

Mousa, Rania; Ozili, Peterson K.

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Article

A Futuristic View of Using XBRL Technology in Non-Financial Sustainability Reporting: The Case of the FDIC

Rania Mousa ^{1,*}  and Peterson K. Ozili ² 

¹ Accounting Department, Schroeder School of Business, University of Evansville, Indiana, IN 47715, USA

² Governors Department, Central Bank of Nigeria, Garki, Abuja P.M.B. 0187, Nigeria

* Correspondence: rm190@evansville.edu

Abstract: The rapid use and development of information and communication technology capabilities in the public sector has revolutionized the mechanism that government agencies use to collect, process, and disseminate data. Electronic government is one of the strategic initiatives that many government agencies have considered adopting to offer efficient web-based services and operations. Although there have been efforts to examine the implementation process of technological innovations in financial and business reporting, many government agencies are about to face a bigger challenge in developing or adopting current technologies to assess their usefulness for non-financial sustainability reporting. The Extensible Business Reporting Language, XBRL, has been adopted by the U.S. Federal Deposit Insurance Corporation (FDIC) to process financial data in the quarterly call reports filed by banks. Using Rogers' well-established theory of innovation adoption process, this paper discusses the FDIC's XBRL implementation process and investigates the roles and experiences of the agency's stakeholders. A case study research methodology, supported by semi-structured interviews, is used to explore each phase of the implementation process. The findings reveal that the process was facilitated by stakeholder engagement, technical support, and the agency's strategic decision-making process. This paper contributes to the literature by examining the applications, benefits, and challenges of using XBRL technology to process non-financial sustainability data, which is still an under-researched area. Therefore, the implications for using the technology in non-financial reporting will be insightful for future regulatory adopters and their stakeholders including filer banks, software vendors, and various users of financial and non-financial information.

Keywords: Federal Deposit Insurance Corporation (FDIC); United States; Extensible Business Reporting Language (XBRL); e-government; sustainability; non-financial reporting



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1. Introduction

Electronic government initiatives have become an essential mechanism to boost the performance of government agencies in collecting, processing, and disseminating regulatory data (Kraemer and King 2003; Detlor et al. 2010; Sagheb-Tehrani 2010). Governments are increasingly aware of the potential of reporting technologies to support and facilitate the delivery of electronic information and services to different stakeholders. Electronic government has emerged as a process which provides significant advantages, such as cost savings, increased government accountability, and improved and timely communication and coordination among different government agencies (Eyob 2004; Heeks 2006). Tahinakis et al. (2006) believe that the development of e-government initiatives enhance the efficiency of tax administration operations as more regulatory authorities utilize web-based reporting systems. Heeks (2006) also asserts that the implementation of e-government initiatives is a complex process. The complexity stems from different factors, including technical infrastructure, organizational resources, stakeholder engagement, user resistance, and government regulations that affect the e-government implementation process.

As established by [Mousa \(2011\)](#), XBRL technology is a process technological innovation which is greatly driven by stakeholder engagement to help the technology adopter cope with the changes brought by the newly adopted innovation and possible user resistance. The interaction between the technology adopter and its stakeholders has been documented in the literature as a crucial factor to create, develop, and modify the technology in different organizational adoption contexts. For example, [Calabrese and Corbò \(2014\)](#) emphasize the importance of stakeholder management and the impact of using certain techniques to drive the implementation of total quality management in service organizations. [Troshani and Hill \(2009\)](#) use qualitative evidence to demonstrate the profound role of organizational stakeholders in the diffusion of mobile services. In the specific context of XBRL technology adoption, [Jahangirian et al. \(2015\)](#) discuss the fundamental role of stakeholder engagement in fostering the success of operational research initiatives in a UK healthcare setting. Furthermore, [Mena et al. \(2010\)](#) point out that XBRL-based project documentation facilitates an efficient information exchange between the stakeholders in the Spanish Architectural Engineering and Construction sector. Additionally, [Ayoub et al. \(2019\)](#) show that the human factor, as a component of organizational culture, influences the successful adoption of XBRL based on their research on 78 small to medium-sized firms in Lebanon. [Doolin and Troshani \(2007\)](#)'s research, focusing on the early stages of XBRL adoption in Australia, underscores the importance of having organizational champion(s) to build a dynamic network of XBRL technology suppliers, adopters, and software vendors to increase the momentum of the technology diffusion process. [Troshani and Hill \(2007\)](#) and [Mousa \(2013\)](#) suggest that building a strong technical infrastructure through meaningful collaboration with software vendors and other government agencies provides a good opportunity for adopters to leverage external expertise and address implementation challenges and user concerns. [Liu et al. \(2014\)](#)'s research on Chinese XBRL corporate adopters suggests that XBRL adoption could be further accelerated by imposing regulatory mandates with stricter policies on quality assurance to ensure the quality and reliability of information reported in XBRL taxonomy.

Despite the benefits of e-government initiatives in the information technology community, regulatory adopters across the globe have faced several challenges during the adoption process. In the process of adopting e-government initiatives, [Margetts and Dunleavy \(2002\)](#), [Mextaxiotis and Psarras \(2004\)](#) and [Shareef et al. \(2009\)](#) emphasize that the process of adopting e-government initiatives is often hampered by several challenges, including technical infrastructure issues, insufficient organizational resources, poor stakeholder engagement, and strong user resistance. Despite the growing adoption of XBRL among international regulatory authorities, there is little evidence on how regulatory authorities deal with the challenges posed by XBRL adoption. Existing studies present little empirical evidence on how regulatory authorities have addressed the challenges faced while adopting XBRL. This paper aims to fill this research gap by discussing the challenges faced by the U.S.'s FDIC as one of the first government agencies that implemented XBRL. In addition, the paper examines the realized benefits and lessons learned from the agency and its stakeholders' perspectives.

We conducted five interviews with the Senior Data Strategist at the FDIC's Division of Insurance and Research, the President and Chief Technology Officer at a major regulatory software development company and the Principal Accounting Officer (currently a Senior Vice President), and a Senior Bank Analyst (currently a Manager of the Financial Reporting Department) at a commercial bank. The interview questions are provided in the Appendix A. It was found that the FDIC's adoption of XBRL for non-financial sustainability reporting was made possible through stakeholder consultations and technical support by information technology experts. The potential use case of XBRL by the FDIC is for collecting, processing, and storing non-financial sustainability information of banks, particularly climate-related disclosures of banks. The identified challenges are whether the FDIC will share sustainability information, whether FDIC will develop its own non-financial sustainability reporting rules while ignoring existing non-financial reporting accounting

standards, whether all banks will be required to adopt the non-financial sustainability reporting rules, and whether the requirement will be mandatory or voluntary. The findings of this case study will inform policy makers, academics, and practitioners about the specific applications or use cases of XBRL in regulatory and supervisory agencies.

