Cheng-Yun Tsang *

A Study on Digitalization of Financial Supervision: An Actor-Network Analysis of Taiwan's Internet-only Bank Supervisory System[1]

(Received Oct 07, 2022; First Revision Dec 08, 2022; Second Revision Jan 03, 2023; Accepted Feb 09, 2023)

Purpose – This paper outlines an actor-network for Taiwan's Internet-only Bank Supervisory System. It analyzes the interactions between actors and actants and the translation process within the network, and how the network informs new thinking to the cross-boundary regulatory framework for fintech.

Design/methodology/approach – Case Interview and Observational Method

Findings – The findings hold three implications for cross-boundary regulatory coordination: First, actors in the network must know one another's position, goal, interest and incentive and collaborate accordingly; Second, the creation of supervisory systems provide regulators with a suitable arena to understand the interacting dynamics between their regulatory measures and the technology adopted; Third, regulators can learn through the lens of ANT and realize the non-human actants' mobility and impacts.

Research limitations/implications – Limited interview samples due to the very few participating stakeholders in building the Supervisory System. Also, to ensure the anonymity of the interviewees, this paper cannot quote the interviewees' words and can only lay out the story relatively obscurely.

Practical implications/Social implications – This paper clarifies the concept of supervisory digitalization and conducts an in-depth case interview to understand digital regulatory reporting better and sheds light on how SupTech-enabled supervisory systems will hold implications for regulatory coordination.

Originality/value – This paper is the first attempt in Taiwan to engage financial supervision literature with STS scholarships. It fills an interdisciplinary research gap.

Keywords – Internet-only banks, Supervisory digitalization, Digital regulatory reporting, Fintech regulation, ANT

---

* Cheng-Yun Tsang is an associate professor at the College of Law, National Chengchi University. (Corresponding Author) Email: cytsang@nccu.edu.tw

[1] This paper was previously presented at 2022 annual conference of Taiwan STS Association, to which the authors thank attendees for offering their valuable suggestions. Also, the author is very grateful to the comments and suggestions provided by Professor Yu-Hsiang Chen at National Taipei University Department of Sociology. The authors would also like to thank the two anonymous auditors for their constructive revisions and suggestions, in addition to the National Science and Technology Council's Columbus Program "Constructing a Cross-Border-And-Industry Regulatory Framework for Interactions between Financial Systems and Technological Innovations" (4/5) (NSTC112-2636-H-004-001-) for their economic support, and research assistants Yu-Tsen Lai, Yueh-Ning Hsieh, Ying-Tung Chou, and Meng-Syuan Li for their vital contributions to the writing of this paper. Lastly, the authors are grateful to all interviewees for their participation and significant contributions to this paper. The authors accept full responsibility for the text.

DOI:10.6656/MR.202304_42(2).ENG095

1. Introduction

Financial supervision is an interdisciplinary research topic that, at its core, involves awareness of economic systems and financial markets as well as an understanding of political systems and legal regulations. It also, at times, includes variables such as risk culture and social traits. In addition to long-term academic endeavour by economists (Goodhart et al. 1998; Stiglitz 2009), it has also become a topic of discussion often participated by legal scientists (Avgouleas 2005; Schooner and Taylor 2010) and political scientists (Quinn 1997); a good many sociologists and anthropologists have also introduced new perspectives from a variety of angles in recent years (Riles 2011, 2018).

Alongside changes to the greater environment, the interdisciplinary traits of financial supervision have not only been reflected in diverse research perspectives, but also in multifaceted research propositions. For example, the development of technology in recent years has brought about the rise of so-called fintech (financial technology), and much literature has begun to explore the relationship between fintech and financial supervision (Brummer and Yadav 2019; Zetzsche et al. 2017). Besides institutional and legal topics, scholars have also begun to carry out research on financial supervision agencies to explore how regulators should respond to the rise of fintech, which also comprises the research background of this paper.

The study aims to explore how technology is used by regulators to satisfy supervisory needs (this refers to the so-called "supervisory technology" or SupTech), the development of which shows that supervision agencies across the globe are currently being driven by "financial supervisory digitalization". It is hoped that digital regulatory reporting can be used as a starting point to effectively manage the information analyses for various supervisory needs and for adopting timely supervision measures to ensure the stability of financial systems and order in the market (Chiu 2016; Omarova 2020).

It is hoped that through process of building a digital regulatory reporting mechanism for Taiwan, the perspective of actor-network theory (ANT) can be used to showcase the dynamics and entanglement (Chen 2010) characterized in the creation of Taiwan's internet-only bank regulatory reporting system and outline the interaction processes of different actors, supervision agencies included, to be used as an incipient outcome that can inform and shape the capacity of fintech regulation.

The study is the first attempt in Taiwan to engage in financial supervision literature involving STS scholarships and explores the impacts that the conception and application of financial supervisory systems has on the interactions between financial supervision agencies and various stakeholders, filling an existing interdisciplinary research gap. In addition, an understanding of the actor networks formed by technological supervision systems is used to inform new thinking with regard to the cross-boundary regulatory framework for fintech.

In terms of object, the digital reporting systems in Taiwan currently in operation include the internet-only real-time banks supervisory system (hereinafter, internet-only banks supervisory system) constructed and maintained by Central Deposit Insurance Corporation (hereinafter, Deposit Insurance Corp.), and the digital supervisory mechanism that Taiwan Depository Clearing introduced for securities finance corporations. This paper chose to conduct research on the earliest system to be launched online, the internet-only banks supervisory system.[2] In addition, the setting up of real-time supervisory and regulatory systems for banks has become a mainstream topic of international development and discussion.

Moreover, the reason why ANT was chosen as the perspective for observation is because it is fundamentally based on empirical research during the process of technological activity and tracking the changes of actors during the technological activity process (Lin 2007). Besides, the field observation of ANT contains no *a priori* elements, nor should it fall under the confines of social constructionism of technology (Pinch and Bijker 1984) or the dichotomous stereotyping of technological determinism (Latour 1983). It is well-suited for the observations of actor interactions during the process of building an unprecedented financial supervisory system, a digital regulatory reporting system, as well as observing interaction dynamics according to the principle of not defining, among actors, who are the observers and who are the objects.

ANT can be understood as a component of STS (scientific, technological, and societal) studies. STS's development from the 1970s to the present includes the gradual adoption of sociological methods in the research and analysis of scientific knowledge (Fu 2019; Law 2017), launching a new field of academic research that combines the three spheres of philosophy, history of science, and humanity (Fu 2019). Over its course of development during over 50 years, STS has also become a research method and observational viewpoint that has been taken by sociologists of different fields, including law and supervision (Cole and Bertenthal 2017; Faulkner, Lange and Lawless 2012). However, dialogue on fintech supervision is still very small in scale: it has only recently become the subject of scholarly articles. A considerable number of such fintech supervision research endeavours include observation and dialogue that is based on a STS perspective (Tsang 2022). This paper is also among the body of academic work on the research and development

[2] The internet-only banks supervisory system was officially launched online in March 2021. Bills Finance Corporations' digital reporting system was officially launched online in June 2021.

of supervisory technology, and as such, attempts to engage in dialogue using STS and ANT perspectives.

Based on the above research context, the second part of this paper is a literature review; the third is the description of research methods; the fourth is the actor-network analysis of Taiwan's internet-only banks supervisory system, which, through outlining the actor network and presenting actor interactions, hopes to inform new thinking for regarding cross-boundary interaction between financial supervision and technological systems. The fifth part is the conclusion.

