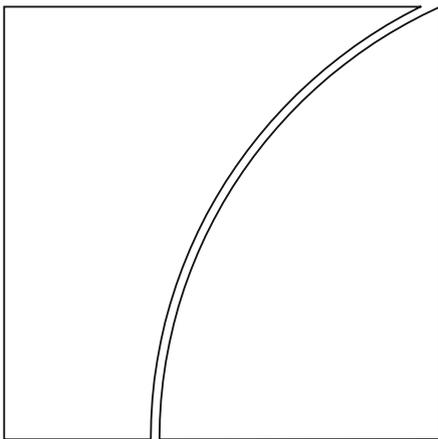


# Financial Stability Institute

## FSI Insights on policy implementation No 29



From data reporting to data-sharing:  
how far can supotech and other  
innovations challenge the status quo  
of regulatory reporting?

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December 2020

JEL classification: G20, G28, O31, O32

Keywords: Supotech, data collection, regulatory  
reporting, data standardisation, regulatory data, data  
transmission



**BANK FOR INTERNATIONAL SETTLEMENTS**

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Authorised by the Chairman of the FSI, Fernando Restoy.

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ISSN 2522-2481 (print)

ISBN 978-92-9259-443-5 (print)

ISSN 2522-249X (online)

ISBN 978-92-9259-444-2 (online)

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# From data reporting to data-sharing: how far can supotech and other innovations challenge the status quo of regulatory reporting?<sup>1</sup>

## Executive summary

**Regulatory data are the backbone of effective financial sector supervision but regulatory reporting is a complex and costly process and bogged down by several obstacles.** Financial authorities need access to timely and good-quality data in order to exercise their regulatory and supervisory functions. The current pandemic, through its limitations to on-site supervisory reviews, has reinforced the importance of robust and flexible regulatory data frameworks in crisis situations. However, multiple factors complicate the regulatory reporting process. These include heterogeneity in how internal data are defined across financial institutions, the complexity of regulations and inclusion of reporting instructions across different regulations. These complicating factors introduce not only a degree of uncertainty about the accuracy and completeness of regulatory reports but also complexity in the process of transforming internal data into reported data. This complexity necessitates significant investment from financial institutions in running their regulatory reporting systems.

**Innovations in regulatory reporting are aimed at mitigating the complexity and addressing the obstacles that exist at the different points in the regulatory reporting process.** Innovations have taken place at the level of either operational data (ie data from business operations) or “input data” (ie data elements needed to populate regulatory reports) by way of standardisation across the industry (eg through the use of data dictionaries). They have also taken place in the way transformation rules (ie description of the steps for generating regulatory reports) or reporting instructions are defined/written. The format and granularity of the required reporting data have also evolved over time. Moreover, the technology used for transmitting data has obviously been progressing over recent years. Lastly, there are initial experiences and experimentations aimed at enabling financial authorities to actively access data from financial institutions.

**This paper covers regulatory reporting initiatives at 10 financial authorities that are implementing or have implemented innovations in their data collection frameworks.** Most authorities are implementing innovations in terms of data standardisation and granularity of required reporting data. Around half are implementing innovations in the means of data transmission and transformation rules. Only a few authorities, however, are implementing innovations in the format of required reporting data or actively accessing data from financial institutions. As data standardisation provides a foundation for improvements in the regulatory reporting process, innovations in transformation rules always occur alongside data standardisation and almost all of the authorities aiming at granular reporting are also implementing data standardisation.

**Innovations are enhancing the quality of regulatory data and setting the basis for achieving the ultimate objective of moving towards the concept of “data-sharing”.** Authorities’ initiatives are

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The authors are grateful to the representatives from the authorities and institutions interviewed, and to Patrick Armstrong, Rodrigo Coelho, Puneet Pancholy, José María Serena, Ken Taniguchi and Joy Wann for helpful comments. We are also grateful to Dung Tran for valuable support with this paper.

enhancing regulatory data quality by either ensuring consistency in data through standardisation or embedding data validation rules in the data transmission solutions. Other common benefits expected from these initiatives include straight through data processing, more timely reports and reports that can be used flexibly for different types of analyses. More advanced regulatory reporting initiatives are expected to result in automatic generation of reports and enabling authorities to shift away from the concept of regulatory data reporting to that of “data-sharing”. This refers to the ability of financial authorities to extract the information they need directly from financial institutions’ databases. “Data-sharing” can therefore help realise on-demand monitoring of financial institutions’ condition and allow authorities to act swiftly if the situation calls for it, thus contributing to greater financial stability.

**However, authorities face a number of issues and challenges in the implementation of their regulatory reporting initiatives, key among which are reconciling the different interests of various stakeholders and addressing legacy systems.** Shepherding the different views, practices, resources and cultures of different stakeholders is the challenge most cited by financial authorities. In particular, the relative burden facing smaller financial institutions in terms of financial and technical resources could make the implementation of ambitious initiatives more challenging. Financial authorities are addressing these constraints by either tailoring the new reporting approaches to different types of financial institutions or providing financial grants or technical support to assist with implementation. In terms of technology, the complicated process of disentangling closely intertwined legacy systems causes a strong preference for the status quo, which in turn makes it challenging to get buy-in.

**Based on the experience of authorities covered in this paper, there may be certain preconditions for a regulatory reporting initiative to succeed.** These include:

- a. Strong commitment and support from top management at both financial authorities and financial institutions;
- b. Alignment of vision by engaging transparently, collaboratively and openly with key stakeholders;
- c. A culture of innovation that relies on data-driven decision-making, openness to experimentation and questioning “legacy thinking” within financial authorities;
- d. A well defined centralised data strategy and data governance framework within financial authorities; and
- e. Effective management of the transition to new regulatory reporting processes, particularly by taking a step-wise approach.

**Looking ahead, while a shift to a “data-sharing” concept may take time, the trend towards more granular and integrated reporting is very likely to continue.** For the “data-sharing” concept to become a reality, the right technology and data standardisation are critical. But the technology to implement this concept is still being developed, and while data standardisation is certainly attractive since it can significantly simplify the regulatory reporting process, implementing it particularly on a wider scale raises financial, practical and competition issues. So a widespread shift to the “data-sharing” concept is unlikely to happen in the near term. That said, many authorities have already started their journey towards more granular and integrated reporting and more will possibly follow. But implementation may take different forms. Smaller financial institutions will likely generate required granular reports in a more traditional way but aided by a more modern format of reports and means of data transmission. Larger financial institutions are expected to be subject to more data standardisation, especially for reporting areas with cross-border elements in which data interoperability is important (eg in the area of derivatives reporting). Several initiatives towards data standardisation are already under way at the regional (particularly in Europe) and international level. FSB (2020), which calls for potential international collaboration in evaluating the scope for common data standards for relevant regulatory areas, provides a boost to these important initiatives.

## Section 1 – Introduction

- 1. Financial authorities rely on good and timely information to fulfil their monetary, financial stability and other mandates.** Statistical and regulatory data constitute the largest category of information that authorities collect from financial institutions. This information allows authorities to obtain an accurate picture of the economy, the financial system and individual financial institutions. Statistical data include balance sheet information, the main objective of which is to support authorities' monetary and macroprudential mandates. Regulatory data refer to prudential concepts such as capital positions and liquidity resources as well as credit, market, operational and other risk exposures. Regulatory data are primarily used to support authorities' micro- and macroprudential supervisory tasks as well as their crisis management responsibilities. The Bank of England estimates that 90% of the reporting forms in a typical bank correspond to regulatory reporting requirements.<sup>2</sup>
- 2. Regulatory data are the backbone of effective financial sector supervision and hence authorities invest considerable resources in data collection and assessment.** Authorities rely on regulatory data to have a comprehensive understanding of the risk profile of a financial institution. This information is a critical input for authorities' deployment of their risk-based supervisory approach, including determining the frequency, scope and depth of on-site reviews. This type of data is also used to identify emerging risks; support policymaking; and facilitate supervisory exercises such as thematic reviews or stress tests. Regulatory data are typically captured through a number of specific reporting requirements, using detailed templates that follow a variety of reporting frequencies and relying on different collection systems. The specific nature of the reporting requirements and templates used have made it challenging to repurpose regulatory data for other uses. This, in turn, has led to redundant reports and substantial investment in IT and staff to collect, store, process and assess regulatory data.
- 3. Collecting and reporting regulatory data is a complex and costly exercise for both financial authorities and financial institutions.** For financial authorities, there may be a lack of a central data governance function resulting in different users determining their own data needs. This leads to an exponential growth in regulatory reports, which have limited uses apart from the intended analysis by the users, and potential data duplication. Data collection solutions may also not facilitate straight through data processing (ie automated processing of data from collection to validation and all the way to analytics and visualisation). For financial institutions, complying with regulatory reporting requirements is complex due to multiple factors, including the fact that reporting instructions are found in different regulations and their wording might be unclear or subject to different interpretations. Importantly, regulatory data do not fully align with data used for internal reporting purposes, which themselves vary across financial institutions. This results in financial institutions having to transform information from their business operations into regulatory data based on their understanding of the reporting instructions. This transformation process typically requires input across units within the financial institution and expert judgment. As such, it introduces not only a degree of uncertainty about the accuracy and completeness of the reported data but also the possibility that the same data could be treated differently across financial institutions. The size of a financial institution, its business model and the resources allocated to deal with regulatory reporting can also make the regulatory reporting process more complex.<sup>3</sup> This complexity requires significant investment from financial institutions in running their regulatory reporting frameworks.