Our study contributes to the literature in the following ways. Our study contributes to the non-financial reporting literature. Existing studies have not explored the potential use, applications, benefits, and challenges of using XBRL to process non-financial sustainability data in call reports. Given that this area is under-researched in the literature, we contribute to the literature by exploring the potential use, applications, benefits, and challenges of using XBRL technology in a non-financial sustainability reporting context. Second, we contribute to the literature by focusing our analysis on a unique regulatory setting. Existing studies have not examined the potential use case of XBRL technology in a regulatory context. We contribute to the literature by focusing our analysis on the FDIC to determine the potential use, applications, benefits, and challenges of XBRL technology by the FDIC for regulatory reporting. Third, our study contributes to the accounting disclosure literature that examines the role of innovation in improving non-financial disclosures. Our study adds to the literature by identifying XBRL as a potential innovation that can assist in improving the disclosure of non-financial sustainability information and in making such disclosures value relevant for regulatory and research purposes. Fourth, this study contributes to the literature by presenting the unrealized benefits and applications of technology in non-financial sustainability reporting. The study provides valuable insights about the relevance and challenges of technology to regulators, banking supervision authorities, and their stakeholders (Hannon and Trevithick 2006; Powell and Boettcher 2007; Chan et al. 2008; Garbellotto 2009; Dalla Via 2020).

The remainder of the paper is organized as follows: Section 2 presents a contextual background. Section 3 presents the theoretical framework of the paper. Section 4 discusses the research method. Section 5 examines the agency's XBRL implementation project. Section 6 discusses the potential use of XBRL in non-financial sustainability reporting. Section 7 presents the conclusions, limitations, and future research directions.

2. Contextual Background

2.1. XBRL

Extensible Business Reporting Language (XBRL) is an extension of XML, Extensible Mark-up Language. The use of XML on electronic reporting platforms has been historically driven by market support and openness as it reduces the cost and risk of government information systems and is accessible to the public (Guijarro 2005). XML as a technology works by specifying the data elements in financial and business reports with clear tags that describe both their use and relationship with other elements in the document. XBRL has been technically developed to possess the same tagging feature by using XML Schema to describe the structure of businesses and financial reports. XBRL has also introduced additional business semantics or meanings which were not provided by XML (Hoffman and Strand 2001). These semantics can link each data element with multiple resources (such as labels, definitions, and calculations) and can be communicated to and used by other users enabling the exchange of these semantics between humans or computer systems (Debrecey and Gray 2001). Hoffman and Rodríguez (2013) distinguish between syntax and semantics. While semantics refers to a set of rules that give meaning to the business information, syntax refers to the representation of the business information. As XBRL develops its functionalities, the technology is gradually evolving and shifting its focus from syntax to semantics. As regulatory adopters strive to process complex information in their filings, the need for more insightful semantics and a granular level of representations becomes imminent.

An essential component of XBRL reporting is XBRL taxonomy, which defines and maps the data elements and relationships for specific reporting purposes, such as reporting financial information under generally accepted accounting principles (GAAP). The tax-

onomy is considered a dictionary of all business and financial terminology that could be used in financial and business reports (Hoffman and Strand 2001). Technically, it is made up of XML Schema files and link-bases. The Schema files capture the company-specific terms and presentation groupings. The link-base provides a broad-based structure for capturing interrelationships (e.g., presentations, calculations, and definitions) and resources (e.g., labels and references which are pointers to authoritative and practical guidance). Public taxonomies, such as the International Financial Reporting Standards-General Purpose (IFRS-GP), define elements and relationships between them according to legislation or standards such as the International Financial Reporting Standards or International Accounting Standards (Hoffman 2006). However, organizations are required to include additional concepts in their reports to define specific reporting procedures which may not be covered by general taxonomies. XBRL allows for adding additional extensions without compromising data consistency; these are called taxonomy extensions (Mousa 2011). However, the addition of extensions might circumvent XBRL's main advantage of data standardization, which is the main feature that incentivizes government agencies to use XBRL to process corporate data and achieve time and cost savings.

To improve the readability of XBRL reports, regulators and the software development industry developed a human-readable form of XBRL, known as Inline XBRL or i-XBRL. Inline XBRL provides a mechanism for embedding XBRL tags in HTML financial and business reports that offers the typical benefits of structured and machine-readable tagged data with a human-readable presentation of the same reports. Furthermore, tagged data in Inline XBRL reports include all untagged items (e.g., graphics and photos) as well as the formatting instructions so that they are human-readable and can be displayed as if in a printed format together with the tagged data elements (Mousa 2011) that would allow corporate and bank filers to retain full control over the layout and presentation of their reports. Therefore, filers could prepare one Inline XBRL document rather than generate an HTML document of their financial reports and then tag a copy of the financial report to create an XBRL version of it. Eventually, the same set of XBRL information could be rendered, allowing both the data producer (banks and corporate filers) and regulators (e.g., SEC and FDIC) to easily read and process the data (Mousa and Pinsker 2020). Effective from 15 June 2021, all corporate companies started filing their financial reports in Inline XBRL format to the SEC. Inline XBRL filings are accessible on the SEC's Inline XBRL Viewer which is part of the agency's EDGAR system.¹

The adoption of Inline XBRL technology has deliberately gained global momentum due to its perceived benefits. Klimczak (2017) indicates that the European Securities and Markets Authority (ESMA) published a feedback statement, which called for using Inline XBRL in the annual reports prepared by corporate organizations operating in the European Union. Klimczak's research captures the impact of Inline XBRL on improving the comparability and quality of financial statements. Furthermore, Fradeani (2022) builds on Klimczak's findings by suggesting that the use of Inline XBRL facilitates the preparation of reports and drives their usability, processability, and comparability. He even predicts that Inline XBRL specifications could be the basis for marking up non-financial disclosure to comply with the European Single Electronic Format mandate. The mandate requires European Union (EU) companies to file annual financial reports in Inline XBRL. While the initial effective date was for corporate fiscal years beginning on or after 1 January 2020, EU member states were granted an option to delay compliance for one year due to the COVID-19 pandemic (FIN-FSA 2022). Research by Tzu-Yi et al. (2016) reveals that the use of Inline XBRL in financial reports by public Taiwanese companies reduces the difference in the information processing costs among investors, thus decreasing the information asymmetry during the filing period.