2. Literature Review

Most of the Taiwanese scholarship on "supervisory digitalization" has focused on "supervisory technology", has discussed Suptech as a major trend in the review of the development of fintech supervision (Peng and Tsang 2019), or analyzed the application of digitalization as a Suptech solution or application scenario (Shen and Wang 2020; Tsang 2018; Wang 2020). However, there is yet to be research on the supervisory implications produced because of the interactions between regulators and other stakeholders during the digitization process. On the other hand, because it was only in early 2018 that Taiwan published its policy statement for the establishment of internet-only banks (Financial Service Commission [FSC] 2018), it wasn't until early 2021 that the first internet-only bank was opened. Consequently, literature on Internet-only banks mostly focuses on the characteristics, niches, challenges, and risks regarding its development (Lee 2018; Zhou 2019). There has also been a considerable number of business management literature that have focused on the business models, profit models, and consumer interactions relating to internet-only banks (Cheng et al. 2022; Kang and Lee 2021; Lo 2020; Lu 2019). Only the author of this paper explored the supervision of the liquidity and credit risks of internet-only banking during Suptech's development in Taiwan (Tsang 2019), and used an Internet-only real-time banks supervisory system as an example to illustrate the challenges that Suptech could face in its development (Tsang 2021).

In summary, Taiwanese literature on supervisory digitalization is extremely scarce. As of today, there has yet to be research on the supervisory implications produced by stakeholder interactions during the implementation of concrete Suptech solutions. Furthermore, as a type of bank whose operations are entirely digital, internet-only banks have emerged as a new business for the promotion of fintech in Taiwan, but literature on how supervisors should digitally carry out risk supervision and explore the possible development trends of Suptech remain limited. Such deficiencies thus constitute the focus of this paper.

Similarly, a large amount of international literature has used the contexts and theoretical bases for issues such as how technology should assist with supervision and how supervision should respond to technological application as its starting point, with the most representative being Roger Brownsword and Karen Yueng's *Regulating Technologies*.[3] As to the practical application of Suptech, the Financial Stability Institute has released periodic investigative reports on related applications for Suptech since 2018 (Beerman, Prenio, and Zamil 2021; Broeders and Prenio 2018; di Castri et al. 2019).

Of note is the existing international literature on supervisory digitalization, which categorized it into the two types of qualitative data and quantitative data, and divided SupTech tools into the categories of "qualitative tools", "quantitative tools", and "qualitative and quantitative tools" to analyze its practical application and subsequent challenges (Beerman, Prenio, and Zamil 2021). Among these tools, regulatory reporting is seen as a key channel for the promotion of supervisory digitalization. Currently, many countries across the globe have made considerable progress in the digitalization of regulatory reporting (Crisanto et al. 2020), which is also a central theme of this study.

Digital regulatory reporting is a process of collaboration and interaction between multiple shareholders. First, financial institutions must comply with the data formats and data transmission methods stipulated by competent authorities and must relay such information to competent authorities using the appropriate report forms. From the standpoint of financial institutions, this process requires the digitalization and standardization of internal data, which not only involves the data department, but also necessitates cross-department communication and the making of changes to operating processes. However, such processes and procedural alterations often require the assistance of external professionals. Although these external vendors know how to operate the professional technologies needed for digital regulatory reporting, such a process demands large amounts of their time, their cooperation with financial institutions, and their skill in acting as a bridge between financial institutions and competent authorities by simultaneously understanding the technical and specification needs of competent authorities and assisting financial institutions with implementation.

On the other hand, the digital collection, processing, and analysis of the data sent by financial agencies by competent authorities requires the internal installation of corresponding equipment and systems and the making of changes in terms of data processing procedures and manpower allocation. In addition, a consistent standard operating procedure and specifications for data reporting must be negotiated with financial institutions, while digital reporting mechanisms and systems must be regularly tested in conjunction with financial institutions. From the point of view of

[3] Brownsword, Roger and Karen Yeung (2008), *Regulating Technologies Legal Futures, Regulatory Frames and Technological Fixes*. Oxford: Bloomsbury.

competent authorities, this process is by no means simple, as it demands the installation of information systems and implicates matters of high cost and a high degree of professionalism, such as the development of machine-readable and executable code conversions for specific supervision specifications. In addition, financial supervision agencies face the constraints of resource limitations (Tsang 2021) and often need to commission external developers to assist with the deployment of related mechanisms or systems, causing external developers to become a critical participant in the overall process.

In short, the initiation and establishment of digital regulatory reporting involves the following stakeholders: financial institutions, the external information vendors outsourced by financial institutions, financial supervision agencies, and the external information vendors outsourced by financial supervision agencies. In addition, besides "human-based actors", digital regulatory reporting also includes "non-human actants" such as the mechanisms and systems required for the implementation of digital regulatory reporting.

In order to analyze the construction of technological systems and the interactive relationships between different stakeholders, much past literature has used the Technology Acceptance Model (TAM) as a starting point for exploring the willingness, decision factors, and behaviors of users when using specific technology (Hung, Liang, and Chang 2005). Other studies have performed multiple case studies on how the behaviors of users impacted the technology adaptation process following organization technology introduction (Chen 2020). Such research on "the introduction, usage, and adaptation of technology" has been a constant focus of the information management field. Some scholars have mentioned that this topic began to evolve vigorously in the 1970s, and that its research has undergone multiple stages of transformation (Ou Yang and Hsu 2017). In Taiwan, the technology acceptance model has become the mainstream for studies on information technology adoption and introduction. Previously, scholars have selected from high-ranking domestic information management and e-commerce publications 82 theses highly related to this research topic, finding that over half of the studies adopted the theories of the technology acceptance model; as many as 80% used questionnaires and surveys while only 12% used case studies as the methodology; in addition, nearly 60% used online e-commerce as the research topic (Ou Yang and Hsu 2017).

Based on its findings, the above research further suggested that future study on related topics should "seek to transcend the methodology of the technology acceptance model and adopt more multifaceted designs that can manifest more richly and three-dimensionally the relationship between organizational context and technology acceptance and introduction."[4] On the other hand, this type of research seldom takes government agencies as its object. A small number have focused on the government's accounting information system (Lin and Huang 2012) or tax platform (Chen and Pao 2007), but none have conducted research on Suptech systems. Based on the above development direction, this paper aims to use a theoretical perspective besides the technology acceptance model to manifest more richly and three-dimensionally the interactive relationship between actors, adopts the less-often-used methodology of the case study, and uses Suptech systems as the objective in hopes of uncovering new research directions and possibilities. As such, this paper draws from the STS school of thought and bases its research on an ANT perspective.

Because abundant literature already exists on the theoretical origin and development of ANT, this is not a point of emphasis in this paper (Latour 1983). Put simply, ANT is a method for the in-depth research of the construction of scientific and technological knowledge; it is not particularly conducive to the context of scientific development or the influence of social background (Barnes 1982), but rather, it takes into account both, concerns the operations of multiple actors (including humans, technological artifacts, and even devices) with an aim to understand the connections between different entities (Shim and Shin 2016).