<sup>2</sup> BoE (2020).

<sup>3</sup> For instance, a large cross-border bank must meet reporting requirements in several jurisdictions and hence repeat the internal transformation process according to different regulatory regimes. In the case of smaller banks with simple business models, their data requirements could be relatively small but the technological and headcount resources needed could make those requirements excessively costly.

McKinsey estimates that regulatory reporting for UK banks costs the industry £2–4.5 billion per year.<sup>4</sup> The European Commission calculates data reporting-related costs to be in the range of 1.2–2.2% of total operating costs.<sup>5</sup>

4. **Challenges around complexity in reporting regulatory data are exacerbated by weaknesses in technological infrastructures and data architectures.** These shortcomings were made evident during the Great Financial Crisis (GFC). Many banks were unable to aggregate risk exposures and identify concentrations fully, quickly and accurately. As such, their data reporting frameworks were deemed inadequate to effectively support the management of their risks. In response, the Financial Stability Board (FSB) and the Basel Committee on Banking Supervision (BCBS) issued a set of principles to strengthen banks' risk data aggregation capabilities and risk reporting practices (Basel 239) in January 2013.<sup>6</sup> While Basel 239 applies to banks' risk management processes, its implementation can also benefit regulatory reporting. The latest report on the implementation of Basel 239 indicated that banks had made notable improvements, particularly in the areas of governance, risk data aggregation capabilities and risk reporting practices, but there was still considerable work ahead, especially with respect to data architecture and IT infrastructure.<sup>7</sup> Unaligned IT solutions and legacy systems are still hindering banks' ability to produce risk data reconciliations and accurate reports with sufficient granularity.

5. **The significant growth of regulatory reporting requirements after the GFC is putting additional pressures on both financial authorities' and financial institutions' reporting systems.** The post-GFC reforms were intended to strengthen the resilience of the global financial system by increasing the quality and quantity of bank capital, establishing new liquidity requirements and introducing workable resolution regimes. In parallel, financial authorities have been expected to implement more intensive micro- and macroprudential supervisory approaches. Therefore, following the GFC, the number, scope and complexity of prudential requirements have been substantially expanded. In the case of the European Union (EU), this post-GFC overhaul involved adopting more than 40 pieces of EU financial services legislation which generated a significant number of new, and mostly more granular, regulatory reporting requirements.<sup>8</sup> Although new reporting requirements are mainly connected with the implementation of post-GFC reforms such as Basel III and resolution planning, in recent years authorities have also sought detailed information on different aspects such as for conducting stress testing.

6. **Emerging risks and supervisory adjustments connected with the Covid-19 pandemic have reinforced the importance of robust and flexible regulatory reporting frameworks.** The pandemic has introduced market stress and a protracted state of uncertainty for financial institutions and their supervisors.<sup>9</sup> Despite the resilience shown by financial institutions, the worsening economic conditions have raised credit, liquidity and operational concerns and the need for enhanced monitoring by authorities. At the same time, Covid-19 introduced serious limitations to on-site supervisory reviews and other face-to-face meetings. Due to this, supervisors had to largely rely on off-site supervision tools such as virtual meetings and regulatory data to closely monitor financial institutions. This enhanced monitoring required upgrading existing data requirements, receiving specific reports at higher frequencies and/or introducing new ad hoc data requests. Considering that information needs are likely to change as the

<sup>4</sup> van Steenis (2019).

<sup>5</sup> European Commission (2019).

<sup>6</sup> BCBS (2013).

<sup>7</sup> BCBS (2020).

<sup>8</sup> European Commission (2019).

<sup>9</sup> Pancorbo et al (2020).

economic impact of the pandemic evolves, Covid-19 has put a premium on robust and flexible regulatory reporting frameworks.

**7. Innovative technologies provide opportunities to improve regulatory data reporting processes within financial authorities and financial institutions but they also introduce risks.**

A recent significant development is the use of innovative technologies by authorities to support their work (suptech) and by financial institutions to meet their regulatory requirements (regtech).<sup>10</sup> These technologies include application programming interfaces (APIs) for transmitting data; artificial intelligence (AI) or machine learning (ML) tools for data processing and analytics; and cloud platforms for data storage. However, the use of innovative technologies raises potential risks. Cyber risks have the potential to grow due to the increased use of digital solutions and greater interconnectedness between financial institutions and third-party service providers. Dependency on a few critical service providers might also create or exacerbate concentration risk. Using sophisticated data analytics tools may also provide opportunities for supervised entities to “game” the system.

**8. A number of financial authorities have launched initiatives to enhance their regulatory reporting practices, including through the use of suptech.**

Previous FSI work has highlighted financial authorities’ efforts to implement suptech or newer “generations” of technologies, including for regulatory reporting purposes.<sup>11</sup> These initiatives seek to reduce the data reporting burden on the industry, increase the timeliness and quality of the collected data and improve their use for prudential decisions. A common theme behind these initiatives is to standardise and automate the regulatory reporting process as much as possible. Authorities have also relied on close coordination with financial institutions to build a common understanding of the challenges involved and the feasibility of potential improvements.

**9. This paper aims to provide an overview of the ongoing initiatives undertaken by authorities to increase the efficiency and effectiveness of their regulatory reporting practices.**

It looks at initiatives in selected central banks such as the Central Bank of the Republic of Austria (OeNB), the European Central Bank (ECB), the Bank of Italy (BdI), the Bangko Sentral ng Pilipinas (BSP), the National Bank of Rwanda (BNR) and the Monetary Authority of Singapore (MAS). It also reviews initiatives at other financial authorities such as the Australian Prudential Regulation Authority (APRA), the European Banking Authority (EBA), the Financial Conduct Authority (FCA) and the Federal Deposit Insurance Corporation (FDIC). The sample of authorities is based on notable or publicly known initiatives and aims at getting a good mix of authorities from developed, emerging and developing economies. This work also benefited from input from selected banks and other entities subject to or involved in the regulatory reporting initiatives driven by the above-mentioned authorities.<sup>12</sup> This paper describes, compares and draws lessons from these different regulatory reporting initiatives.<sup>13</sup> Specifically, Section 2 describes a framework for looking at the main innovations that have taken place at key points in the regulatory reporting process. Using this framework, Section 3 presents the different regulatory reporting initiatives of the authorities mentioned above. Section 4 describes the issues and challenges associated with the process of implementing these initiatives. Section 5 concludes.

<sup>10</sup> Broeders and Prenio (2018); FSB (2020).

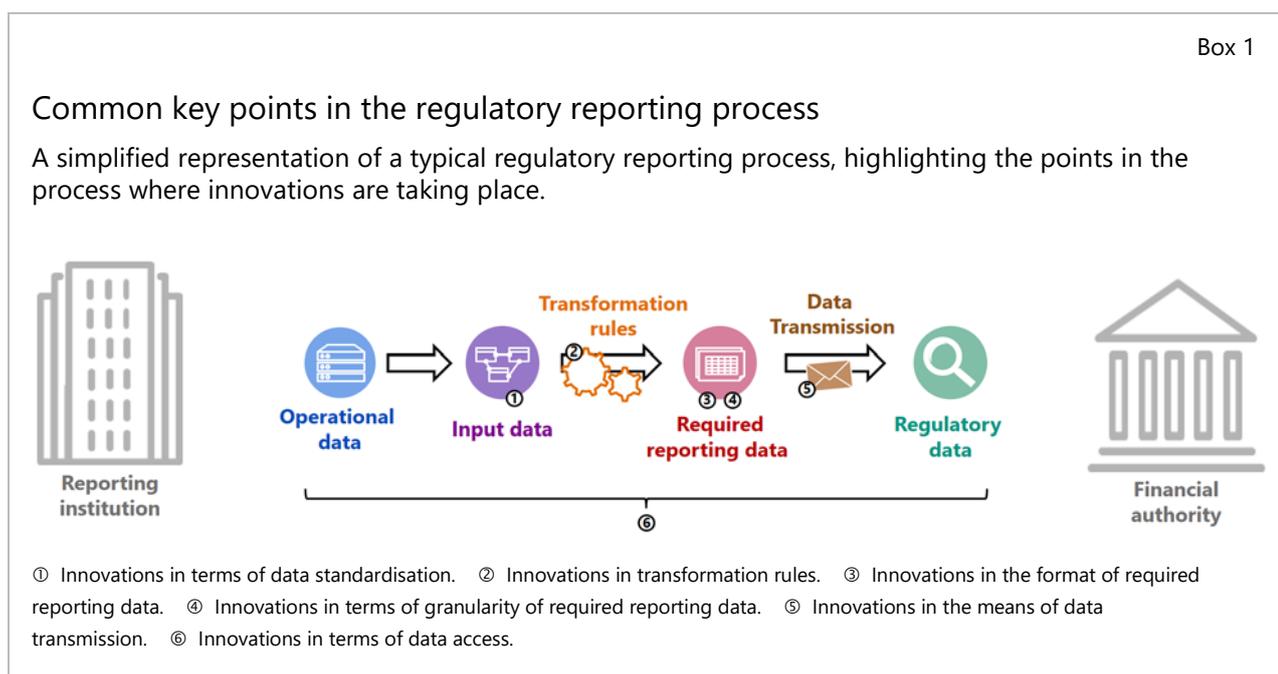
<sup>11</sup> di Castri et al (2019).