2.2. FDIC Background

Established in 1933, the Federal Deposit Insurance Corporation (FDIC) is the main independent U.S. federal regulator for state-chartered banks and savings institutions which

are not members of the Federal Reserve System. It seeks to promote public confidence and stability in the American banking system of insured depository institutions, and it examines more than 5000 banks and savings associations for compliance with consumer protection laws. The FDIC does not receive congressional appropriations as it is funded by the fees paid by banks for deposit insurance coverage.² Filer banks create two different consolidated reports, depending on the bank's domestic or foreign locations. Banks file these reports to the Federal Financial Institutions Examination Council (FFIEC). The FFIEC is an inter-agency federal body in charge of setting uniform principles, standards, and report forms for the federal examination by the call agencies. Call agencies include the Board of Governors of the Federal Reserve System (FRB), the Federal Deposit Insurance Corporation (FDIC), the National Credit Union Administration (NCUA), the Office of the Comptroller of the Currency (OCC), and the Consumer Financial Protection Bureau (CFPB).³

2.3. Structure of Call Reports

According to the FDIC's Senior Data Strategists, filer banks publish structured reports on a quarterly basis. These reports are called call reports and they include the bank's balance sheet, income statement, and sub-schedules. The structured report format facilitates data processing and validation by the FDIC's bank examiners. In addition to the financial statements, call reports contain voluminous footnotes which clarify financial information reported in the statements themselves. The quarterly reports were called call reports due to the recurrent phone call communications between the FDIC's bank examiners and filer banks to resolve data inconsistencies in the reports. The older version of the call report was prepared as a flat text file that used to be completed by the filer banks and submitted to the clearing house's electronic data systems (EDS). Upon processing the report, the EDS sent it to the FFIEC to disseminate the report content with the call agencies. Call agencies typically set their own criteria to validate the content of the reports, depending on their own needs and uses of the shared information. Such validation criteria defined the required checks to ensure that the call data have the correct summation and tolerances. To facilitate the data validation process, each call agency used to send two versions of the data validation criteria to their regulatory software vendors.

2.4. FDIC's Motivation for Change

Even though the quarterly call report is highly structured, the instructions and technical requirements were distributed in a non-structured format by means of a collection of PDF, MS Word, and MS Excel documents. The use of information in these different formats required significant amount of manual manipulation by the FDIC. Banks have 30 days following the quarter-end to submit their completed call reports. The FDIC's bank examiners use a validation process and tests to check the incoming data for validity errors, which include mathematical and logical errors (Mousa and Pinsker 2020). The FDIC's bank examiners corresponded with filer banks to identify and resolve data inconsistencies in the call reports. The apparent variations in each call agency's data validation criteria amplified the risk of data misinterpretation. Consequently, the call report processing system's functionalities to facilitate data exchange, validation, and analysis were severely undercut, which elevated the compliance burden for filer banks.

3. Theoretical Framework

This case study uses one of the most salient theories of information technology adoption which is the Rogers' innovation adoption process (Rogers 1983). The Rogers' innovation adoption process has been widely noted as one of the leading theories in information technology adoption in regulatory authorities (Mousa 2013; Brudney and Selden 1996; Bugler and Bretschneider 1993; Norris and Kraemer 1996). Rogers describes the innovation adoption process as the "the process through which an organization passes from the first knowledge of an innovation to a decision to adopt or reject, to implementation of the new idea" (Rogers 1983, p. 21). Figure 1 shows the Rogers' innovation adoption process.

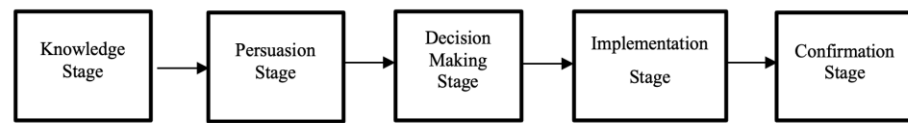


Figure 1. Rogers' innovation adoption process (1983).

The first stage of the process, "Knowledge", signifies the adopting organization's awareness of the innovation (or technology), its capabilities, functions, and features. Upon developing an awareness in the knowledge stage, adopters are often persuaded by how the newly adopted innovation (or technology) might contribute to their organization based on the specific needs of the adopters. The third stage, "Decision Making", takes place when the organization will have to decide whether to adopt or reject the new technology based on whether the organization has the motive and resources to invest in the technology. The fourth stage, "Implementation", indicates that the organization has actively adopted the new technology by putting it into use to assess its usefulness and whether it will meet the organization's expectations. The last stage, "Confirmation", finalizes the implementation process by evaluating the result(s) of the process. In this stage, the organization might continue to use the innovation or reverse its initial decision by discontinuing the use of the new technology if it falls short of the organization's expectations, which results in the rejection of the technology.

4. Research Method

This case study examines the XBRL implementation at the FDIC by emphasizing the role and experiences of the agency and its stakeholders, including software developers and filer banks. The use of a case study in this research is purposeful as it facilitates a thorough and comprehensive presentation of the empirical evidence, as suggested by Yin (2003). Case studies are appropriate to investigate the organizational adoption of emerging technologies as recommended by Yin (1994) and Benbasat et al. (1987). Therefore, the use of a case study to investigate the adoption of XBRL at the FDIC provides a great opportunity to better understand the intricacies of adopting the technology in a regulatory setting.

To support the data collection process, five semi-structured interviews were conducted in 2013 with the FDIC and representatives of the agency's stakeholders. The researchers prepared a list of open-ended interview questions to thoroughly explore and understand the roles and experiences of the research participants with XBRL implementation at their organizations. As recommended by Saunders et al. (2006), the semi-structured interview approach was successful as it generated a rich body of empirical evidence covering the implementation and use of XBRL at the research participants' organizations. The participants were decisively selected based on their roles and experiences with XBRL technology as a potential adopter and user, represented by the FDIC and a filer bank, and as a facilitator, represented by the software developer.

At the time of the initial interview, our first interview was conducted over the phone with a Senior Business Analyst at the Division of Insurance and Research at the FDIC in 2013. A recent email correspondence with him—as an appointed Chief of Data Strategy—was initiated to gauge his thoughts on the FDIC's efforts to use XBRL in non-financial sustainability reporting in 2021. The second and third recorded phone interviews were conducted with the President and Chief Technology Officer at a regulatory software development company, vetted by the FDIC. The fourth and fifth interviews were conducted in person with the Senior Vice President and the Manager of the Financial Reporting Division at a commercial bank.

Regarding phone interviews, Dinham (1994) and Taylor (2002) document several advantages for using this method. For example, phone interviews give researchers the opportunity and access to varied information resources without incurring potential travel expenses to meet research participants (Cannell 1985; Dinham 1994; Taylor 2002). They also

allow for gathering contextual information (Sobo et al. 2003), achieve “friendly rapport”, and generate “excellent data” (Stephens 2007, p. 211).