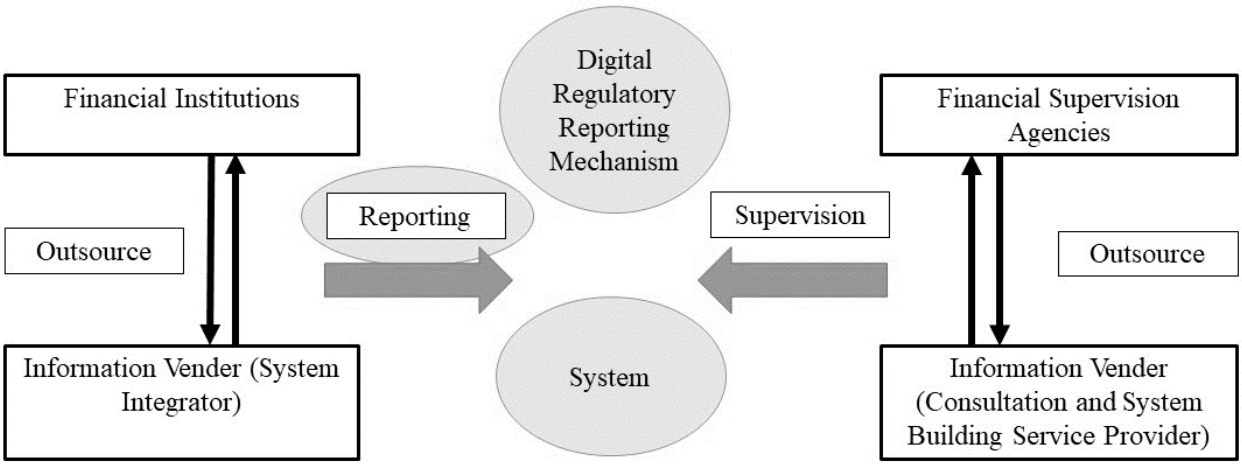
In essence, ANT focuses on the interactive and translation process between heterogeneous actors (Callon 1984). It uses the understanding of the definitions, roles, interests, and functions of different actors as a starting point and extends this to the question of whether the actions of a spokesperson helped to develop awareness and definitions for the common topics and interests between actors, further resulting in the displacement of different actors from their original positions and the forming of an entirely new network relationship (written by Latour, translated by Lin 2004). Various scholars have further interpreted this as a matter of how different actors form relationships through interactions and connections so that they can adapt to each other and form a consistent consensus (Chou and Tsai 2013). During this process of connection and adaptation, the motives of actors may change and become influenced by other actors, resulting in the forming of free association united under common or incidental goals or interests (Callon 1984; Newton 2002). Therefore, the key to ANT analysis lies in "observing the actions of actors to illustrate the trajectory of how internal network operations and external representation are ultimately formed through changes in actors' identities, the forming of relationships, and the building of networks and order." (Chou and Tsai 2013).[5]

In summary of the above, the scenario depicted by digital regulatory reporting is one of interaction, conception, entanglement, and evolution between professional personnel and professional technological artifacts (See Figure 1).

[4] Shirley Ou Yang and Carol Hsu (2017), page 236.

[5] It is worth noting that the term "structuring" is often used by STS academia when referring to the "building of networks…" mentioned by these authors.

The important research topics derived from this process include whether the birth of a system impacts the interaction between financial supervision agencies and financial institutions, and whether the construction and continued usage of a system can prompt financial agencies to use other technological artifacts or form interactions with multiple stakeholders.



Note: Rectangle: Human Actor; Circle: Non-Human Actant.

Figure 1 Interaction Network between Human Actors and Non-Human Artifacts

3. Methodology

3.1 Framework and Design

The research framework of this study contained two parts. The first was the analysis of secondary data and the second was the data collection and analysis of qualitative research interviews, while the perspective of this paper was formed through the cross-reference and analysis of the two. In terms of research design, the development of an internet-only banks supervisory system in Taiwan was used as a case study, and interviews were conducted on the selected research participants during the period from July 2021 to January 2022 and further corroborated by the personal experiences and observations of the authors. In terms of secondary data, related literature and media reports were compiled for comparison and analysis with the contents of the interviews.

This paper outlines the actor network that emerged after the development of an internet-only banks supervisory system in Taiwan and is the first attempt in Taiwan to engage financial supervision literature with STS scholarships.[6]

3.2 Research Participants, Method, Tools, and Administrative Procedures

Important actors in the construction of Taiwan's internet-only banks supervisory system were chosen as the research participants, and were respectively Deposit Insurance Corp., Industrial Technology Research Institute (ITRI), MetaEdge, LINE Bank, and one other anonymous Internet-only bank.

A semi-structured interview design was used. Related supplementary contents such as the interview invitation letter, interviewees' informed consent form, and interview outline were all audited by the National Chengchi University Research Ethics Review Board in advance to ensure the protection of interviewees.[7] In terms of research tools, the question bank in the interview outline was used as a reference for the interviews and was primarily designed according to the characteristics of the various interviewees. Decisions regarding relevant interview questions were made based on the authors' understanding of the research topic and observations made from the collection and analysis of secondary data, from which relatively open-ended questions were extracted that were able to reflect the necessary aspects of ANT analysis. In terms of administrative procedures, this study provided the interview outline to the interviewees for

[6] There is also literature in Taiwan that adopts an ANT perspective to conduct research in different fields. For example, Chen-Jai Lee, Ben-Chuan Liao, and Cheng-Hsin Dai (2010), "An Analysis of Power and Action in the Context of Local Development: A Comparison of Governmentality and Actor-Network Theory", *Journal of Taiwan Land Research*, Volume 13, Issue 1, Pages 95-134; Hsin-Hui Chou and Chih-Hao Tsai (2013), "Structuring of Interorganizational Relationship Network Governance: A Dynamic Perspective from Actor-Network Theory," *NTU Management Review*, Volume 23, Special Issue, Pages 135-164.

[7] Submission number: NCCU-REC-202105-I022; passed on June 4th 2021.

reference in advance. Because the question bank allows for a certain degree of flexibility, the questions posed in actual interviews did not necessarily follow the order or language of the questions in the question bank, but were rather decided by the flow of the interviews. Each interview was approximately 1.5 to 2 hours in length. Depending on whether the interviewee gave consent, interviews were audio-recorded in their entirety. All interview contents were also transcribed in writing and given to the interviewees to review contents and decide whether to be anonymous.

3.3 Qualitative Research Data Analysis

In terms of the representativeness of research participants, the participants of this study were drawn from the Financial Service Commission (FSC), Deposit Insurance Corp., ITRI, MetaEdge, LINE Bank, Next Bank, and Rakuten Bank. This study attempted to interview all the participants sampled, but because the Financial Service Commission is a competent authority, unless the head that oversaw the policy were interviewed, it would be difficult to know the actual considerations of the FSC's decision to implement its policy regarding internet-only banks. To this end, Li-hsiung Koo, the former chairman who initiated this policy, was unable to participate in the interview due to holding transferred to a key position in National Security Council. Aside from this one exception, this study successfully interviewed all the other participants, except for one internet-only bank owing to an unforeseen circumstance. However, because the interviews were completed for two of the three internet-only banks, sufficient representation was achieved. On the other hand, the two most important players in Taiwan's bank supervisory system, Deposit Insurance Corp. and ITRI, were included among the interviewees, providing sufficient representativeness and feasibility for this study's adoption of an ANT analysis perspective. The purpose of this study was to provide an outline of the actor-network for Taiwan's internet-only banks supervisory system and attempt to engage in empirical research that integrates STS methodology and an ANT perspective in order to depict the reality of interactions between different actors. As such, the qualitative analysis of the data obtained from the interviewees was sufficient to meet the purpose of this study.

This paper faced limitations in terms of the qualitative research and analysis of data. For example, the Financial Supervisory Commission was a key player in the process, but due to the aforementioned interview difficulties, had to be discarded as an interviewee. Nevertheless, the authors played an important long-term advocacy and consultative role in the process of Taiwan's supervisory digitization and the construction of an internet-only banks supervisory system. As such, his first-hand observations of the considerations of competent authorities serves to partially make up for the deficiency of being unable to interview the FSC. Although it is acknowledged that the participation of the author could cause issues of reflexivity, such as whether the participation or responses of interviewees were influenced by the role of the author, from another angle, the author' long-term participation in the aforementioned advocacy and discussion process makes him the most appropriate administrators of this study. In addition to his understanding of related contexts and secondary literature, the trust that was established with each interviewee was also an influencing factor that allowed interviewees to be honest in their interviews. Moreover, from a theoretical perspective, some scholars believe that the intervention of researchers in the research process is inevitably influenced by their own life histories, growth experiences, and even attitudes toward life, and it is therefore not suggested that researchers exclude themselves from research activities (Shih 2003).