<sup>12</sup> This includes Asia ING, Austrian Reporting Services, Bank of the Philippine Islands, BearingPoint, Erste Group Bank, the International Swaps and Derivatives Association, Raiffeisen Bank International, Sunoida Solutions, UniCredit Bank Austria and Vizor.

<sup>13</sup> Some of these initiatives also cover statistical data.

## Section 2 – Innovations in regulatory reporting

10. **There are a number of common key points in the regulatory reporting process.** While the detailed processes for generating regulatory reports within financial institutions vary, there are key points in the regulatory reporting process that are common across institutions (see Box 1). First, financial institutions collect data from their business operations (ie their operational data, such as detailed data on mortgage loans extended to customers). Second, they map their operational data to the “input data”, which are the data elements needed to populate regulatory reports (eg outstanding loan amount, number of days past due, etc).<sup>14</sup> Third, they transform the input data to the required reporting data based on reporting instructions provided by financial authorities. Finally, required reporting data is transmitted to the financial authority.



11. **Innovations in regulatory reporting happen at different points in the regulatory reporting process.** Following the common points in the regulatory reporting process described above, innovation can happen at the level of either operational data or input data by way of standardisation across the industry. Innovation can also happen in the way transformation rules<sup>15</sup> or reporting instructions are defined/written. The format and granularity of the required reporting data can also be subject to innovations. Moreover, the technology used for transmitting data has obviously been subject to innovations and has evolved over time.<sup>16</sup> Lastly, innovations might also enable financial authorities to actively access data (ie they are no longer passive recipients of data but are actively extracting the information they need from financial institutions), which could facilitate the shift away from the concept of regulatory data reporting to that of regulatory “data-sharing”.<sup>17</sup>

<sup>14</sup> At first glance, financial institutions with manual processes may be viewed as skipping this step, but in practical terms the worksheets that they use to prepare required reporting data effectively contain their input data.

<sup>15</sup> Transformation rules refer to the description of the steps for generating regulatory reports.

<sup>16</sup> di Castri et al (2019) outline the four generations of technology used by financial authorities in the different data processes, focusing in particular on data transmission in the case of the data collection process.

<sup>17</sup> See, for example, Barefoot (2020).

12. **The earliest form of innovation is in the format of required reporting data.** Regulatory reports began as tabular reports in paper form. They eventually evolved into digital form with the advent of computers, albeit retaining their “paper-like” qualities, ie continuing to be tabular reports. For example, the Excel spreadsheet is basically just a digitised version of the paper spreadsheet. More recently, authorities have proceeded to collect information in Extensible Markup Language (XML) or XML-based data formats.

13. **Innovations in the format of required reporting data increase the amount of data that can be accommodated in a single file and the types of analyses authorities can perform.** Excel spreadsheets, for example, are limited to around 1 million rows and 16,000 columns. Similarly, workbooks are limited to roughly 2 gigabytes depending on the version.<sup>18</sup> In addition, common spreadsheets are only able to perform data analyses that are relatively rigid and produce static reports that require manual updating. Newer data formats can accommodate a much larger magnitude of data sets and, thus, are much better suited for regulatory reporting that involves a significant number of data elements. Moreover, they can enable more advanced data analytics and dynamic visualisation.

14. **Another earlier innovation is in the means of data transmission.** Financial institutions may have started out hand-delivering or mailing paper reports, which were subsequently replaced by computer disks. Eventually, financial institutions were able to transmit reports digitally via email. More recently, financial institutions have been able to upload required reporting data via web portals put in place by financial authorities. Authorities are moving towards machine-to-machine transmission of reports from financial institutions, for example via an API.

15. **Innovations in the format of required reporting data and in the means of data transmission are complementary.** As financial institutions are required to report increasingly more data, newer data formats are able to accommodate more data points while newer data transmission methods reduce file size restrictions and allow for straight through data processing. This enables financial institutions to transmit larger amounts of data to financial authorities. Newer data transmission methods (eg in encrypted form via a virtual private network) also reduce operational and information security risks compared to, for example, transmission in paper form or via email.

16. **The more recent innovations are somewhat interrelated and arise from the shift towards more integrated reporting and away from siloed reporting.** In most financial authorities, while collection and storage of reports may be centralised, the reports are designed and used by different units (in some cases, the need for reports may also be determined by different units). This creates some inefficiencies since there are bound to be reports that are redundant or, worse, reports that are similar but defined slightly differently. The shift towards more integrated reporting by financial authorities is an effort to address these inefficiencies especially in the face of significantly increasing regulatory reporting requirements post-GFC. Under the integrated approach, financial institutions are required to provide a single set of reporting data (instead of multiple sets of reports) that satisfies the needs of the different users within the financial authority. This involves centralised governance of regulatory data, including in the determination and design of the required reporting.

17. **The shift towards more integrated reporting necessitates more granular required reporting data.** Given that under the integrated reporting approach financial institutions are only required to provide a single set of reporting data, these data must be sufficiently granular to satisfy the different needs of financial authorities.<sup>19</sup> For example, financial institutions in some jurisdictions may already be required to report data broken down along a number of dimensions but still on a certain aggregated level, as in the

<sup>18</sup> To illustrate, the use of Excel has been cited as the reason why Covid-19 test results in the United Kingdom were not properly reported (see [www.bbc.com/news/technology-54423988](http://www.bbc.com/news/technology-54423988)).

<sup>19</sup> For a discussion of the benefits of an integrated approach for reporting agents, compilers and users, see ECB (2020).

“data cube approach”<sup>20</sup> to reporting. The ultimate granularity in reporting, which will significantly increase the number of regulatory data points, is when financial institutions report transaction- or instrument-level data similarly to how they store their operational data.

18. **Granular reporting can reduce complexity of reporting, further improve the flexibility of financial authorities’ analyses and reduce ad hoc reporting.** Most regulatory reporting currently uses predefined templates that were designed based on specific uses. Granular reporting removes the need for these multiple templates, thus reducing complexity. In addition, it avoids the loss of information that typically happens when aggregating at the template level. Granular reporting therefore provides flexibility in financial authorities’ analyses since granular information can be easily repurposed for different uses. This in turn could potentially reduce the need for ad hoc reporting. Moreover, the large volumes of data afforded by granular reporting can also contribute to the further development of financial authorities’ data analytics tools, particularly in training ML-enabled tools.

19. **More granular required reporting data raises the need for data standardisation.** Financial institutions typically define their own operational data differently from others’ given the heterogeneity in financial institutions’ products and services and their approach to managing their businesses. Within financial authorities, different users may also define required data differently as they are meant to address their specific use cases. As such, if financial institutions were to provide more granular data to be used by different users within the financial authority, there would have to be a common understanding of what those data were. Authorities are addressing this challenge by standardising the input data to which financial institutions map their operational data before generating the required reports. Industry data standards are also starting to emerge,<sup>21</sup> which would make it much easier for financial institutions to directly map their operational data to required reporting data with no or minimal processing.

20. **Data standardisation can significantly simplify the regulatory reporting process by making data consistent at source.** For the purposes of this paper, data standardisation involves setting standards relating to the attributes, terminology, structure, relationship and format of the data elements.<sup>22</sup> By standardising input data, financial authorities will make the generation of required reporting data by financial institutions simpler and more consistent. Standardising operational data (for example through industry initiatives), on the other hand, can either eliminate or greatly simplify the cost of building and maintaining input data. Since the GFC, financial authorities have started or facilitated work on standardising certain data elements, which are useful for reporting purposes, at the international level (eg legal entity identifiers). Authorities continue to recognise the need for international collaboration in this area.<sup>23</sup>

21. **Data standardisation enables more advanced innovations in transformation rules.** Reporting instructions provided by financial authorities mainly remain in natural language that requires interpretation on the part of financial institutions. Innovations in this area aim to help in the interpretation of natural language instructions to reduce errors and speed up the collection process. These involve, for example, following guidelines in rule drafting to enforce consistency in the writing of reporting instructions.<sup>24</sup> They may also include providing annotations to reporting instructions to make them easier to navigate and understand. Annotations can include tags to a range of metadata, thereby allowing for

<sup>20</sup> A data cube is a multidimensional array of values representing granular data.

<sup>21</sup> For example, ISDA’s Common Domain Model (CDM) for derivatives.

<sup>22</sup> Adapted from definition in Gal and Rubinfeld (2019).

<sup>23</sup> See FSB (2020).

