What do we know? *Journal of Financial Intermediation*, 41, 100833.
- <sup>66</sup> Muiruri, J. M., & Ngari, J. M. (2014). "Effect of Financial Innovation on Financial Performance of Commercial Banks in Kenya." *International Journal of Business and Management Invention*, 3(10): 1-10.
- <sup>67</sup> Xu, F., Kasperskaya, Y., & Sagarra, M. (2025). "The impact of FinTech on bank performance: A systematic literature review." *Digital Business*, 5(2): 100131.
- <sup>68</sup> Sadraoui, T. (2025). "The Dynamics of Financial Innovation and Bank Performance." *Journal of Risk and Financial Management*, 18(6): 333.
- <sup>69</sup> Arnaboldi and Rossignoli (2015), op. cit
- <sup>70</sup> Arnaboldi and Rossignoli (2015), op. cit
- <sup>71</sup> Prasad, B., & Harker, P. T. (1997). "Examining the Contribution of Information Technology Toward Productivity and Profitability in U.S. Retail Banking." *Financial Institutions Center Working Paper 97-09, The Wharton School, University of Pennsylvania, Philadelphia*.
- <sup>72</sup> *ibid*
- <sup>73</sup> Fiserv. (2009). *How to Achieve a Compelling ROI from Mobile Financial Services*. Fiserv White paper.

<sup>74</sup> Bain & Company (2016) *Bank Branch and Call Center Traffic Jam. Why Do Customers Keep Visiting Tellers and Calling the Contact Center?*. Bain & Co., Inc.

<sup>75</sup> Johnson, S., & Kwak, J. (2012), op. cit

<sup>76</sup> Llewellyn, D. T. (2009). “Financial Innovation and a new economics of banking: Lessons from the financial crisis.”

<sup>77</sup> Beck et al. (2016), op. cit

<sup>78</sup> Boyd, J. H., G. De Nicolo, and A. M. Jalal (2006). Bank Risk-Taking and Competition Revisited: New Theory and New Evidence. *IMF Working Paper No. 297*.

<sup>79</sup> Beck et al. (2016), op. cit

<sup>80</sup> Gennaioli, N., Shleifer, A. and Vishny, R.W. (2012) ‘Neglected risks, financial innovation, and financial fragility’, *Journal of Financial Economics*, 104(3), pp. 452–468.

<sup>81</sup> Beyani, M. and Kasonde, R. (2009) “Financial innovation and the importance of modern risk management systems – a case of Zambia”, *IFC Bulletin*, 31:283-293

<sup>82</sup> Azmeh, S., Foster, C. and Echavarri, J. (2024). Exploring the dual relationship between fintech and financial inclusion. *PLOS ONE*, 19(1), pp.1–20.

<sup>83</sup> KPMG (2013). *Africa Banking Industry Customer Satisfaction Survey*. KPMG.

<sup>84</sup> Suri, T. and Jack, W. (2016) The long-run poverty and gender impacts of mobile money. *Science*, 354(6317).

<sup>85</sup> Demirgüç-Kunt, A., Klapper, L., & Singer, D. (2017). Financial inclusion and inclusive growth: A review of recent empirical evidence. *World Bank Policy Research Working Paper*, 8040.

<sup>86</sup> Belleflamme, P., Lambert, T. and Schwienbacher, A. (2014) Crowdfunding: Tapping the right crowd. *Journal of Business Venturing*, 29(5): 585-609

<sup>87</sup> Financial Conduct Authority [FCA] (2025). Crowdfunding and peer-to-peer lending.

<https://www.fca.org.uk/consumers/crowdfunding>

<sup>88</sup> McCrea, J. (2025). *The State of UK Equity Crowdfunding*. <https://www.beahurst.com/blog/uk-equity-crowdfunding>

<sup>89</sup> FCA (2025), op. cit

<sup>90</sup> Demirgüç-Kunt, et al. (2017), op. cit

<sup>91</sup> Gadanez B. and K. Jayaram (2009), “Measures of financial stability – a review”, *IFC Bulletin* 31: 365-380

<sup>92</sup> Beyani and Kasonde (2009), op. cit.

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