4. Analysis and Discussion

4.1 Actor-Network Analysis of Taiwan's Internet-only Banks Supervisory System

4.1.1 Origin of Taiwan's internet-only banks supervisory system

On July 30th, 2019, the FSC announced the approval list for granting permission to establish internet-only banks (FSC 2019). It also disclosed in a public statement made in October of the same year the following; "The FSC has tasked Deposit Insurance Corp. with helping to oversee the relevant liquidity control mechanism. Deposit Insurance Corp. will devise a new financial supervision system for internet-only banking that implements measures such as automated reporting, off-site real-time monitoring, and the real-time provision of relevant data on supervision matters in order to strengthen the liquidity management of internet-only banking." (Chen 2019)

Actually, as early as August 2019, the FSC had asked the joint task force consisting of the Banking Bureau, Financial Examination Bureau, and Deposit Insurance Corp., to implement the "Digital Regulatory Reporting Mechanism" for internet-only banks in accordance with the resolution of the "Discussion Meeting for the Long-term Planning of Possible FinTech Development Projects". After reporting to the FSC in October of the same year, Deposit Insurance Corp. also began to develop an internet-only banks supervisory system.[8] Worthy of note is that the research and development of this internet-only banks supervisory system, from conception, planning, construction, and testing up to actual implementation took a total of roughly one year in terms of time (Chen 2021) (see Figure 2 for the development timeline of the Internet-only Banks Supervisory System).

[8] Source: "Documentation of Deposit Insurance Corporation's Establishment of Internet-only Banks Supervisory System" (hereinafter, "Deposit Insurance Documentation" [on file with author]).

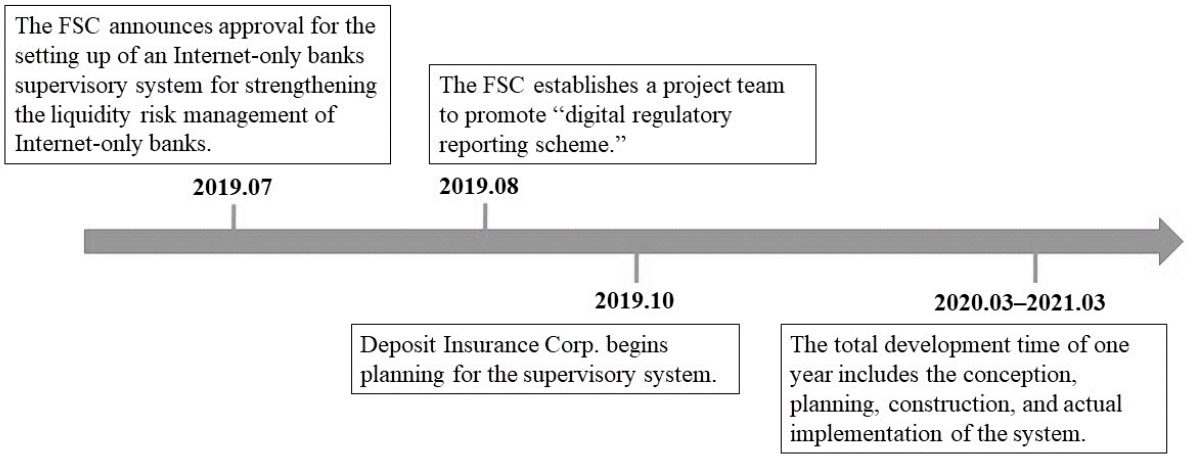


Figure 2 Development Timeline of Internet-only Banks Supervisory System[9]

4.1.2 An ANT analysis of the reasonability of Taiwan's internet-only banks supervisory system

Some researchers may suggest that a system whose construction was seemingly mandated by competent authorities was not suited for ANT analysis because the related actors did not have the freedom of choice to not participate. Nevertheless, the reasons below demonstrate that ANT presents a suitable theoretical perspective for investigating this type of system.

First, the original intention of the FSC's policy was only to ensure the liquidity monitoring of internet-only banks. Even Deposit Insurance Corp. who was entrusted with the implementation of this project expressed in interviews that conflicting opinions were held internally regarding the scale of the project at the time. Colleagues in the risk management department believed that since the objective was liquidity monitoring, if no new monitoring items were needed, the existing monitoring mechanism achieved its purpose and there was no need to create another system. But other colleagues believed that if such a mechanism could be improved so as to become a more comprehensive real-time monitoring system, why not take the opportunity. In other words, because the Deposit Insurance Corp.'s existing system was still sufficient for meeting the objectives of the FSC, there was not necessarily any need to build a new real-time supervisory system for internet-only banks.

In that case, why was the decision made to build another system? It is known that the key consideration that resulted in the birth of the new system was ostensibly that banks had to submit various documents through the single reporting window of the Financial Supervisory Commission's Financial Examination Bureau. Moreover, competent authorities had begun to consider other models such as API for handling different types of reporting. The emergence of internet-only banks in the market thus provided a valuable opportunity to kill two birds with one stone. Consequently, a consensus was reached in Deposit Insurance Corp. under the guidance of former chairman Michael M. K. Lin to build an internet-only banks supervisory system.[10] Chairman Lin not only invested large amounts of time and energy into building the system, but even personally participated in its on-site implementation. His leadership and resolve were consistently mentioned in the interviews conducted by this research as the main reason for why it was believed that an internet-only banks supervisory system could be successfully built and launched online in a timely manner.

In addition, even given the direction of competent authorities, there have still been many cases of failure internationally. The best known case was on the occasion when the United States' Securities and Exchange Commission (SEC) passed relevant laws and regulations in 2012 (Office of the Federal Register 2012) for its decision to build a system for strengthening the monitoring of securities market trading activities. Furthermore, self-regulatory organizations, including the New York Stock Exchange, were responsible for building the Consolidated Audit Trail (CAT) supervisory system to serve as a warehouse for tracking security transactions and for implementing real-time monitoring (Wishnick 2021). However, due to problems with the bid winners themselves as well as a multitude of information security and system design-related concerns, CAT was suspended at the insistence of the US Congress. It was only after the passing of many years that this project was launched again in recent years (Rundle and Malakian

[9] Credit to research assistant Yu-Jhen Lai for the figure.
[10] Chairman Michael M. K. Lin later retired in June 2021. He currently serves as Chairman of the Insurance Stabilization Fund.

2019).

It is thus clear that although the will and resolution of competent authorities is important, the actual process of system construction may diverge from expectations due to the dynamic changes of different actors. As a result, it is still necessary to use ANT to track the process of the construction of Taiwan's internet-only banks supervisory system.

4.1.3 Actions and translation of system builders

After deciding to build an internet-only banks supervisory system, the first issues that Deposit Insurance Corp. had to resolve were those regarding technology and professionalism. At this time, Deposit Insurance Corp. faced pressures from two major sources. First were the expectations of the competent authority, and the second involved the expectations of the internet-only banking market and operators. After a permit was obtained, the three operators began to actively plan and strove to officially obtain a business license within one to two years. However, the conditions for obtaining a business license not only required the integration of a deposit insurance system, but also building a corresponding API system and the interface for the deposit insurance system as well as the completion of testing. Consequently, Deposit Insurance Corp. was under considerable time pressure due to being required to complete system building and testing within the timeline of one year.

Due to the two reasons, Deposit Insurance Corp. required external assistance and resources. It was during this time that through the introduction of this paper's author and the FSC, it began to consider the possibility of entering a collaborative partnership with ITRI. It is also worth mentioning that the author of this paper has been invited as a scholar by Deposit Insurance Corp. to give speeches on Suptech topics, and frequently participates in speeches and advocacy regarding the international trends and necessity of Suptech's development in Taiwan, among which audiences include FSC's high-ranking supervisors. Therefore, the author probably conform to the definition for the role of spokesperson espoused by Latour as having played a considerable role in the early stages of the recruitment of actors and forming of connections.