<sup>24</sup> See, for example, the Semantics of Business Vocabulary and Rules (SBVR): [www.omg.org/spec/SBVR/](http://www.omg.org/spec/SBVR/).

information to be extracted in an automated way (effectively making the reporting instructions “machine readable”). With standardisation in operational or input data, reporting instructions can be published in more “formal” transformation rules<sup>25</sup> that provide a technical description of the steps for generating regulatory reports. Reporting instructions can also be published in programming codes referencing these standardised data, thus allowing for regulations that can be “machine-executable”.<sup>26</sup>

22. **The more advanced innovations seem to be moving away from the concept of regulatory data reporting to that of regulatory “data-sharing”.** These innovations radically change how data are accessed by financial authorities. For example, instead of financial institutions actively “reporting” or transmitting data to financial authorities (the “push approach”), the latter could have on-demand access to the former’s data (the “pull approach”). Meanwhile, distributed ledger technology (DLT) could potentially change the whole “regulatory reporting” process. It envisions a scenario where records of all financial transactions are stored in a distributed ledger. Financial authorities are given access to the relevant records in the distributed ledger and they can then simply extract the information they need.<sup>27</sup> This effectively removes the need for the intermediate steps in the regulatory reporting process described above (see paragraph 42 for more discussion on the use of DLT for reporting). In both the “pull approach” and DLT-based “reporting”, financial authorities are no longer passive recipients of data but are actively extracting the information they need from financial institutions. Hence, in essence, this is no longer “data reporting” but more like “data-sharing” arrangements.

### Section 3 – Regulatory reporting initiatives

23. **The 10 financial authorities covered in this paper are implementing or have implemented multiple innovations in their regulatory reporting processes.** More than half of the authorities are implementing innovations in terms of data standardisation and granularity of required reporting data. Five are implementing innovations in the means of data transmission, while four are implementing innovations in transformation rules. As mentioned in Section 2, data standardisation, transformation rules and granular reporting are quite interrelated. In fact, innovations in transformation rules always occur alongside data standardisation. Meanwhile, four out of the six authorities aiming to introduce granular reporting are also implementing data standardisation. Not many authorities, however, are implementing innovations in the format of required reporting data. This may perhaps reflect the relative maturity of innovations in this area, which may have already been implemented previously. Moreover, only one authority is implementing innovations that enable it to actively access data from financial institutions. Table 1 provides an overview of all the authorities’ initiatives covered in this paper.

<sup>25</sup> “Formal” transformation rules refers to a well defined syntax and semantics that allow a complete and accurate description of reporting instructions (similar to programming languages).

<sup>26</sup> See, for example, BoE (2020).

<sup>27</sup> See, for example, Auer (2019).

Overview of initiatives covered in this paper

Table 1

Financial authority	Initiatives covered	Areas of innovation					Data access	Status of initiatives	Support by external stakeholders, eg software vendors
		Data standardisation	Transformation rules	Format of reports	Granularity of reports	Data transmission			
APRA	APRA Connect				X	X		In development	Developed by external vendor
BdI	PUMA	X	X					Operational	Joint work with financial institutions
BNR	Pull approach	X			X		X	Operational	Developed by external vendor
BSP	API-based reporting			X		X		In development	Pilots with vendors and financial institutions
EBA	Feasibility study, EUCLID, DPM	X			X	X		Experimental, In development, Operational	Collaboration amongst authorities
ECB	BIRD, IReF	X	X		X			Operational, In development	Development with financial institutions and software vendors
FCA	DRR	X	X					Experimental	Pilots with vendors and financial institutions
FDIC	Modernisation of reporting				X	X		Experimental	Competition amongst software vendors
MAS	DCG			X		X		In development	Developed by external vendor
OeNB	Data model; Smart cubes	X	X		X			Operational	Joint work with financial institutions

Acronyms of initiatives:

API – Application Programming Interface

BIRD – Banks’ Integrated Reporting Dictionary

DCG – Data Collection Gateway

DPM – Data Point Model

DRR – Digital Regulatory Reporting

EUCLID – European Centralised Infrastructure for Supervisory Data

IReF – Integrated Reporting Framework

PUMA – cooperation initiative of the Italian banking system for reporting purposes

Sources: FSI interviews with authorities and publicly available documents.

24. **The nature of the innovation being implemented dictates the kind of third-party involvement in the initiative.** For initiatives that implement innovations in the means of data transmission, technology vendors are often involved. This is because these initiatives require changes in the IT systems of financial authorities or putting in place IT solutions. Initiatives that introduce data standardisation, on the other hand, typically involve close collaboration with financial institutions as well as other relevant authorities. These types of initiatives require strong consensus-building so that the resulting data standards have the full support of key stakeholders.

25. **Financial authorities' initiatives can be powerful drivers for the enhancement of the quality of regulatory data and financial institutions' information systems.** All of the initiatives are meant to enhance regulatory data quality by either ensuring consistency in data through standardisation or embedding data validation rules in the data transmission solutions. However, it is challenging for financial institutions with legacy systems or manual processes to implement new reporting solutions and take advantage of their benefits. Initiatives to implement such solutions therefore force financial institutions to upgrade or automate their systems and processes. The more far-reaching the initiative is, the more extensive the impact will be on financial institutions' systems and processes. For example, the BNR's "pull approach" initiative led to the clean-up of financial institutions' customer data and, in some cases, even the digitisation of loan application processes.

## Data transmission

26. **Authorities implement innovations in the transmission of regulatory reports in order to overcome inefficiencies associated with segmented data processes.** As mentioned in Section 2, innovations in the means of data transmission entail the development of IT systems for data collection, such as web platforms that allow straight through data processing (ie data processes such as collection, validation, analysis and visualisation are no longer handled independently or by separate IT solutions). For example, the MAS has already started implementing its new data collection platform, called the Data Collection Gateway (DCG). The DCG streamlines and consolidates data collection, validation and administration into a single solution, while allowing flexibility in the format of reporting data. A similar initiative is the EBA's European Centralised Infrastructure for Supervisory Data (EUCLID), which is a scalable, more efficient infrastructure for data collection. EUCLID allows the EBA to collect data from the European Economic Area (EEA) national competent authorities on all their credit institutions and banking groups.<sup>28</sup>

27. **The use of APIs for data transmission helps to overcome data transfer file size restrictions.** In 2018 and 2019, the BSP piloted a prototype API for data collection with the involvement of several Philippine commercial banks.<sup>29</sup> The success of the two pilot exercises prompted the BSP to overhaul its data collection system while simultaneously changing the reporting data format. In the longer term, the BSP plans to integrate its supervisory reporting requirements into one single data package. This will reduce "double reporting", facilitate consistency of data across different uses and at the same time make amendments to reporting requirements less burdensome for financial institutions. This project involves, as a first step, the implementation of a web upload solution that is tailored to the new data format. As a second step, the BSP will implement the piloted API solution for larger banks while smaller banks will continue to use the web upload solution.<sup>30</sup>

28. **Many authorities are making continuous efforts towards a solution that allows them to monitor financial institutions' condition "on demand".** The MAS is exploring how a seamless connection between its systems and financial institutions' systems can be achieved, even as practical realities make this challenging. The FDIC, on the other hand, has just launched a TechSprint that aims to explore new data collection solutions for a timelier and less burdensome regulatory reporting process.<sup>31</sup> This is an initial step towards the FDIC's long-term goal of having a regulatory reporting solution that would allow "on-demand" monitoring of banks as opposed to being constrained by "point-

<sup>28</sup> See EBA (2020).

<sup>29</sup> See di Castri et al (2018).

<sup>30</sup> The Bank of Ghana has also implemented API-based reporting ([www.vizorsoftware.com/news/vizor-software-achieved-first-milestone-with-bank-of-ghana/](http://www.vizorsoftware.com/news/vizor-software-achieved-first-milestone-with-bank-of-ghana/)).

<sup>31</sup> See [www.fdic.gov/news/press-releases/2020/pr20109.html](http://www.fdic.gov/news/press-releases/2020/pr20109.html).

in-time” reporting. This project is particularly targeted at smaller, community banks that provide only aggregated data on their financial health on a quarterly basis, which can create information gaps particularly in crisis situations such as the current pandemic.<sup>32</sup>

29. **Improvements in data transmission are closely intertwined with improvements in data validation, storage and analysis.** For example, APRA is developing its new data collection platform called “APRA Connect” within the framework of a large-scale data modernisation project that has delivered new technology and capability for the whole data process, including the establishment of an enterprise data warehouse, business intelligence (BI) tools for internal data usage and the enhancement of APRA’s data-sharing capabilities. This will allow APRA to more easily perform aggregations and transformations of the data it collects and to be more flexible regarding the types and amount of data collected (eg more granular data). Many of the innovations in data transmission also include data validation upon receipt of reports. For example, the BSP’s API-based reporting will include a validation engine that automatically tests the transmitted data and provides feedback to the reporting financial institution on the results of the validation tests.