The face-to-face interviews were conducted in that form due to the proximity of the midwestern bank headquarters to the researcher’s location. In-person interviews can be utilized to obtain “insightful information based on respondent’s reactions to questions” (Neelankavil 2007, p. 218). This type of interview also provides an opportunity to probe the research participant for sophisticated and complex answers, which adds greater value to the data collected (Sreejesh et al. 2014). The researchers sent transcripts of the interviews via email to the research participants to verify and clarify their responses and add any missing details as needed.

5. FDIC’s XBRL Implementation Project

5.1. First Phase: Planning

The FDIC’s early journey with XBRL technology started in 2001 when the agency was looking for a data standard which could facilitate the data validation process of the call reports. Representatives of the FDIC attended XBRL international conferences to build trusted networks of XBRL stakeholders. During those conferences, the FDIC started collaborating with members of the U.S. working groups which were part of the XBRL international organization. Those groups possessed valuable technical knowledge about the technology which was essential for the FDIC at the time to create an informed understanding of the technology specification. The specification defines the basic structure of XBRL which includes output documents or instance documents (e.g., call reports), concepts, and taxonomies.

In 2002–2003, the FFIEC took the first step to elevate data sharing and transparency through the Call Report Modernization project (Mousa and Pinsker 2020). That decision ignited the FDIC desire to develop and centralize the processing of all the data into a single shared location, the Central Data Repository (CDR) system. The goal of the CDR was to make use of an open data standard to “define metadata, publish taxonomies, exchange information, and receive and process data by federally regulated financial institutions” (Debreceeny et al. 2009, p. 210). A decision was made to allocate a budget of \$40 million for the CDR modernization project to use XBRL technology in standardizing the call report. The inception of the CDR project motivated the FDIC to use the funding to develop its initial formula syntax, which was rudimentary and simplistic, employing Excel-type macros. In addition, the availability of government funding for the modernization provided room for further development, which paved the way to use XBRL in the call report and the Uniform Bank Performance Report.

5.2. Second & Third Phases: Persuasion & Decision Making

In 2004, the FDIC made the decision to adopt XBRL technology by developing a proof of concept and showing it to its two main stakeholder groups, which were composed of a selected list of financial institutions and software vendors. The proof of concept included five components: (1) metadata definitions and business rules; (2) data exchange; (3) data validation; (4) data analysis; and (5) data dissemination or distribution. The metadata definitions presented the FDIC’s standardized business rules, which were based on XBRL technology. The proof of concept allowed the agency to use XBRL formulas and validation criteria to generate reports in different formats such as PDF, HTML, and text. It also showed the potential of developing, validating, and publishing XBRL taxonomy by call agencies on their own digital platforms. To facilitate the creation of the initial proof of concept, the FDIC invited its trusted network of financial institutions and software vendors to round table discussions to solicit their feedback. The FDIC was greatly persuaded by the potential efficacy of the technology based on its stakeholders’ feedback. Many of their recommendations became the requirements for the newly created “XBRL Project”.

5.3. Fourth Phase: XBRL Implementation

The FDIC relied on its in-house technology specialists to create the framework for XBRL taxonomy and define the agency's own validation criteria and data patterns. Those efforts led the agency to develop the first version of the XBRL formula link base. The link base is an essential part of XBRL taxonomy, which defines the structure for data interrelationships and resources. The previously discussed five components of the proof of concepts were also captured in the XBRL taxonomy.

The FDIC's interviewee emphasized the importance of engaging all the call agencies in the CDR modernization project through the articulation of a Memorandum of Understanding (MOU). The MOU emphasized the importance of using a common identifier for the new CDR system to support the metadata and financial management. The Federal Reserve's Micro Data Reference Manual or MDRM⁴ captured the taxonomy development and financial data validation and storage. The Federal Reserve's MDRM has been used as the call agencies' common data dictionary since the 1970s. A developed version of the MDRM was utilized in the CDR modernization project to support data sharing among the call agencies and regulatory software vendors.

The MDRM contains highly structured business rules/reporting forms. The specific nature of the structured data led the FDIC to make a strategic decision to adopt a closed taxonomy approach. That approach became one of the main hallmarks of a potential regulatory XBRL mandate. Each call agency has its own set of business reportability rules which are defined in the XBRL formulas (FFIEC 2006). Filer banks must provide only the data/items in the call reports, which are submitted to the FDIC on a quarterly basis. The call report taxonomy contains 3000 data/line items for banks. To better utilize XBRL taxonomy, the FDIC decided to use XBRL in the call report presentation, instructions, and validation criteria. The standardized nature of the closed taxonomy approach facilitated the oversight of data exchange. The call agencies reaped the benefits of the improved data exchange which was one of the features they often used through the CDR. It also improved the functionality of the data validation and analysis process.

The FDIC officially mandated the use of XBRL in October 2005. It was considered part of the larger CDR Modernization Project which became the first mandated large-scale use of XBRL in the world for processing banking information by a federal agency. The banking community showed great interest in following the regulatory mandate as the agency articulated its commitment to ease the pressure by adopting the closed taxonomy approach, which proved to be beneficial for banks to report their quarterly call reports in an efficient manner.

5.4. Fifth Phase: Confirmation and Development of Inline XBRL

Empirical evidence shows the FDIC as a true advocate of XBRL technology and a dedicated collaborator with its stakeholders, which characterized the implementation process at the agency. The FDIC confirmed its decision to implement XBRL by exploring its potential use through the development of Inline XBRL in its existing Examination Tool Suite (ETS). The FDIC's ETS application used the agency's web services to download call report and unified business performance report data. The application is a key platform for generating real-time bank data used by the FDIC's bank examiners. Under the previous system, bank examiners used to spend significant time waiting on call report information to update the ETS application. ETS developers used to review the application on a quarterly basis to identify any changes in the quarterly call reports. The developers had to manually interpret those changes and provide updates in the ETS application. Due to the significant delays in receiving the information and inputting the updates, the data became obsolete for meaningful analysis. Even though the FDIC considered the use of a rendering link base, it did not proceed with this option as the rendering link base had to be built in one of the existing taxonomies. However, updating such taxonomies was costly as it meant that the FDIC would incur additional CDR development expenses. Therefore, to assist the ETS

developers, the FDIC instead decided to use an updated version of XBRL technology to maintain a Hypertext Markup Language (HTML) presentation style.