From the perspective of Deposit Insurance Corp., ITRI holds abundant information technology research and development capacities due to being a government-supported foundation. In addition, it is an organization that has a high inclination towards public welfare as well as a strong sense of purpose, making it an ideal collaboration partner. With this being the case, what then was ITRI's motivation for collaborating with Insurance Deposit Corp. to establish a system? Several years previously, ITRI had already realized it could no longer focus on the research and development of core technologies and then carry out technology transfer afterwards but must pay more attention to market needs and find ways to provide applicable solutions that resolve the problems of operators. This new direction in thinking resulted in a reform in ITRI's Information and Communications Research Laboratories, leading to the establishment of the "Financial and Supervision Technology Department" which aims to assist supervision agencies and other peripheral units with the promotion of Suptech solutions. It was also due to such a change that before the system was established, ITRI had invested great efforts into holding visits with FSC executives and financial institutions and engaging in collaborative research with scholars to establish recognition in the market.

As a result, the collaboration between Deposit Insurance Corp. and ITRI had undergone the *problematization* and *interessement* phases of Michel Callon's four phases of translation (Lee, Liao, and Dai 2010; Callon 1984). First, the question posed by ITRI was initially unclear: "How must our area of expertise be used to help Taiwan's financial supervisory agencies launch supervisory technology?" However, through the defining and clarification of the task by Deposit Insurance Corp., the following consensus was formed between the two parties: "How must a supervisory system for internet-only banks be set up in the shortest time possible that can simultaneously be used for regulatory reporting and the monitoring of liquidity risks?" It was the formulation of such a question that allowed both parties to enter the "Obligatory Point of Passage (OPP)" phase as defined by ANT and form a preliminary consensus.

Although the two organizations entered an obligatory point of passage, from the perspective of ITRI, it still needed to clarify its role as well as obtain interest incentives (Chou and Tsai 2013). It is known from the interviews that because Deposit Insurance Corp. is a competent authority and did not have a clear understanding of the specifications for an internet-only banks supervisory system, it could not directly invest economic resources on commissioning ITRI to play the role of a system builder. Consequently, in the beginning, ITRI was required to assist Deposit Insurance Corp. with the evaluation of system specifications and general direction issues, after which Deposit Insurance Corp. independently confirmed the scope and requirement specifications for system construction and issued a contract according to government procurement laws and regulations.

It is worth noting that within the cultural context of Taiwanese society where government agencies are seemingly faulted at every turn, if it were not for a public-welfare-based government foundation such as ITRI, government agencies that want to launch collaborations with purely private manufacturers would likely face immense difficulties as well as unnecessary doubts. As a result, the translation process for the two actors Deposit Insurance Corp. and ITRI for the most part had already formed upon the establishment of incentives. This was the case because both parties had a common awareness of the problems concerning the development of a supervisory system and both needed the incentives of the other party. However, they still had to follow legal regulations and governmental procurement procedures before they

could begin enrollment procedures. Thus, from the perspective of ITRI, it was not imperative for them to assist Deposit Insurance Corp. in the development of an internet-only banks supervisory system. However, because in the end ITRI was the only bidder, it is unable to be determined whether there was a process or necessity for the mobilization of actors during the translation process.

4.1.4 Actors interactions in the process of setting up an internet-only banks supervisory system

After choosing its collaborative partner for the setting up of an internet-only banks supervisory system, Deposit Insurance Corp. began to carry out planning for the two major components of the internet-only banks supervisory system: the liquidity supervisory system and the real-time supervisory system.

In terms of the liquidity supervisory system, Deposit Insurance Corp. had planned that internet-only bank operators must report through API daily deposit and loan balances and liquid reserve ratios, and then on the last business day of every week, report in a similar manner regarding the cash on hand, due from banks (including the Central Bank), balance of interbank transfer guarantee accounts, as well as the available interbank financing amount, in order to determine the status of liquid assets available for the next week.[11]

Regarding the real-time supervisory system, the real-time monitoring of the balance of "Interbank Funds Transfer Guarantee Special Accounts" (#87 accounts), in addition to the real-time monitoring of non-executable deposits were the primary objectives.

In terms of the balance of #87 accounts, internet-only banking transactions do not distinguish between time of day and as a result funds can be transferred online or retrieved via ATM in an extremely short period of time. Consequently, the balance of internet-only banks and other financial institutions' #87 accounts is an important indicator in determining whether internet-only banks can provide sufficient liquidity. If too many customers transfer out funds in a short period of time, this causes a reduction in the #87 account balances of certain financial institutions. Deposit Insurance Corp. currently requires that internet-only bank operators set 20% of the daily balance of #87 accounts as alert values, in addition to making an immediate report to Deposit Insurance Corp. through API when a balance falls below the alert value. If the balance continues to decrease, reports should continue to be made until the balance exceeds the alert value.[12]

In terms of failed deposit reports, if the reason customers were unable to complete transactions online was attributed to software abnormalities, information security incidents, the inappropriate behavior of personnel, or other reasons, internet-only bank operators must immediately make a report through API to Deposit Insurance Corp. when "a transaction has been unable to be completed for over 10 minutes".[13]

It is worth noting that Deposit Insurance Corp. personnel possessing various levels of access are enabled to use their mobile phones to receive alerts and browse visual supervision data owing to the design of such real-time reports.

The above system design and the related values for alerts and notifications require the constant communication and coordination between Deposit Insurance Corp., authorities inclusive of Central Bank, as well as the three internet-only bank operators. Such a process also involves the decisions around several issues: system specifications, data transmission methods, interface pipelines, formatting of data reports, and scalability of future systems. Each issue at its core implicates the finance and business information of internet-only bank operators. The submission of such data is at first quite alien to first-time bank operators, who are also required to allocate considerable manpower from the finance department, risk department, as well as the information department to carry out processing.

Consequently, internet-only banks must seek the assistance of external vendors. It was perhaps not a coincidence that each of the three internet-only banks ended up appointing the same system integrator, MetaEdge Corporation, to aid them in the construction of a relevant legal reporting system that meets the requirements of Deposit Insurance Corp. MetaEdge had focused on regulatory reporting and information storage in the financial industry for many years. The key reason why it was able to receive offers from the three banks simultaneously was probably due to the need for internet-only banks to obtain business licenses and open for business in an extremely short period of time. In addition, the regulatory reports processed by banks are extremely complicated, implicating not only reporting requirements, but also domain knowhows such as post-reporting checkpoints. It was thus such time pressure that caused the banks to decide to find someone with experience in this field. As it turned out, the unanimous decision made by the three banks inadvertently played an important role in the construction of the internet-only banks supervisory system. In other words, MetaEdge played the role of acting as a bridge for the three banks' communication with Deposit Insurance Corp. or ITRI by helping to effectively level the gaps of understanding between both sides.

Of course, interviewees also stated that because reporting for the internet-only banks supervisory system requires the collection of information and reports that do not exist in ordinary commercial banks, although MetaEdge was certainly effective in providing banks with a fluid interface for making reports using their own core systems, many

[11] Deposit Insurance Documentation (on file with author).
[12] As above.
[13] As above.

reporting contents were a novelty even to MetaEdge, who in the end, still had to put in quite a lot of additional work. On the other hand, due to the requirement that internet-only banks must be individually assessed and evaluated before they can be opened for business, in the testing phase after the completion of the system, Deposit Insurance Corp. and ITRI still had to individually carry out testing with each of the three banks.