## Data standardisation and transformation rules

30. **Data standardisation is at the core of many initiatives covered in this paper that aim at generating consistent and better-quality reports.** Many initiatives covered in this paper incorporate standards via a data dictionary.<sup>33</sup> This is the case, for example, with how the required granular data are specified in the BNR approach. The BNR data dictionary is updated frequently in order to capture developments in the financial system (see paragraph 41 for an extensive discussion of the BNR approach). The EBA has developed the Data Point Model (DPM), which is a data dictionary that implements uniform and consistent definitions that serve as a basis for the EBA’s reporting requirements. The MAS, meanwhile, is working with the industry on the appropriate standards that should underpin selected regulatory reports.

31. **Data standards facilitate the expression of transformation rules through a “formal” language.** They can form the basis of a common input data model across the industry. A common input data model, in turn, can serve as a foundation for expressing transformation rules or reporting instructions in a “formal” language. One example is the approach taken by the OeNB, which expresses transformation rules as algorithms or select statements (see Box 2 for an example) instead of purely in natural language that, although it can be broadly understood, may be subject to multiple interpretations.

<sup>32</sup> While the FDIC initiative, which is still in an experimental stage, seems to focus more on data transmission, it is likely that any solution identified will introduce innovations at other points of the regulatory reporting process, including access to more granular data and more advanced analytical techniques.

<sup>33</sup> A data dictionary is a collection of metadata that provides information on attributes, terminology, structure, relationship and format of the various data elements.

## Transformation rules in pseudo code

Example transformation calculating a Boolean variable that indicates if a loan is 90 days past due<sup>①</sup>

```

FUNCTION 90_DAYS_PAST_DUE(business_case_ID id, Observed_Agent_ID oa, Reporting
Date repDate)
    //Selection of the instrument's past due date from the Basic Cube's entity
    containing all business cases
    past_due_date = SELECT past_due_date FROM business_case
    //By default, the instrument is not considered past due
    90_days_past_due = FALSE
    //In case the instrument is not past due, the past due date is set to the
    value "999912312". Further conditions have to be considered only for past
    due instruments.
    IF (past_due_date IS NOT "99991231") THEN
        //The term (repDate - past_due_date) computes the difference between
        the two dates in days.
        IF ((repDate - past due date) > 90) THEN
            //In case the difference between the reporting date and the date of
            past due is more than 90 days, the variable 90_days_past_due is set
            to TRUE.
            90_days_past_due = TRUE
        END IF
    END IF
    //The attribute 90_days_past_due is returned.
    RETURN 90_days_past_due
END OF FUNCTION

```

① Kienecker et al (2018).

32. **The combination of a common input data model and “formal” transformation rules is referred to as an “input approach” to regulatory reporting, which has been adopted by a number of European countries in different configurations.**<sup>34</sup> Standardising the input data and the way these are transformed into reporting data through “formal” transformation rules prevent different interpretations of reporting instructions. Under this approach, both the input data model and the transformation rules are typically developed in close collaboration between financial authorities and financial institutions (in some cases, other stakeholders, eg software vendors, are involved as well). For example, since 1974 the Bdl has been involved in the Italian banking system’s “PUMA” cooperation initiative. This initiative is developing and maintaining a common input data model and, based on this, transformation rules (albeit in natural language) for generating statistical and regulatory reports.<sup>35</sup> A similar input approach was adopted by the OeNB, which replaced pure natural language instructions for

<sup>34</sup> Technology vendors also offer regtech solutions that define the input data model and transformation rules for financial institutions. In such cases, the input data model and transformation rules would be based on the vendors’ understanding of the regulatory requirements.

<sup>35</sup> See [www.cooperazionepuma.org/homepage/index.html](http://www.cooperazionepuma.org/homepage/index.html).

reporting requirements with transformation rules that “are drafted as algorithms in a pseudo code language based on Structured Query Language (SQL)”.<sup>36</sup>

33. **Efforts are under way to have the input data model and transformation rules expressed in a “formal” language that is machine-readable.** The implementation of input models and transformation rules may be burdensome when done manually. The high complexity of reporting requirements can easily result in complicated input data models and transformation rules. Hence, to automate and simplify report generation, some initiatives are opting for input data models and transformation rules expressed in machine-readable language. In this regard, the European System of Central Banks (ESCB) and the banking industry have worked together to produce the Banks’ Integrated Reporting Dictionary (BIRD), which is based on a methodology for defining the structure and relationship of a group of data sets that have been compiled using different modelling methodologies.<sup>37</sup> This allows for a precise description of the data that should be extracted from banks’ internal systems. BIRD also uses a standard language for validation and transformation rules, which allows reporting rules to be specified in a logical and technology-agnostic way (see Box 3 for an example).<sup>38</sup> This enables “machine-readability” of the rules and automatic calculations of required data. The implementation of BIRD by banks is fully voluntary.

<sup>36</sup> See Kienecker et al (2018).

<sup>37</sup> See [www.ecb.europa.eu/stats/ecb\\_statistics/co-operation\\_and\\_standards/smcube/html/index.en.html](http://www.ecb.europa.eu/stats/ecb_statistics/co-operation_and_standards/smcube/html/index.en.html).

<sup>38</sup> Validation and Transformation Language (VTL) developed by the SDMX community ([www.sdmx.org/wp-content/uploads/VTL-2.0-User-Manual-20180416-final.pdf](http://www.sdmx.org/wp-content/uploads/VTL-2.0-User-Manual-20180416-final.pdf)).

## Transformation rules in Validation and Transformation Language (VTL)

Example transformation calculating the carrying amount depending on the accounting classification<sup>①</sup>

```
define operator D_CRRYNG_AMNT(ACCNTNG_CLSSFCTN component, FV component, GRSS_CRRYNG_AMNT_E_INTRST
component, ACCRD_INTRST component, FV_CHNG_HDG_ACCNTNG component, ACCMLTD_IMPRMNT component,
CRRYNG_AMNT component, IS_CRRYNG_AMNT_DRVD component)
returns component is
  if IS_CRRYNG_AMNT_DRVD = "T"
  then
    if ACCNTNG_CLSSFCTN in /*FV_ACCNTNG_CLSSFCTNS*/ {"14", "6", "8", "4", "2", "41"}
    then
      FV
    else
      GRSS_CRRYNG_AMNT_E_INTRST + ACCRD_INTRST - FV_CHNG_HDG_ACCNTNG - ACCMLTD_IMPRMNT
    else
      CRRYNG_AMNT
end operator;
```

Meanings of variables and codes used:

CRRYNG\_AMNT: Carrying amount

ACCNTNG\_CLSSFCTN: Accounting Classification (2 = Financial assets held for trading; 6 = Financial assets at amortised cost; 8 = Financial assets at fair value through other comprehensive income; 4 = Financial assets designated at fair value through profit or loss; 14 = Cash balances at central banks and other demand deposits; 41 = Non-trading financial assets mandatorily at fair value through profit or loss)

FV: Fair value

GRSS\_CRRYNG\_AMNT\_E\_INTRST: Gross carrying amount excluding interest

ACCRD\_INTRST: Accrued Interest

FV\_CHNG\_HDG\_ACCNTNG: Fair value changes due to hedge accounting

IS\_CRRYNG\_AMNT\_DRVD: Is carrying amount derived (parameter to trigger the generation of the Carrying amount)

ACCMLTD\_IMPRMNT: Accumulated impairment

<sup>①</sup> BIRD version 5.0, see [www.ecb.europa.eu/stats/ecb\\_statistics/co-operation\\_and\\_standards/reporting/html/bird\\_content.en.html](http://www.ecb.europa.eu/stats/ecb_statistics/co-operation_and_standards/reporting/html/bird_content.en.html).

34. **Transformation rules or reporting instructions can also be written as programming codes to enable “machine-executable” regulations.** This is what the FCA is trying to achieve in its Digital Regulatory Reporting (DRR) initiative.<sup>39</sup> In the DRR vision, the input data layer is standardised and the programming codes of the reporting instructions refer to this standardised data, thus allowing for automatic or machine execution of reporting requirements. This means regulations are published in codes or digital form (potentially alongside the natural language version) and financial institutions’ reporting systems should be designed to be able to execute these digital regulations. Reporting data could then be “pushed” to (ie financial institutions transmitting the data) or “pulled” by (ie financial authorities extracting the data) financial authorities. Controls or governance procedures could also be added at any point in the process to enable human oversight.

35. **An “input approach” could reduce the burden of reporting “passive data”.** “Passive data” refers to data that only get reported to financial authorities under specific circumstances, eg in a resolution scenario. In such cases, having standardised input data ready for collection upon request could reduce

<sup>39</sup> See FCA (2020).

both cost and time for report preparation. This approach is being piloted in Austria for resolution reporting.<sup>40</sup> It would be even more effective with machine-executable transformation rules as this would allow fully automated, and possibly real-time, generation of such reports.

36. **Data standards that could be used for regulatory reporting already exist and are continuing to emerge at the international level.** This is especially true in the derivatives space.<sup>41</sup> The FSB facilitated the establishment of the legal entity identifier.<sup>42</sup> The Committee on Payments and Market Infrastructures and the International Organization of Securities Commissions developed global guidance on the harmonisation of data elements reported to trade repositories, including unique transaction identifiers and unique product identifiers.<sup>43</sup> From the industry side, the International Swaps and Derivatives Association (ISDA) has developed the Common Domain Model (CDM), which is a digital representation of derivatives information at the trade level. The CDM has been used to test the concept envisioned in the FCA DRR. It has also been used to develop the winning solution in the G20 TechSprint for the regulatory reporting category.<sup>44</sup> ISDA is continuing to work with the industry and the regulatory community to improve derivatives reporting using the CDM.