The agency decided to develop Inline XBRL (i-XBRL) to support the functionalities of its ETS application. The developed version of XBRL was used as a report template to present the Uniform Bank Performance Reports (UBPR) in the ETS, while pulling the latest UBPR taxonomy and call report data from CDR using web services. This new use of i-XBRL enabled the FDIC’s bank examiners to have prompt access to the call report and UBPR data, analyze bank information in real-time, and cut the delivery time for quarterly updates to ETS. Figure 1 shows the digital filing process of the quarterly call report. Figure 2 demonstrates the integration of the MDRM and the validation and reportability rules in the process and the development of output reports in Semicolon Delimited Format (SDF), XBRL, and Portable Document Format (PDF).

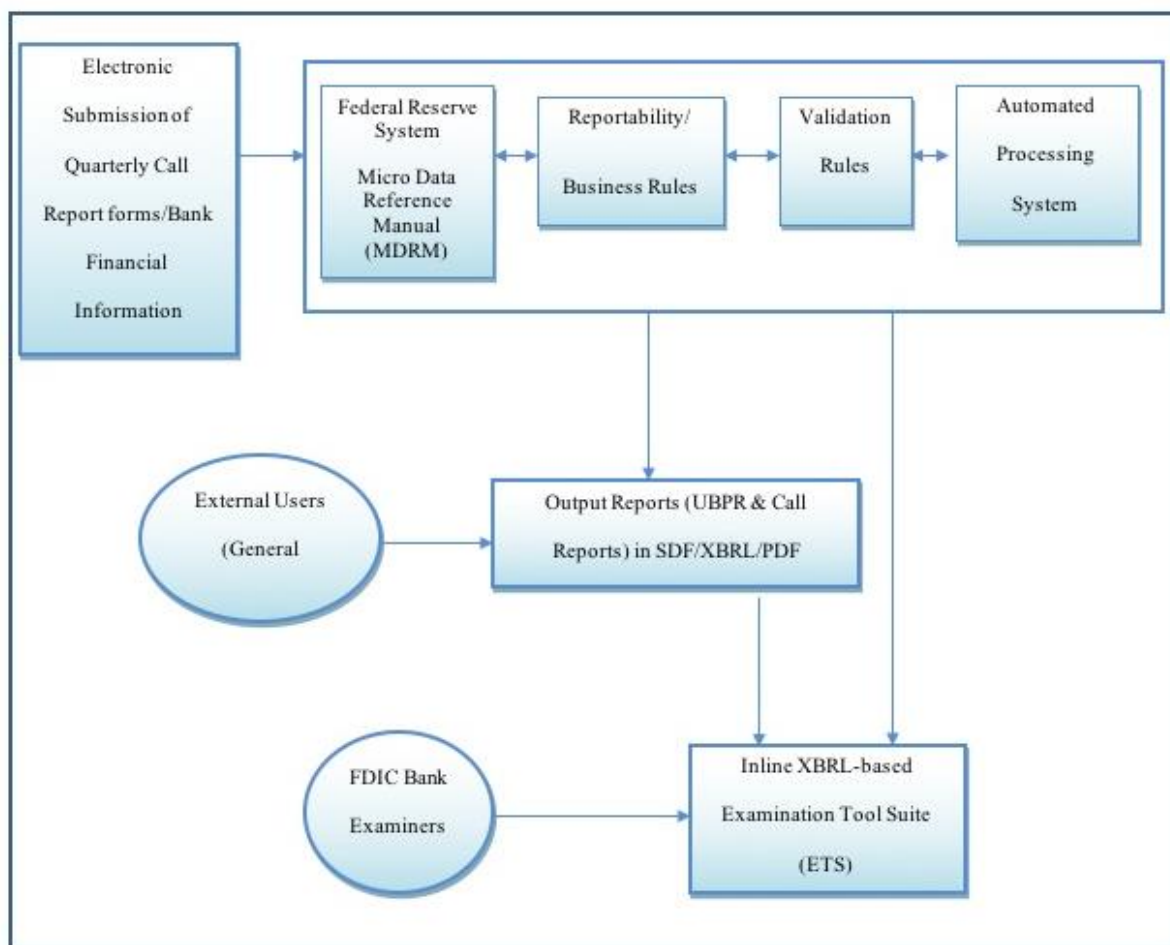


Figure 2. XBRL call report framework.

6. The Potential Use of XBRL in Non-Financial Sustainability Reporting

6.1. Untapped Applications and Benefits of Inline XBRL

On 20 May 2021, the Biden Administration issued an executive order on climate-related financial risk. The order states that the Secretary of the Treasury, as the Chair of the Financial Stability Oversight Council (FSOC), shall engage with FSOC members to consider assessing and facilitating the sharing of climate-related financial risk data and information among FSOC member agencies and other executive agencies (White House 2021). The FDIC is a member of the FSOC, but the agency has not announced its intention or decision to include such information in bank filings. This sentiment has been expressed by the FDIC interviewee as he stated,

“The FDIC is a member of the FSOC but at this point there is no statement or movement from FDIC on ESG-like requirements for banks. When FDIC does start addressing climate-related requirements from the banks, we will most likely follow GAAP and FASB definition.”

Based on the previous statement, the FDIC has no intention to incorporate climate-related information in bank filings soon. However, that does not necessarily preclude the agency from exploring the potential of using Inline XBRL technology to streamline structured non-financial data in bank filings. Such a potential initiative will bring a shift in the FDIC’s reporting strategy which initially focused on processing financial data in the call and UBPR reports. The processing of non-financial data was not part of the FDIC’s digital reporting strategy, yet the use of Inline XBRL might bring noticeable human, social, and economic benefits to corporate users and data aggregators.

As an essential stakeholder for the FDIC, the banks’ use of XBRL in non-financial reporting is key to realize the full potential of the technology. Banks particularly play a profound role in serving and supporting their local and regional communities. Therefore, it is fair to say that banks should be accountable to contribute and add value to the human, economic, and social development of their community members. In other words, banks should commit to create a new reporting practice where they disclose decision-useful, relevant, and reliable sustainability information to their stakeholder. The Sustainability Accounting Standards Board has developed a set of 77 industry-specific sustainability accounting standards, namely the SASB standards (SASB 2018). In the specific context of Commercial Banks, SASB’s Sustainability Disclosure topics address data security, financial inclusion, environmental, social, and governance factors in credit analysis, business ethics, and systemic risk management.