4.1.5 Influence of non-human actants

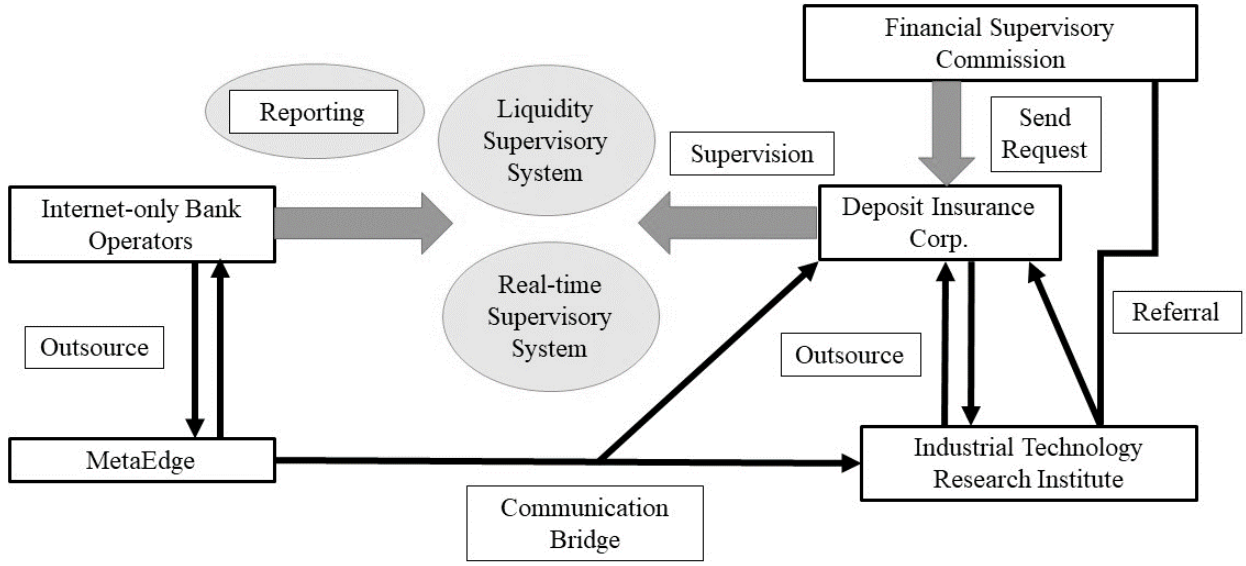
Besides human actors, the most unique feature of an internet-only banks supervisory system is the perception of the mechanisms, systems, and technologies that it generates and builds as extremely important non-human actants. These non-human actants include reporting forms, API technologies and specifications, as well as system check and alert functions. During actual implementation, these non-human actants influence the internal operating methods and resource investments of nearly all actors in this internet-only banks supervisory system actor network. In addition, some researchers have used the perspective of ANT to suggest that researchers should focus on the impact of non-human actants in the forming of market activities and market behaviors. Such a perspective reflects that of the continued observation of the role played by technological artifacts in internet-only banks supervisory systems (Chen, Hsu, and Chao 2019). Basically, non-human actants play the role of facilitating the presentation of mutual casualties between actors, giving researchers sufficient interactive processes for earnestly understanding the contexts and dynamics in actor networks (Latour 2005).

From the perspective of internet-only banks, the transfer of data into databases by means of API not only shortens human submission times, but also allows for the integration and cross-tabulation of transmitted data and cross-column checks performed automatically by the system, eliminating the need for human audit. However, during actual implementation, before internet-only bank operators send data through API, they still must attend to the correctness of report information. It is thus hoped that before the submission of reports, a management review procedure can be added to internal procedures. This amplifies the point that the automated functions of supervisory systems do not necessarily demand the complete automation of all operational processes, as from the standpoint of banks, the automated confirmation of data correctness before submission may pose a considerable challenge.

Secondly, the mechanism for filing a report when “a transaction has been unable to be completed for over 10 minutes” has the effect of making it difficult for banks to identify false information. Because processing times are lengthy and implicate layers of internal review procedures, this also impacts and result in changes to the reporting management procedure for bank contents. To conform to regulations, banks will have to prepare according to factors such as internal information flows, generation of warnings, and post-warning procedures.

In other words, a single non-human mechanism will influence aspects such as the internal information arrangement and manpower allocation of banks. For example, banks need to arrange the necessary manpower for tasks such as conducting reviews and finding the sources of problems at the earliest moment possible, to which the positive developments brought about by digital reporting systems will, in the initial stages, bring a considerable burden to bank employees and also necessitate making adjustments to banks’ internal distribution of labor and power. In addition, the presence of such non-human actants will also cause internet-only banks to formulate corresponding internal regulations, conduct drills, and adjust internal standard operating procedures or the distribution of labor and power, which reflects the deep influence that non-human actants have on this actor network.

On the other hand, once an alert notification is produced by the system in accordance with set parameters, the regulators of supervision agencies must attend to related processes immediately. This requires a division of labor, as well as the establishment of a standard operating procedure and a corresponding accountability mechanism for reporting, which brings regulators considerable pressure, as the timestamps left behind by alert notifications will be able to be traced by the outside world in the future. It may therefore be because of such a design, in addition to an environment in which the outside world is highly critical of public service systems, that regulators may not entire accept of this kind of technological function (Tsang 2021). This may also result in developments that were not anticipated when this actor network first developed. In order words, such a supervisory system that is technologically driven is in line with the views of STS academia; that is, as a technological artifact with political attributes, it will influence and shape the culture and order within financial supervision agencies and may even transform existing supervision methods (Written by Winner, translated by Fang and Lin 2004).



Note: Rectangle: Human Actor; Circle: Non-Human Actant.

Figure 3 Network Formation and Interaction of Taiwan's Internet-only Banks Supervisory System[14]

4.2 Implications for Fintech Supervision

The players in the case included Deposit Insurance Corp. and ITRI and featured the leadership role of the former in system building and the unexpected role of MetaEdge as a communication bridge. In this actor network, the actor with the lowest activity or agency can be said to be internet-only bank operators,[15] who, to obtain a business license and open for business, could only comply with related system building and testing processes. However, as they could rely on an external system integrator to aid in the communication process, their profile is not one that is entirely lacking in activity or agency.

Furthermore, the non-human actants in this actor network cause numerous internal organizational and procedural changes for internet-only bank operators as well as adjustments in manpower allocation. These changes are inevitably reflected in the scope of understanding and monitoring required by regulators, which may cause them to have to decide whether to adjust the design of the non-human mechanisms and technological artifacts of internet-only banks supervisory systems. As a result, when such networks first form, the activity of different actors may not exhibit an equal state, but as the networks evolve, the agency of different actors may change, which then reshapes the actor network.

The above actor network analysis of Taiwan's internet-only banks supervisory system has the following implications in regard to the cross-boundary collaborations for fintech.

(1) Supervisory digitalization is an important international trend that may in the future give birth to actor networks that have Suptech systems at their core in various countries. The actors in these networks must have a clear understanding of their respective positions, objectives, interests, and incentives, and should engage in dynamic cooperation to resolve issues in financial supervision.

(2) Fintech's development implicates regulators' understanding of science and technology and technological artifacts, but such understanding is unable to be formed or accumulated in a vacuum. To this end, building a Suptech system is a field of application that is well suited for regulators' accumulation of relevant knowledge. By means of viewing themselves as an actor, regulators can objectively recognize the interactive relationship that exists between their supervisory measures and technology, and further develop supervisory models and strategies that are conducive to the management and control of the risks brought about by fintech activities.

(3) The perspective of actor network analysis is beneficial to financial supervision agencies' understanding of the complicated network they partake in and facilitates understanding of the influences and entanglements that non-human actants bring to the agency and activity of different actors in the actor network. When financial supervision

[14] Credit to research assistant Yu-Jhen Lai for the figure.

[15] The following study can be used as a reference for the activity level of actors: Wen-Yuan Lin (2014), "Invisible Agency: A Theory of Displacement for Subalterns", Taipei: Institute of Sociology, Academia Sinica.

agencies initiate cross-boundary (cross-border and cross-industry) regulatory collaborations in the future, they will be able to better examine their own activity level and positioning and can attempt to predict the possible actions of various actors in the actor network so as to improve the efficiency of financial supervisory collaborations.