## Granularity of required reporting data

37. **More recently, financial authorities have been replacing template-based, aggregated reporting by more granular reporting.**<sup>45</sup> As mentioned above, the BNR collects granular (ie instrument- and customer-level) data from financial institutions. Elsewhere, one of the many things that the EBA feasibility study is considering and analysing is a possible shift from its current approach, which mainly focuses on the collection of aggregated data, towards more granular reporting.

38. **Financial authorities have also implemented a data cube approach to granular regulatory reporting, in which data are broken down across multiple dimensions.** This approach was initiated in 2014 by the OeNB, which started to collect a single set of cube data ("smart cubes") that was sufficiently granular to replace a number of former, template-based statistical reports. The approach follows the principle of finding the common denominator of the different reporting requirements. It therefore reduces the burden on financial institutions since aggregation efforts are shifted to the financial authority. It also eliminates redundant reports. Similarly, APRA has begun collecting more granular data in cube form rather than in template form.

39. **Granular reporting can also result from more integrated reporting.** For instance, the ESCB is currently assessing the costs and benefits of the Integrated Reporting Framework (IReF).<sup>46</sup> The IReF aims to integrate the ESCB's existing statistical reporting requirements for banks based on the principle of collecting data on a more granular level only once and thereby replacing a variety of aggregated data requirements. The integrated reporting scheme would be based on a standardised data model and would

<sup>40</sup> Austria's Financial Market Authority has issued a consultation paper on minimum standards describing certain data points that have to be kept ready and submitted if a financial institution is in trouble.

<sup>41</sup> ISO 20022 also exists for information transferred between financial institutions arising from payment transactions, securities trading, etc. Authorities have also leveraged this standard for reporting purposes (see BoE (2020)).

<sup>42</sup> See FSB (2019).

<sup>43</sup> See CPMI-IOSCO (2018).

<sup>44</sup> See [www.bis.org/hub/g20\\_techsprint.htm](http://www.bis.org/hub/g20_techsprint.htm).

<sup>45</sup> Some authorities are also leveraging granular data from other sources. The Central Bank of Brazil, for example, is using granular data from trade repositories on government securities, private financial instruments and derivatives to support the calculation of liquidity ratios, market risk stress scenarios and other systemic stress analyses, such as the identification of vulnerabilities and propagation of risks and bankruptcies (see [www.fsb.org/wp-content/uploads/Brazil-peer-review-report.pdf](http://www.fsb.org/wp-content/uploads/Brazil-peer-review-report.pdf))

<sup>46</sup> See [www.ecb.europa.eu/stats/ecb\\_statistics/co-operation\\_and\\_standards/reporting/html/index.en.html](http://www.ecb.europa.eu/stats/ecb_statistics/co-operation_and_standards/reporting/html/index.en.html) and the IReF overview document published therein.

make use of the same data reporting dictionary as the BIRD. This would be a major step towards standardisation as currently the ECB's legal acts on statistical data collection only specify a minimum set of reporting data points and leave national central banks a large degree of freedom in implementation. This has resulted in different dictionaries, derogations, formats and data collection models that have inevitably imposed an undue burden particularly on large, cross-border banks.

40. **Granular reporting could help promote a more data-driven culture.** As mentioned in Section 2, granular reporting can improve flexibility in authorities' analyses, reduce ad hoc reporting and help train ML analytics tools. Since granular data can be easily adapted for different uses, this, in turn, could help encourage greater utilisation of data by internal users, thereby helping promote a more data-driven culture.

## Data access

41. **Only a few of the initiatives are changing the way financial authorities access required reporting data and moving closer to the concept of "data-sharing".** The BNR's "pull approach" is the only example among the initiatives covered that is already operational. In this approach, the BNR automatically pulls standardised and granular instrument- and customer-level data from the systems of more than 600 financial institutions, including commercial banks, insurance companies, microfinance institutions, pension funds, forex bureaus, telecoms operators and money transfer operators.<sup>47</sup> Some data are pulled monthly, some even daily. Financial institutions use computer scripts to extract their operational data and load them into a dedicated database within their systems but separate from their core banking systems. The BNR pulls the data in an encrypted way through a virtual private network (VPN) channel from this database. The BNR uses a solution that covers the end-to-end data reporting process, including a tool for automated data quality checks, an enterprise data warehouse, a business rules layer for data processing and a platform for visualisation and analytics. The FCA's DRR initiative could also potentially result in changes to how authorities access required reporting data. While the DRR's focus is on digitising regulation to enable machine execution of reporting requirements, it should be easy to pair "machine-executable" regulation with a "pull approach" to enable financial authorities to extract data.

42. **While it is still not being actively pursued by financial authorities and may be viewed as aspirational, DLT has the potential to fundamentally transform the way data is managed by replacing today's practice of financial institutions keeping different records of the same transaction.**<sup>48</sup> Typically, the use of DLT for reporting purposes is envisaged in a broader context of DLT-based decentralised markets, which make use of smart contracts that replace today's financial contracts.<sup>49</sup> A key aspect of the concept is that the single record of a financial contract stored on the distributed ledger may replace the separate records of all parties of the financial contract. Most models foresee that authorised parties, such as supervisors, would be able to connect directly to the ledger. In such a system, the current regulatory reporting process could be simply replaced by sharing relevant data aggregates with the supervisor in the DLT network. In this case, since everyone is looking only at a single record of financial contracts, "data standardisation" effectively happens at the level of the operational data. A main benefit of this approach is that it would make reconciliation efforts a thing of the past. At the same time, DLT may prevent unintentional, practical reporting errors and reporting of deliberate, eg fraudulent, misinformation. It is expected that, generally, the trust-creating mechanism of decentralised markets

<sup>47</sup> See Broeders and Prenio (2018).

<sup>48</sup> BearingPoint tested the concept of DLT-based regulatory reporting in the Bank of Lithuania's LBChain, which is a blockchain-based sandbox.

<sup>49</sup> OTC derivatives are a typical use case for DLT-based markets; see eg Stark (2017).

would result in better data quality making current verification processes obsolete. This approach therefore has the potential to significantly reduce the overall costs of compliance in DLT-based markets.<sup>50</sup>

43. **Approaches based on the concept of “data-sharing” enable on-demand monitoring of financial institutions’ condition and allow convergence of authorities’ and institutions’ views on risk exposures.** The BNR, for example, is able to pull certain data on a daily basis. The DLT model can in principle allow real-time or near real-time access to data and could eliminate the need for ad hoc reporting. This should address authorities’ objective (mentioned above) of being able to monitor financial institutions’ condition on demand rather than relying on point-in-time reporting. In addition, since a “data-sharing” approach leads to a more real-time and granular view of data, it would also lead to internal and external reporting being closely aligned. This would mean that financial authorities’ assessment of a financial institution’s risk exposures should converge with the latter’s own assessment.

## Section 4 – Issues and challenges

44. **Financial authorities face several issues and challenges when undertaking initiatives to improve their regulatory reporting practices.** These are either applicable to the implementation of any regulatory reporting initiative or specific to the regulatory reporting approach being taken. Generic issues and challenges include those related to stakeholder buy-in, technology, complexity of regulations, cost of implementation and availability of technical expertise. Specific issues and challenges could arise when authorities implement granular reporting, data standards or “machine-executable” regulations.

45. **Stakeholder buy-in is the challenge most cited by the financial authorities covered in this paper.** Financial authorities have to deal with both internal and external stakeholders. In both cases, stakeholders have different interests, different data cultures and may already be quite used to the way they are doing things (ie the existence of legacy thinking). External stakeholders also have varying resources. So achieving consensus on a common vision would be very challenging.

46. **Another key challenge to improving regulatory reporting practices is the presence of legacy systems in both financial authorities and financial institutions.** Legacy systems have limited functionalities and are usually incompatible with newer systems. However, they cannot be easily replaced because they are extensively used within organisations and are therefore closely intertwined with other business processes. Both financial authorities and financial institutions therefore face the issue of high inertia from their users against migrating to new systems. The migration process also takes substantial effort and is time-consuming as there is a need to migrate data sets, conduct tests to ensure successful migration, change the existing processes and train users. As such, Coelho et al (2019) posit that jurisdictions where authorities and financial institutions are just starting to develop their data infrastructure have a “late mover” advantage and may find it easier to implement innovations in regulatory reporting.

47. **There are other technology-related issues and challenges that naturally arise given that regulatory reporting initiatives involve the use of technology.** Particularly with the collection of more granular data, the technical capacity and processing power of authorities’ IT systems must increase to cater to the larger volume and higher velocity of data. In addition to back-end processing challenges, finding the right platform with an intuitive front-end interface that can cater to all stakeholders is another challenge. Financial authorities are also careful to avoid vendor lock-in and potential concentration risks when engaging third-party vendors for their new data collection systems as this could lead to substantial switching costs in the long run. Moreover, while new regulatory reporting approaches result in more secure transmission of reports compared to more traditional approaches (eg transmitting encrypted data via VPN compared to sending an Excel file via email), data security issues remain or may take different form.