Given the variety of SASB disclosure topics, it is important to address the applications of Inline XBRL technology in the specific context of the Commercial Bank’s Sustainability Disclosure Topics. In the growing world of cybersecurity threats, the FDIC could leverage its existing digital security measures—currently used to secure the filing of the Inline XBRL-based call report and UBPR report—to meet data security disclosure requirement. The agency could require banks to provide evidence-based information on their efforts to safeguard client data against cybersecurity threats and security breaches based on metrics by tracking the number of data breaches and bank account holders affected by such breaches. It could also require banks to disclose their risk management strategies to avoid and/or prevent data security risks. As the FDIC used Inline XBRL technology to tag data items in the call report, it can leverage the same technology to tag bank’s information pertinent to the data security metrics, either as a number, percentage, or even an entire paragraph. The tagging feature of XBRL will support the role of the FDIC’s bank examiners by ensuring compliance and generating cross-sectional analysis of different banks’ data security strategies to determine best practices. An illustration of a Sustainability Disclosure, Data Security, by Moody’s Corporation is provided in Figure 3.

SUSTAINABILITY DISCLOSURE TOPICS AND ACCOUNTING METRICS				
Topic	Accounting Metric	Category	Code	Moody's Response
Data security	Description of approach to identifying and addressing data security risks	Discussion and analysis	SV-PS-230a.1	<p>Moody's protects the data and security of its stakeholders, investing in world-class IT systems and infrastructure. Moody's employees uphold its security-first philosophy, and the Company holds its third-party partners to this same standard.</p> <p>Moody's is committed to developing and maintaining a best-in-class information security program that addresses, among other areas, privacy and data security, including of its customers' data. Moody's program integrates the Company's business objectives with industry and internal best practices to provide a foundation for decision-making regarding the management, security and use of data within the organization. All employees receive global privacy and information security training at onboarding and periodically thereafter. Data is safeguarded based on requirements and controls determined by Moody's Information Risk and Security, which include access and right-of-use controls. Security controls are periodically evaluated by Internal Audit.</p> <p>The global pandemic and remote work raised new threats in cybersecurity and the growing intersection of supply chains, connectivity and access to data is increasing the potential for cyber attacks. As a result, Moody's built on its existing disaster preparedness capabilities for working from home with enhanced training on new methods for cyber-attack management. The Company continued to monitor and strengthen its IT infrastructure and partner with leading organizations to share cutting-edge security solutions.</p> <p>Security management</p> <p>Moody's combines expertise and technological innovation to outpace emerging threats. The Company's employees take cybersecurity training to better recognize and respond to potential threats, including attack and phishing simulation exercises several times a year. Moody's provides training portals on emerging cyber threats that help educate software-development teams on secure coding practices.</p> <p>Data privacy</p> <p>Moody's policies comply with the data privacy laws in the jurisdictions in which it operates. Moody's Privacy Policy explains how the Company collects personal information, how it uses, discloses and protects such information, and the choices its customers have concerning use of such data.</p> <p>Reasonable organizational and technical measures were implemented to protect personal information within Moody's organization, and the Company's employees are required to take privacy and information security training that covers these concepts.</p>

Figure 3. Sustainability disclosure sample: data security.

As XBRL lets information move rapidly and accurately among different organizations, regulatory XBRL software vendors, another FDIC's stakeholder, could play a significant role in building a strong technology infrastructure for facilitating the sharing and dissemination of financial and non-financial risk information. Such information could be used to alleviate the economic hardship of members of the society by supporting struggling local businesses and investing in underserved communities. Banks and mortgage lenders could use such information in making informed lending decisions which could support community members struggling to start and operate a business due to weak credit standing. Furthermore, from an ethical standpoint, banks could utilize this information to improve their lending practices by providing services to individuals living in predominantly minority neighborhoods. In terms of social benefits, regulatory XBRL software vendors could play a significant role by collaborating with banks to support digital inclusivity by making technology and Internet services more accessible for underserved community members to stay connected and work remotely. Additionally, XBRL software developers could work closely with local school districts and colleges by creating apprenticeship schemes geared towards elevating student technological skill sets, which could offer them a future pathway to become data scientists, software developers, and engineers. In terms of economic benefits, Inline XBRL is known for its ability to facilitate financial data analysis and comparability. Banks along with their software developers could leverage this advantage by launching accessible education portals which could offer free courses on financial technology education to teach basic financial planning skills which allow individuals to analyze and compare the financial performance of different companies and make informed financial decisions as potential investors.

Inline XBRL technology could be also utilized in non-financial reporting processes to provide organizational benefits and achieve efficiencies. For instance, as the COVID 19 pandemic ravaged the world over the course of the last two years, XBRL could offer the benefit of streamlining and analyzing internal personnel information to support the

professional development of bank employees and their families. Such personnel information could also be used to reassess the bank's diversity initiatives by demonstrating the importance of having an inclusive work culture, which is less concerned with managing quotas and more focused on creating balanced organizational diversity in terms of talent and mindset. In terms of achieving efficiencies, Inline XBRL technology enables banks to change from paper, PDF, and HTML reports to XBRL reports. Non-financial information in notes, tables, graphs, and images can be all tagged in Inline XBRL. This represents a great step towards minimizing the consumption of paper and the reduction of carbon footprint across different business processes performed by bank employees.

The FDIC is in an enviable position to use a closed taxonomy approach in reporting non-financial bank information. The time to make such a decision could not be any better than now as the SASB has recently released a revised version of the SASB XBRL taxonomy, which is now available for public use as of September 2021. The new taxonomy includes SASB's 77 industry standards, including Commercial Banks, as noted by SASB President and Chief Operating Officer, Matthew Welch, *"this development is especially important as key regions around the world move to encourage structured reporting of sustainability information, just as they have done with financial information."* (XBRL 2021). The use of structured reporting that is supported by SASB XBRL taxonomy will facilitate the integration of such standards into existing bank filings including the call report. The FDIC could leverage its existing trusted networks of banks and software developers to devise strategies to develop its current XBRL taxonomy to integrate data items/elements that could be tagged in the SASB XBRL taxonomy. Sustainability-specific information (e.g., data security measures or financial inclusion) can be added as additional data/line items in the bank filings. The use of closed taxonomy could alleviate the compliance burden for banks as the FDIC outlines specific reportability/validation rules which meet the SASB standards. Banks will also reap the benefits of generating value-added and data-driven information which will support banks' initiatives to adhere to sustainability standards and better engage with and serve their communities. Given the fact that the SASB has already developed its own XBRL taxonomy, the FDIC could incorporate that taxonomy in the call reports by aligning it with the agency's existing taxonomy. The collaboration between SASB and the FDIC will ensure that both agencies avoid duplicative taxonomies which could drive inefficiencies and undermine data comparability and analysis.