Such implications have considerable value in regard to Taiwan's development of Suptech. First, the development of Suptech cannot be completed by supervisory agencies alone, but requires frequent collaboration with various stakeholders, including technology providers, system integrators, and academic research institutions. These collaborations will be beneficial to deepening regulators' understanding of the potential and limitations of using Suptech as a technological artifact and in investing limited supervision resources more effectively.

5. Conclusion

The purpose of this study was to introduce the development of digital regulatory reporting as well as the process of Taiwan's building of a digital reporting mechanism and hopes to use the perspective of the Actor-Network Theory (ANT) to present the dynamics encompassed in the birth and construction of Taiwan's internet-only digital reporting mechanism.

This paper's analysis has several important implications in regard to cross-boundary Fintech supervision collaborations. First, building a Suptech system is a field of application that is well suited for regulators' accumulation of relevant knowledge. By means of viewing themselves as an actor, regulators can objectively recognize the interactive relationship that exists between their supervisory measures and technology, and further develop supervisory models and strategies that are conducive to the management and control of the risks brought about by fintech activities. Secondly, the perspective of actor network analysis is beneficial to financial supervision agencies' understanding of the complicated network they partake in, and facilitates understanding of the influences and entanglements that non-human actants bring to the agency and activity of different actors in the actor network. When financial supervisory agencies initiate cross-boundary (cross-border and cross-industry) regulatory collaborations in the future, they will be able to better examine their own activity level and positioning and can attempt to predict the possible actions of various actors in the actor network so as to improve the efficiency of financial supervisory collaborations.

The contribution of the above implications is that the development of Suptech in Taiwan cannot rely on supervisory agencies alone but requires collaboration between various stakeholders. Furthermore, the observation of the dynamics as well as the activities and agencies of different actors in the collaborative process will assist regulators in the promotion and pre-assessment of the effectiveness and limitations of related Suptech solutions in the future.

It is hoped that by means of this paper's attempt to engage in cross-boundary research, the attention of STS researchers may be drawn to inject even greater intellectual energy into financial supervision and fintech literature.

References

1. Chinese

Chen, Hui-Ling (2019), "Sneak Peek of the FSC Report: Strengthening Supervision on Six Aspects to Reduce Liquidi ty Risks of Internet-only Banks," Anue, (accessed October 5, 2022), [available at https://news.cnyes.com/news/id /4392330].

Chen, Jui-Chih and Wen-Kai Pao (2007), "The Study of the Information System Performance in the Government Departments - The Case of the National Taxation Information System," *Chung Yuan Management Review*, 5(2), 73-96.

Chen, Jui-Lin (2010), *Philosophy of Science: A Theoretical and Historical Introduction*. Taipei: Socio.

Chen, Shin-Horng (2020), "Effects of Users on Technology Adaptation: Multi-Case Studies from Morphogenetic Approach," *NTU Management Review*, 30(3), 77-110.

Chen, Yi-Cih (2021), "Realtime Liquidity Supervision of Internet-only Banks: Taiwan Takes the Lead," *Economic Daily News*, (accessed October 5, 2021), [available at https://money.udn.com/money/story/5613/5851058].

Chen, Yu-Hsiang, Shu-Hsiang Hsu, and Yu-Han Chao (2019), "Trust as a Rational Calculation Foundation: P2P Lending in Taiwan," *Taiwanese Journal of Sociology*, 66(December), 1-54.

Cheng, Jacob Chun, Chao-Min Chiu, Ting-Peng Liang, Jack Shih-Chieh Hsu, and Yi-Chen Chen (2022), "Understanding the Drivers of Switching to Internet-only Bank from the PPM Perspective," *Sun Yat-Sen Management Review*, 30(1), 3-36.

Chou, Hsin-Hui and Chih-Hao Tsai (2013), "Structuring of Interorganizational Relationship Network Governance: A Dynamic Perspective from Actor-Network Theory," *NTU Management Review*, 23(SI), 135-164.

Financial Service Commission (2018), "Policy Statement for the Establishment of Internet-Only Banks," (accessed Ja nuary 3, 2013), [available at https://www.fsc.gov.tw/ch/home.jsp?id=96&parentpath=0,2&mcustomize=news_vi ew.jsp&dataserno=201804260002&aplistdn=ou=news,ou=multisite,ou=chinese,ou=ap_root,o=fsc,c=tw&dtable= News].

---- (2019), "Granting of Internet-only Bank Approval," (accessed October 5, 2022), [available at https://www.fsc.gov. tw/ch/home.jsp?id=96&parentpath=0,2&mcustomize=news_view.jsp&dataserno=201907300001&aplistdn=ou= news,ou=multisite,ou=chinese,ou=ap_root,o=fsc,c=tw&dtable=News].

Fu, Dai-Wie (2019), *A Genealogical History of STS and Its Multiple Constructions: To Weave an Extensive Network for Gazing upon the Modern Sciences*. Taipei: National Taiwan University Press.

Hung, Shin-Yuan, Ting-Peng Liang, and Chia-Ming Chang (2005), "A Meta-Analysis of Empirical Research Using TAM," *Journal of Information Management*, 12(4), 211-234.

Kang, Sin-Yun and Hsu-Tung Lee (2021), "A Study on the Adoption of Internet-only Bank Based on UTAUT and Status Quo Bias," *Soochow Journal of Economics and Business*, 103(December), 39-66.

Latour, Bruno (2004), "Give Me a Laboratory and I Will Raise the World (translated by Tzung-De Lin)," in *Social Aspirations of Technoscience: Taiwanese Readers of STS Translation I*, Chia-Ling Wu, Dai-Wie Fu and Sean Hsiang-Lin Lei, eds. Taipei: Socio, 210-263.

Lee, Chen-Jai, Ben-Chuan Liao, and Cheng-Hsin Dai (2010), "An Analysis of Power and Action in the Context of Local Development: A Comparison of Governmentality and Actor-Network Theory," *Journal of Taiwan Land Research*, 13(1), 95-134.

Lee, Wo-Chiang (2018), "Niches and Challenges of Internet-only Banks in Taiwan," *Accounting Research Monthly*, 389(April), 19-23.

Lin, Wen-Yuan (2007), "On the Ontology of Actor-Network Theory," *Taiwanese Journal for Studies of Science, Technology and Medicine*, 4(April), 65-108.

---- (2014), *Invisible Agency: A Theory of Displacement for Subalterns*. Taipei: Institute of Sociology, Academia Sinica.

Lin, Yueh-Chin and Jing-Wen Huang (2012), "An Application of Technology Acceptance Model to Government Budgeting and Accounting System," *Journal of Technology Management*, 17(4), 1-37.

Lo, Ching-Lin (2020), "Are Internet-only Banks Able to Gain Profits in Three Years? – Analysis Based on Comparable Company Operating Conditions in South Korea and Japan," *Money Watching & Credit Rating*, 144(July), 4-16.

Lu, Huan-Mo (2019), "Finance 4.0 - Taiwan Must Develop Internet-only Banks that Do Not Act like Banks," *Money*

Watching & Credit Rating, 137(May), 107-122.

Ou Yang, Shirley and Carol Hsu (2017), "A Literature Review of the Information Technology Adoption, Implementation, and Related Themes in Information Systems Research in Taiwan (2000-2015)," *NTU Management Review*, 27(3), 215-252.

Peng, Jin-Lung and Cheng-Yun Tsang (2019), "FinTech Regulation and a Review of Taiwan's Financial Regulatory Sandbox Mechanism," *Management Review*, 38(4), 15-31.

Shen, Chung-Hua and Lee-Rong Wang (2020), *Comptech, Suptech, and Fintech Regulation*. Taipei: Taiwan Academy of Banking and Finance.