<sup>50</sup> See Auer (2019).

A further complication arises for financial institutions that operate and use the same systems in multiple jurisdictions. Any modification in the system in a subsidiary would require coordination or approval from the parent company. For authorities in jurisdictions with less developed IT and communications infrastructure, implementation of initiatives that are heavily reliant on such an infrastructure would be heavily compromised.

48. **The complexity of existing regulations makes changing regulatory reporting practices not an easy feat.** Implementing new regulatory reporting approaches may require revisiting or even overhauling existing regulations. This is the case, for example, when integrating reporting requirements from different regulations. The process of revisiting and overhauling regulations to reconcile different reporting requirements can be complex and tedious due to the fact that: (i) regulations might have been written in a vastly different manner as they are drafted at various times; (ii) regulations are interdependent and any changes made to one set of regulations will lead to a downstream impact on the others; and (iii) there are many supplementary materials tied to regulations such as reporting rules, reporting instructions, FAQs and clarifications from the authorities.

49. **The cost of implementing regulatory reporting initiatives is unavoidable, but it could have a relatively bigger impact on smaller financial institutions.** Depending on the new regulatory reporting system/approach an initiative implements, initial cost of implementation could be very high as it would involve considerable transformation within financial institutions, including but not limited to changing existing business processes, redesigning internal data models to conform to new data standards, recalibrating internal validation rules and upgrading IT systems. While larger financial institutions, particularly those with more complex business models, would certainly face steep costs due to a number of reasons (such as multiple systems in multiple locations, legacy systems, etc), for smaller financial institutions the cost involved could be significant relative to their resources. This constraint is a major consideration for authorities when embarking on a project to overhaul their regulatory reporting practices and could make the challenges of implementing ambitious initiatives much more significant.

50. **Innovations in regulatory reporting require different types of skill sets for both financial authorities and financial institutions.** Financial authorities note that while business knowledge is essential, it is increasingly imperative for employees to have some form of data knowledge and technical skill sets. For financial institutions, the profile of staff they need in their regulatory reporting units will also change with developments in regulatory reporting practices. More technical innovations, such as use of "machine-readable" or "machine-executable" transformation rules, will result in a more dramatic change in needed skill sets.

## Issues and challenges specific to certain regulatory reporting approaches

51. **While granular reporting has its benefits, this method has its fair share of issues and limitations.** Increases in data volume and granularity make data management at financial authorities much more complex. In addition, having granular data (eg at the transaction or customer level) within their systems requires that financial authorities take measures to further improve data security. Authorities have to ensure that they have proper safeguards in place, such as access controls, user authentication, data encryption and strong firewalls to defend against internal and external threats. Furthermore, having access to very granular data might lead to an unrealistic public expectation that authorities would be able to prevent failure by any financial institution. For financial institutions, granular reporting might lead to more challenging audit requirements. In terms of limitations, granular data may not be suitable for all reports as some data points cannot be directly derived from granular data without additional financial institution-specific information, eg on pricing, risk calculations or forecasts, or external concepts such as accounting or regulatory standards that may require some judgment (eg assessment of risk weights).<sup>51</sup> As such,

<sup>51</sup> See BoE (2020).

ad hoc reporting – especially during crisis situations – may not be fully eliminated even with granular reporting.

52. **While data standardisation can significantly simplify the regulatory reporting process, there are financial, practical and competitive considerations that need to be carefully weighed.** Standardisation at the level of either operational data or input data can certainly make generating regulatory reports easier and more consistent. Data standards, particularly at the international level, can also achieve interoperability of data sets across jurisdictions, which is important for cross-border financial institutions. However, agreeing on a standard requires input and consensus from all stakeholders and therefore could take time. Some authorities are of the view that standardisation should be led by the industry, while others think that it is the responsibility of authorities to set standards in order to overcome the collective action problem. Once standards are set, implementing them will require a significant amount of investment. Standards could also stifle innovation, especially if the industry is locked in to inefficient standards or if the standards become outdated due to market developments. Standards may also negatively affect competition, especially if these impose relatively high compliance costs on some financial institutions or serve as a barrier to entry for new players.<sup>52</sup>

53. **“Machine-executable” regulations also raise several practical issues and challenges.** Implementation of “machine-executable” regulations requires standardisation at the granular data level, so it poses the same issues and challenges as granular reporting and data standards. It would also have similar limitations to granular reporting, ie it is not applicable to all reports, particularly those that require specific inputs or judgments from financial institutions. Indeed, BoE (2020) notes that regulation written in codes “will never remove the need for human judgement completely...could make it clearer where human judgment is required as an input to reporting and help ensure that those judgments are implemented correctly and updated as necessary”. Human translation of all existing regulations to codes will also be quite expensive. In addition, having authorities write regulations in programming codes and financial institutions generating reports from these codes would require different skill sets. “Machine-executable” regulations could also raise some legal questions of liability in cases where a financial institution’s report contains an error due to an incorrect code. Related to this is the issue of finding an adequate way for “draft” regulations in codes to be subject to the usual policy development process. In some jurisdictions, this process may involve cost-benefit analysis and briefings to parliament or other government agencies that provide oversight. Achieving effective oversight in such a case could be challenging and would require some technical expertise in the oversight bodies.<sup>53</sup>

## How are financial authorities addressing some of these challenges?

54. **Securing strong commitment from top management of both financial authorities and financial institutions is critical before rolling out any regulatory reporting initiative.** This sets the tone down the hierarchy at authorities and financial institutions and ensures that sufficient resources are committed to the initiative. This was the case, for example, in Austria, where the top management of the OeNB and the largest Austrian banks signed a cooperation agreement to establish a Standing Committee on Reporting.<sup>54</sup> In the Philippines, the BSP Governor communicated the new data collection initiative to the banking industry through a series of engagements with industry associations. In Rwanda, the BNR Governor also initiated the process in order to gather support from all parties.

55. **Engaging key external and internal stakeholders early in the process is also important in order to build a common regulatory reporting vision.** Key external stakeholders include financial

<sup>52</sup> See Gal and Rubinfeld (2019) for a comprehensive discussion of issues around data standardisation.

<sup>53</sup> Even if the draft regulation in code is accompanied by a draft in natural language, ascertaining that the two are just different forms of the same thing would also require technical expertise.

<sup>54</sup> See Kienecker et al (2018).

institutions as well as technology firms who may be involved in the design, development and experimentation of new regulatory reporting solutions. Other main external stakeholders may also include other government agencies who may be users of data that financial authorities produce. Internal stakeholders include regulatory experts, data users in the supervisory and other units, data managers, IT teams, innovation teams, etc.

56. **Financial authorities have highlighted the value of establishing a transparent working relationship with financial institutions when enhancing regulatory reporting practices.** On the one hand, it will ensure that financial institutions understand the changes that are being contemplated, including their rationale, and how that would impact their own processes in the near and longer term. On the other hand, it will provide financial authorities insights into financial institutions' reporting practices that may result in improvements in the initiative. For instance, the ESCB's open exchange with banks with regard to its BIRD initiative improved its awareness of banks' internal practices and provided clarity to financial institutions on authorities' expectations. This exchange was also used and proved essential in shaping the design of the AnaCredit<sup>55</sup> reporting from a content perspective for the benefit of all stakeholders. Similar exchanges are envisaged regarding the IReF initiative. As another example, APRA conducted workshops with industry representatives on its planned new data collection solution that provided information to industry and also assisted the project greatly in developing its implementation approach.

57. **Financial authorities have worked with their financial institutions in a collaborative way by helping them achieve a clearer understanding of the longer-term benefits that improved regulatory reporting brings.** In introducing changes to regulatory reporting practices, some financial authorities believe it is important to engage with financial institutions in a way that goes beyond the traditional authority – supervised/regulated entity relationship, ie mandating financial institutions to follow new reporting technologies or approaches. To them, the focus of the collaborative approach should be on helping financial institutions realise that implementing and embracing new technologies/approaches would be to their benefit in the long run. In that way, financial institutions have come to appreciate that, although costs are incurred at the beginning, improving regulatory reporting is a worthwhile investment since it can streamline their internal processes, result in resource and time savings in report preparation and minimise manual work that is prone to errors and thus may prove to be economical in the long run. Having a clearer understanding of the benefits that improved regulatory reporting brings creates a stronger buy-in and commitment.

58. **Being open to the perspective of financial institutions and considering their concerns is also key.** Financial authorities are taking into account the issues and challenges financial institutions are facing in implementing their regulatory reporting initiatives. The MAS, for example, has progressively taken a stakeholder-centric approach that aims first to understand the structure and availability of data in financial institutions as opposed to requesting data based purely on the authority's needs. Meanwhile, some authorities offer different reporting approaches to cater to different kinds of financial institutions. Another approach, which is taken by the BNR, is to make hardware and infrastructure investments heavier on its side and less so on the side of financial institutions to reduce the cost to the industry. While both approaches are helpful, particularly to smaller institutions, they also increase complexity and costs to financial authorities. On the other hand, a few authorities provide financial grants or technical support to assist financial institutions in migrating to new systems/approaches.