Various stakeholders including financial analysts, investors, accounting firms, and regulators could greatly benefit from using Inline XBRL. For instance, analysts could use the technology to automate non-financial data collection and reporting, and prepare forward looking financial analyses, forecasts, and real-time financial performance reports. Other uses could include the creation of standardized governance, risk, and ESG performance reports. The standardized data feature of Inline XBRL can be significant to analysts as it improves the comparison of non-financial performance of multiple companies across different sectors and industries. This will have long-term implications for investors as the technology will provide valuable insights about non-financial corporate information and will meet the changing expectations of investors. Accounting firms could utilize Inline XBRL in driving the development, design, and implementation of sustainability strategies of their clients. They can also develop better ESG maturity models to help their clients align and close the gap between financial and non-financial performance. Government agencies and regulators can expand the use of Inline XBRL to facilitate the collection, assembly, validation, and review of non-financial regulatory filings. In that regard, the Securities and Exchange Commission (SEC) spearheaded the efforts in March 2022 by proposing new rules to enhance and standardize climate-related disclosures.⁵ Such disclosures include the requirement for companies to tag both narrative and quantitative climate-related disclosures in Inline XBRL. In June 2022, the European Commission finalized the adoption of the Corporate Sustainability Reporting Directive, which will require companies to tag their sustainability information using Inline XBRL taxonomy developed by the European Financial Reporting Advisory Group.⁶

6.2. Potential Challenges

An implementation challenge could arise if the FDIC decides to develop its own set of metrics to measure banks' compliance with sustainability requirements in the call report. That important step has not been explored yet by the FDIC because such metrics should be aligned with SASB standards and existing disclosure topics. The potential lack of such alignment will present an additional compliance burden for filer banks which may have to prepare a separate sustainability report to file it with the FDIC and/or the SEC.

The FDIC might face another challenge with storing and sharing sustainability information. Given their volume and breadth, the agency should decide whether and how it will use its current Central Data Repository (CDR) to store such information safely. Given the fact that the CDR was mainly created to store bank financial data, an effort should be made to address the possibility of increasing that capacity to include non-financial information or alternatively store it remotely in the Cloud. The agency will also have to determine the parties/agencies requiring direct access to the information. Ensuring a safe, reliable, and accessible mechanism for sharing data with the public should also be pursued given the importance and relevance of such information to the public.

Another challenge facing the FDIC would be to determine whether it will require all banks, regardless to their size and asset base, to file sustainability information on a quarterly or annual basis and whether this requirement will be mandated or voluntary. As the agency held meetings with its stakeholders to make the business case for the initial XBRL mandate, the FDIC should provide effective messaging and rationale for mandating the filing of sustainability information to ensure compliance. That could be accomplished by emphasizing the bank's social responsibility towards its local, regional, and international community in addition to maximizing shareholders' wealth. Banks' commitment to its social and ethical responsibility should be actualized, assessed, and disclosed to create better awareness and transparency of their business operations. The agency should also emphasize the importance of the banks' engagement with stakeholders to listen to their needs and meet their expectations.

6.3. Lessons Learned

The lessons learned from this research are of significance to XBRL regulatory adopters, technology policy makers, software developers, and other stakeholders. First, the case demonstrates the importance of championing the technology by top management through demonstrating its commitment to deploy resources and align XBRL technology with existing digital reporting platforms. The significant commitment and backing of the FFIEC during the development of the CDR Modernization Project and XBRL implementation was notable. Moreover, the FDIC took advantage of its long history of collaboration with vetted software vendors by establishing a trusted network of regulatory software vendors to facilitate the integration of XBRL into their filing packages. These factors have collectively enabled the agency to better integrate XBRL functionalities into the banks' digital reporting platforms.

Second, the case study shows that the advantages of using a closed taxonomy approach are threefold. It enabled the FDIC to exert additional control over the data received and shared among call agencies. The need to develop taxonomy extensions was diminished, as all banks must submit their filings to match the FDIC's standard taxonomy and business reportability rules. Finally, it alleviated the burden of offering additional specialized training to potential XBRL users at the FDIC and banks.

Third, the case study provides valuable insights to all stakeholders involved in XBRL implementation and development. For instance, government agencies—based on their own needs—can benefit from the FDIC's experience in determining and using capabilities of Inline XBRL to enhance data rendering and presentation in regulatory reports. Additionally, strategic partnerships between the FDIC and regulatory software vendors enabled filer banks to use both the agency's business reportability rules and validation criteria and the developers' technical experience to facilitate the preparation and presentation of call

reports. Furthermore, the FDIC's smart collaboration with the vendors supported the agency's decision to use the closed XBRL taxonomy approach, which was one of the key benefits of using the technology in call reports.

Fourth, upon the "potential" incorporation of sustainability disclosure requirements in bank filings, Inline XBRL could facilitate the reporting of sustainability data which will provide value-added information that will deliver untapped human, economic, and social advantages to different stakeholders. Commercial banks must determine their social responsibility toward their local and regional communities. Yet, that responsibility has not been fully articulated in banks' call reports. To meet that challenge, the FDIC could utilize its existing network of software developers and banks by collaborating with SASB to assess the integration of XBRL SASB Taxonomy Standards to facilitate the reporting and processing of sustainability information in bank filings. Because SASB standards XBRL taxonomy is compatible with taxonomies used in financial reporting (e.g., IFRS and US GAAP), the FDIC could leverage this pre-existing technology infrastructure to use it in tagging SASB disclosure in bank filings.

7. Conclusions, Limitations and Future Research

In this paper, we explore the potential adoption of XBRL for non-financial sustainability reporting by the FDIC. Our study is original because it is the first study to explore the potential adoption of XBRL for non-financial sustainability reporting in a banking regulatory institution, particularly, the FDIC. The case study analysis contributes to existing XBRL studies that examine the benefits, use cases, and challenges of XBRL, including works by [Mousa \(2011\)](#), [Calabrese and Corbò \(2014\)](#), [Troshani and Hill \(2009\)](#), [Jahangirian et al. \(2015\)](#), [Mena et al. \(2010\)](#), [Ayoub et al. \(2019\)](#), [Doolin and Troshani \(2007\)](#), [Troshani and Hill \(2007\)](#), [Mousa \(2013\)](#), and [Liu et al. \(2014\)](#).

The findings reveal that the FDIC's adoption of XBRL for non-financial sustainability reporting was made possible through stakeholder consultations and technical support by information technology experts. The potential use case of XBRL by the FDIC is for collecting, processing, and storing non-financial sustainability information of banks particularly climate-related disclosures of banks. The identified challenges are whether the FDIC will share sustainability information, whether FDIC will develop its own non-financial sustainability reporting rules while ignoring existing non-financial reporting accounting standards, whether all banks will be required to adopt the non-financial sustainability reporting rules, and whether the requirement will be mandatory or voluntary.