Shih, Chih-Yu (2003), "Why Do Social Scientists Do Research? -A Critical Note," *Universitas: Monthly Review of Philosophy and Culture*, 30(3), 135-154.

Tsang, Cheng-Yun (2018), "A Tentative Analytical Framework and Developing Roadmap for SupTech," *Management Review*, 37(4), 15-39.

---- (2019), "Proposals for Developing SupTech in Taiwan," *Deposit Insurance Quarterly Journal*, 32(4), 50-77.

---- (2021), "Critical Challenges for Developing SupTech – Taiwan's Digital Regulatory Reporting Mechanism for Internet-only Banks as an Example," *The Taiwan Law Review*, 316(September), 36-52.

---- (2022), "*Analyzing Fintech Regulation through the Lens of STS*," in *Imagination of Law 4: Social Science and Law*, Editors Group of Essays in Honor of Professor Su Yung-Chin's 70th Birthday, eds. Taipei: Angle, 809-824.

Wang, Lee-Rong (2020), "Global Trends and Types of FinTech Supervision Development," *Economic Outlook Bimonthly*, 187(January), 18-24.

Winner, Langdon (2004), "Do Artifacts Have Politics? (translated by Jyun-Yu Fang and Chung-His Lin)," in *Social Aspirations of Technoscience: Taiwanese Readers of STS Translation I*, Chia-Ling Wu, Dai-Wie Fu and Sean Hsiang-lin Lei, eds. Taipei: Socio, 123-131.

Zhou, Pei-Ling (2019), "Operating Characteristics and Risks of Internet-only Banks," *Accounting Research Monthly*, 408(November), 78-85.

2. English

Avgouleas, Emilios (2005), "The Regulation of Market Abuse," in *The Mechanics and Regulation of Market Abuse - A Legal and Economic Analysis*. Oxford; New York: Oxford University Press, 156-236.

Barnes, Barry (1982), *T. S. Kuhn and Social Science*. New York: Columbia University Press.

Beerman, Kenton, Jermy Prenio, and Raihan Zamil (2021), "FSI Insights on Policy Implementation No. 37: Suptech Tools for Prudential Supervision and Their Use During the Pandemic," *BIS*, (December 2), (accessed January 3, 2023), [available at https://www.bis.org/fsi/publ/insights37.pdf].

Broeders, Dirk and ---- (2018), "FSI Insights on Policy Implementation No. 9: Innovative Technology in Financial Supervision (Suptech) – The Experience of Early Users," *BIS*, (July 16), (accessed January 3, 2023), [available at https://www.bis.org/fsi/publ/insights9.pdf].

Brownsword, Roger and Karen Yeung (2008), *Regulating Technologies Legal Futures, Regulatory Frames and Technological Fixes*. Oxford: Bloomsbury.

Brummer, Chris and Yesha Yadav (2019), "Fintech and the Innovation Trilemma," *Georgetown Law Journal*, 107(2), 235-307.

Callon, Michel (1984), "Some Elements of Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay," in *Power, Action and Belief: A New Sociology of Knowledge*, John Law, ed. Boston: Routledge & Kegan Paul, 196-233.

Chiu, Iris H-Y. (2016), "Fintech and Disruptive Business Models in Financial Products, Intermediation and Markets - Policy Implications for Financial Regulators," *Journal of Technology Law and Policy*, 21(1), 55-112.

Cole, Simon A. and Alyse Bertenthal (2017), "Science, Technology, Society, and Law," *Annual Review of Law and Social Science*, 13(October), 351-371.

Crisanto, Juan Carlos, Katharina Kienecker, Jermy Prenio, and Eileen Tan (2020), "FSI Insights on Policy Implementation No. 29: From Data Reporting to Data-Sharing: How Far Can Suptech and Other Innovations Challenge the Status Quo of Regulatory Reporting?" *BIS*, (December 16), (accessed October 5, 2022), [available at https://www.bis.org/fsi/publ/insights29.pdf].

di Castri, Simone, Stefan Hohl, Arend Kulenkampff, and ---- (2019), "FSI Insights on Policy Implementation No. 19: The Suptech Generations," *BIS*, (October 17), (accessed January 3, 2023), [available at https://www.bis.org/fsi/publ/insights19.pdf].

Faulkner, Alex, Bettina Lange, and Christopher Lawless (2012), "Introduction: Material Worlds: Intersections of Law, Science, Technology, and Society," *Journal of Law and Society*, 39(1), 1-19.

Goodhart, Charles, Philipp Hartmann, David T. Llewellyn, Liliana Rojas-Suarez, and Steven Weisbrod (1998), *Financial Regulation, Why, How, And Where Now?* London: Routledge.

Latour, Bruno (1983), "Give Me a Laboratory and I Will Raise the World," in *Science Observed: Perspectives on the Social Study of Science*, Karin D. Knorr-Cetina and M. Mulkay, eds. London: Sage Publications, 141-170.

---- (2005), *Reassembling the Social: An Introduction to Actor-Network Theory*. London: Oxford University Press.

Law, John (2017), "STS as Method," in *The Handbook of Science and Technology Studies*, Ulrike Felt et al., eds. Cambridge, MA: The MIT Press, 31-57.

Newton, Tim J. (2002), "Creating the New Ecological Order? Elias and Actor-Network Theory," *Academy of Management Review*, 27(4), 523-540.

Office of the Federal Register, National Archives and Records Administration (2012), "Consolidated Audit Trail," (August 01), (accessed October 05, 2022), [available at https://www.govinfo.gov/content/pkg/FR-2012-08-01/pdf/FR-2012-08-01.pdf].

Omarova, Saule T. (2020), "Technology v Technocracy: Fintech as a Regulatory Challenge," *Journal of Financial Regulation*, 6(1), 75-124.

Pinch, Trevor and Wiebe Bijker (1984), "The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other," in *The Social Construction of Technological Systems - New Directions in the Sociology and History of Technology*, Wiebe E. Bijker, Thomas P. Hughes, and Trevor J. Pinch, eds. Cambridge: The MIT Press, 17-50.

Quinn, Dennis (1997), "The Correlates of Change in International Financial Regulation," *The American Political Science Review*, 91(3), 531-551.

Riles, Annelise (2011), *Collateral Knowledge: Legal Reasoning in the Global Financial Markets*. Chicago: University of Chicago Press.

---- (2018), *Financial Citizenship: Experts, Publics, and the Politics of Central Banking*. Ithaca: Cornell Global Perspectives.

Rundle, James and Anthony Malakian (2019), "CAT's Tale: How Thesys, the SROs and the SEC Mishandled the Consolidated Audit Trail," *Waters Technology*, (February 14), (accessed October 5, 2022), [available at https://www.waterstechnology.com/regulation/4152906/cats-tale-how-thesys-the-sros-and-the-sec-mishandled-the-consolidated-audit-trail].

Schooner, Heidi M. and Michael W. Taylor (2010), *Global Bank Regulation: Principles and Policies*. Burlington: Academic Press.

Shim, Yongwoon and Dong-Hee Shin (2016), "Analyzing China's Fintech Industry from the Perspective of Actor-Network Theory," *Telecommunications Policy*, 40(2-3), 168-181.

Stiglitz, Joseph (2009), "Government Failure vs. Market Failure: Principles of Regulation," in *Government and Markets: Towards A New Theory of Regulation*, Edward J. Balleisen and David A. Moss, eds. New York: Cambridge University Press, 13-51.

Wishnick, David (2021), "Reengineering Financial Market Infrastructure," *Minnesota Law Review*, 105(January), 2379-2441.

Zetzsche, Dirk A., Ross Buckley, Janos Barberis, and Douglas Arner (2017), "Regulating a Revolution: From Regulatory Sandboxes to Smart Regulation," *Fordham Journal of Corporate & Financial Law*, 23(1), 31-103.