59. **Within financial authorities, it is important that everyone involved stay aligned on the goals of the initiative.** The initiative should take into consideration the needs and interests of all internal stakeholders. For example, it should not solely focus on the innovation unit's ambition of building a state-of-the-art solution for regulatory reporting. Rather, it should take into account the practical realities

<sup>55</sup> AnaCredit is a data set with detailed information on individual bank loans in the euro area. For more information, see [www.ecb.europa.eu/explainers/tell-me-more/html/anacredit.en.html](http://www.ecb.europa.eu/explainers/tell-me-more/html/anacredit.en.html).

that data users, data managers and IT teams that will implement, manage and maintain the solution face. The objective should be for the new regulatory reporting solution to make reporting more efficient, not more complex.

60. **Regulatory reporting initiatives are benefiting from a culture of innovation at financial authorities.** This includes promoting a data-driven culture, a culture of openness to experimentation and a culture of questioning “legacy thinking”. Financial authorities should embrace the use of data in all decision-making and enforcement actions. By emphasising the strategic value of data, staff would be encouraged to seek ways to capture, access and use it more efficiently. Authorities should also be open to experimentation, recognise the possibility that it may not be a smooth transition and be prepared for setbacks and tweaks to their initiatives. Moreover, authorities should encourage internal stakeholders to question the fundamentals of how they do things. For example, why are data reported in a certain way, or why is it necessary to collect certain sets of data? Traditionally, financial authorities collect data from a policy point of view. This tends to result in template-based data collection, which is not ideal for in-depth analysis. It is therefore essential for policymakers to rethink how they satisfy their data requirements. Furthermore, promoting the right culture can also be aided by acquiring new talents or raising the data and technical literacy of existing staff through development programmes such as technical training or sharing sessions to cultivate a data-driven culture within the organisation.

61. **Financial authorities that are making progress in enhancing their reporting frameworks are relying on well defined data strategies, including centralised data governance.** For example, the MAS is developing a single data strategy for the whole institution. Data-sharing within the MAS is extremely complex due to its multiple mandates and the different units within the authority that carry them out. This is why proper, centralised data governance is needed in order to prevent silos in data collection and consequent duplications in data requests. Elsewhere, the OeNB’s Statistics Department recently established a cross-section division to implement its revised, more output-oriented data strategy including an OeNB-wide data governance framework, which covers the whole process chain from data input to data usage. This will complement the successful realisation of its “input approach” to regulatory reporting that focuses on data standardisation, transformation rules and granular reporting, and that was fostered by a horizontal organisational structure based on a single point of contact for reporting institutions. Similarly, the Bdl has a dedicated Statistical Data Collection and Processing Department that acts as a servicer to data users for the shared statistical information system. Users define their data requirements, which are then transformed by data managers into a form for data collection and uploaded into the common data dictionary. This is managed within a governance framework involving a statistical Steering Committee that takes decisions on how the new requirements should be handled and provides a venue for finding savings or synergies across units. If commonalities are identified, the data needs of different users are consolidated.

62. **Financial authorities are managing the transition to new regulatory reporting approaches using a step-wise approach.** Several authorities have indicated that they are taking a gradual approach when introducing new regulatory reporting approaches. Authorities usually start with one or a few reporting areas to test. For example, APRA is starting with new superannuation returns and the MAS with its banking returns. Also, the FCA’s pilot phases 1 and 2 of its DRR initiative tested the concept in two areas – retail and wholesale, and mortgage and derivatives, respectively.<sup>56</sup> The advantage of a step-wise approach is that financial authorities can address any potential issues before widening the implementation scope. During the implementation phase, authorities should also recognise that financial institutions have varying data cultures and resources and would thus adapt differently to the new regulatory reporting approaches. As mentioned above, authorities are either tailoring the new reporting approaches to different types of financial institutions or providing financial grants or technical support to assist them with implementation.

<sup>56</sup> See FCA (2019, 2020).

## Section 5 – Conclusions

63. **Regulatory data are the backbone of effective financial sector supervision and their importance is highlighted by the current pandemic.** Financial authorities need access to timely and good-quality data in order to exercise their supervisory functions. The current pandemic, through its limitations to on-site supervisory reviews, has reinforced the importance of robust and flexible regulatory data frameworks as a foundation for effectively monitoring financial institutions. This drives authorities' ultimate objective of being able to monitor financial institutions' condition "on demand" and not be constrained by "point-in-time" reporting. Achieving this objective would allow authorities to act swiftly if the situation called for it, thus contributing to greater financial stability.

64. **Efficient and effective collection of regulatory data, however, is bogged down by obstacles in the regulatory reporting process.** These obstacles include the heterogeneity in how data are defined across financial institutions and the complexity of regulations that lead to varying interpretations of reporting requirements. The prevalent practice of aggregated, template-based reporting also presents obstacles as this leads to redundant reporting while at the same time limiting the use of each report. Old formats and ways of transmitting regulatory reports also constrain the amount of data that can be transmitted and prevent straight through data processing and secure transmission. These obstacles are exacerbated by weaknesses in technological infrastructures and data architectures that have led to international initiatives to strengthen the risk data aggregation capabilities and risk reporting practices of financial institutions, such as the development of Basel 239.

65. **Innovations in regulatory reporting present opportunities to address these obstacles.** These innovations can be found at different points in the regulatory reporting process, including in the preparation of input data, in defining transformation rules, in the required format and granularity of the reports and in the means of transmission of required reports to authorities. Among the initiatives examined in this paper, the focus has largely been on implementing innovations in the area of input data standardisation, granularity of reports and, to a slightly lesser extent, data transmission. The most common benefits expected from these initiatives include straight through data processing; consistent, better-quality and more timely reports; and reports that can be used flexibly for different types of analyses. More advanced regulatory reporting initiatives are expected to result in automatic generation of reports.

66. **Innovations that allow financial authorities to actively access data from financial institutions can facilitate the shift away from the concept of regulatory data reporting to that of "data-sharing".** The "data-sharing" concept refers to the ability of financial authorities to extract the information they need from financial institutions. This means that authorities no longer depend on financial institutions to "report" or transmit data to them. Rather, by allowing authorities to actively access or extract data, financial institutions are in effect "sharing" data with them. These innovations can therefore help realise authorities' ultimate objective of on-demand monitoring of financial institutions' condition.

67. **Authorities' initiatives to implement innovations in regulatory reporting face a number of issues and challenges, key among which are reconciling the different interests of various stakeholders and addressing legacy systems.** Shepherding the different views, practices, resources and cultures of different stakeholders is the challenge most cited by financial authorities. In particular, the relative burden facing smaller financial institutions in terms of financial and technical resources could make the implementation of ambitious initiatives much more challenging. Financial authorities are addressing these constraints by either tailoring the new reporting approaches to different types of financial institutions or providing financial grants or technical support to assist them with implementation. In terms of technology, the complicated process of disentangling closely intertwined legacy systems causes a strong preference for the status quo, which in turn makes it challenging to get buy-in.

68. **Based on the experience of authorities covered in this paper, there may be certain preconditions for a regulatory reporting initiative to succeed.** These include:

- a. Strong commitment and support from top management at both financial authorities and financial institutions;
- b. Alignment of vision by engaging transparently, collaboratively and openly with key stakeholders;
- c. A culture of innovation that relies on data-driven decision-making, openness to experimentation and questioning “legacy thinking” within financial authorities;
- d. A well defined centralised data strategy and data governance framework within financial authorities; and
- e. Effective management of the transition to the new regulatory reporting processes, particularly by taking a step-wise approach.

69. **Looking ahead, while a shift to a “data-sharing” concept may take time, the trend towards more granular and integrated reporting is very likely to continue.** For the “data-sharing” concept to become a reality, the right technology and data standardisation are two of the important prerequisites. Technology to implement this concept is still being developed. On the other hand, while data standardisation is certainly attractive since it can significantly simplify the regulatory reporting process, implementing it particularly on a wider scale poses financial, practical and competition issues. So a widespread shift to the “data-sharing” concept is unlikely to happen in the near term. Meanwhile, many authorities have already started their journey towards more granular and integrated reporting and more will possibly follow. But how this will be implemented may take different forms. For example, widespread use of “machine-readable” or “machine-executable” transformation rules will be unlikely in the near term given the technical and resource constraints they impose. The levels of input data standardisation are expected to vary for the reasons cited earlier. Smaller financial institutions will likely generate required granular reports in a more traditional way but aided by a more modern format of reports and means of data transmission. Larger financial institutions, on the other hand, are expected to be subject to more data standardisation. This is especially the case for reporting areas with cross-border elements in which data interoperability is important (eg in the area of derivatives reporting). As mentioned above, several initiatives towards data standardisation are already under way at the regional (particularly in Europe) and international level. FSB (2020), which calls for potential international collaboration in evaluating the scope for common data standards for relevant regulatory areas, provides a boost to these important initiatives.

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