From our case study, it can be concluded that the examination of the XBRL implementation process at the FDIC, using the Rogers' Innovation Adoption Process theory, provides an insightful overview of the agency's awareness, motive, and lessons learned, which led to the development of Inline XBRL.

Our study has several implications. First, the findings of this research support the importance of using smart measures in overcoming the lack of data standardization in technology implementation and development. Despite the structured nature of call reports, different measures had to be used to validate the data submitted by filer banks. The technology was used to consolidate all meta-data definition and exchange, validation, analysis, and data distribution into a central shared location. This supports the idea of [Jahangirian et al. \(2015\)](#). Second, the case study shows that the use of the closed taxonomy approach was one of the main features which characterized the agency's XBRL implementation process. This approach facilitated collecting, processing, and disseminating data and enabled the agency to make an effective business case to its stakeholders. Information technology experts and practitioners at regulatory agencies can learn significant insights from following this approach to standardize data collection and processing in XBRL format; this is in line with [Mousa \(2011\)](#). Third, this research emphasizes the importance of re-examining the use of XBRL to meet the SASB sustainability requirements. The FDIC could leverage XBRL features and advantages and its existing network of stakeholders to collaborate with SASB and facilitate the incorporation of SASB Standards XBRL Taxonomy in reporting sustainability

information. This is also in line with [Jahangirian et al. \(2015\)](#), who emphasize the important role of stakeholder engagement in adopting XBRL technology. There are several unrealized benefits and applications for banks to generate XBRL-based sustainability information which could bring economic, human, and social benefits to different stakeholders. As an early XBRL regulatory adopter, the FDIC could spearhead the efforts to reimagine the use of the technology to collect, process, and analyze different sets of bank data for the purpose of generating high quality bank information, which would have global and wider non-financial applications.

This research is based on a single case study conducted in the U.S. The intention of performing case study research is not to provide generalized facts but rather to identify and assess meaningful relationships in a certain context. Therefore, this research presents an image of what the context is in the U.S. It identifies and discusses some of the issues that could be taken into consideration by IT policy and decision makers in government agencies and their stakeholders interested in adopting and developing XBRL technology.

This paper provides venues for future researchers to conduct multiple case studies in different jurisdictions to allow common implementation experiences among XBRL adopters to be identified. Another opportunity is to investigate the role of XBRL stakeholders including corporate and other agents of change who might play an important role in driving the use of Inline XBRL in regulatory ESG disclosure. Such a research opportunity could help in identifying the roles and contributions that stakeholders can offer to overcome potential challenges faced by current organizational XBRL adopters.

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Appendix A. Interview Questions

(A) The FDIC Questions:

1. Could you state your job affiliation and role at your organization?
2. Can you talk about the FDIC's prior experience with the digital filing process of the Call Reports?
3. How did the FDIC come across XBRL technology?
4. Could you explain the agency's motivation(s) to adopt XBRL?
5. Who were the team members of "XBRL Project" at the FDIC? Please, explain their role and experiences.
6. How did the agency fund XBRL implementation and development?
7. Who is currently in charge "XBRL Project"?
8. How did the FDIC prepare and develop XBRL taxonomy infrastructure used to support the filing of quarterly Call Reports by banks?
9. What were the challenges of implementing XBRL at the agency?
10. What was/were the result(s) of XBRL implementation? Did the agency have any metrics to measure such results?
11. How does the agency secure its digital filing platforms?
12. Could you share with us your insights about possible future uses of XBRL technology?

(B) The Regulatory Software Developer Questions:

1. What is your job affiliation and role at your organization?
2. Could you tell us about your experience with software solutions which are used for regulatory filings?

3. Did you develop XBRL-enabled solutions? And for which user groups?
4. According to your website, you have developed a software solution for the bank's FFIEC Call Report data. Did you customize this software solution for the Call Report? If so, how did you customize and develop the software package?
5. Could you walk us through the process of developing the software and building the taxonomy infrastructure?
6. Why did you choose to work specifically on Call Report data?
7. How did you measure the suitability/applicability of the software solution to accommodate the processing of regulatory data in the Call Report in XBRL format?
8. Did you work on Inline XBRL?
9. How did you get the software certified by the FFIEC?
10. Did you conduct software testing and/or simulations with the banks and/or the FDIC?
11. Did you provide software documentation?
12. Is there any *special* security measure that supports the data authentication/verification functions in the software solution that you developed?
13. Did you encounter any challenges or issues during the development and/or testing of the software?
14. Did you further develop your software solution for the FFIEC Call Report since it was initially introduced? How often? And on what basis?

(C) The Bank Questions:

1. What is your job affiliation and role at your organization?
2. Could you tell us about your experience as a bank user with XBRL since it was mandated in 2004?
3. What are the components of the Call Report that your bank must file?
4. How do you compile all the information (subject to filing) in the Call Report?
5. Did XBRL make any difference in the filing process of the Call Report?
6. How did you select your XBRL software vendor? And how much did it cost you?
7. Did you offer any training on XBRL filing?
8. Since 2004, did you implement any changes or developments with the software?
9. What do you think is the difference between the FDIC and SEC reporting?
10. Did you encounter any problems or challenges with XBRL filing?
11. Could you describe your collaboration with your software vendor?
12. Do you receive any feedback from the FDIC after filing your Call Report?

Notes

¹ Inline XBRL SEC Viewer can be viewed here: https://www.sec.gov/ix?doc=/Archives/edgar/data/920760/000162828016017488/len-20160531_95xixbrl.htm (accessed on 19 October 2022). Please, click on the numeric figures in the report to view Inline XBRL tags.

² <https://www.fdic.gov/deposit/deposits/faq.html> (accessed on 19 October 2022).

³ <https://www.ffiec.gov/about.htm> (accessed on 19 October 2022).

⁴ The MDRM contains 8-character words consisting of a mnemonic prefix and a numbered suffix. The number defines a financial term (e.g., 2170 is "Total Assets" for all financial collections established by the FFIEC). The mnemonic defines a financial collection or data series (e.g., BHCK is Bank Holding Company or RCFN is foreign only). When combined, the MDRM explicitly defines financial items for any given FFIEC data collection <http://www.federalreserve.gov/apps/mdrm/> (accessed on 19 October 2022).

⁵ <https://www.xbrl.org/news/sec-proposes-digital-climate-disclosures-in-inline-xbrl/> (accessed on 19 October 2022).

⁶ <https://www.xbrl.org/news/efrag-reaches-another-milestone-with-draft-esrs-standards/> (accessed on 19 October 2022).

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