FINANCIAL CONDUCT AUTHORITY

Digital Regulatory Reporting

Feedback Statement on Call for Input

Feedback Statement
FS18/2

October 2018

This relates to

our Call for input which is available on our website at www.fca.org.uk/publications.

Please send any comments or queries to:

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How to navigate this document onscreen

returns you to the contents list

Contents

1 Introduction

Why we are issuing this paper

1.1 In February 2018, we published a call for input on how technology could achieve smarter regulatory reporting. The call for input outlined a 'proof of concept' developed at our November 2017 TechSprint which could potentially make it easier for firms to meet their regulatory reporting requirements and improve the quality of the data that they provide.

1.2 The call for input sought feedback on technical aspects of this proof of concept and asked for views on how it could be improved. It also sought feedback on some of the broader issues associated with the development and potential implementation of the proof of concept.

1.3 In this feedback statement we:

- summarise the feedback we received from the call for input
- set out our response to the feedback received
- explain our next steps.

Context

1.4 We have been exploring how regulatory reporting can be modernised. Data are now even more so the lifeblood of regulation, with the data received from regulatory reporting critical to our ability to deliver effective supervision, monitor financial markets and detect financial crime.

1.5 Every firm we regulate is required to send us data via regulatory reports, but some can find it difficult to meet these obligations. Many firms tell us it takes them significant effort to navigate and interpret our Handbook, necessitating expenditure and reliance on external professional services to understand what information we need and when. Firms then implement and codify these interpretations into their in-house regulatory reporting systems. Most firms do this manually, creating the risk of different interpretations and inconsistent reporting.

1.6 We wanted to explore how we could use technology to make the current system of regulatory reporting more accurate, efficient and consistent. We particularly wanted to find ways to make our reporting rules less reliant on human interpretation and implementation.

1.7 In November 2017, we held a two-week TechSprint with the Bank of England (BoE). This built on work undertaken at a previous TechSprint in November 2016. The event developed a proof of concept that proved we could turn a set of reporting rules into

a machine-readable language. In other words, we could create a regulatory language that machines could understand and so remove the need for human interpretation.

1.8 Machines then used this language to automatically carry out (execute) the rules. Once the rules were translated, machines could fulfil the requirements by accessing the information required and then pulling this information directly from a firm's databases. We originally referred to this process as 'Model Driven Machine Executable Regulatory Reporting', but have renamed it Digital Regulatory Reporting (DRR). Although the TechSprint proved the possibility of DRR using only a small sub-set of reporting rules, in theory the approach could be expanded to a broader range of regulatory reporting requirements.

1.9 DRR has not, to date, been implemented successfully by any other regulator but, we believe, has the potential to fundamentally transform how the industry understands, interprets and then reports regulatory information. The potential benefits for firms and regulators alike are widely appreciated. The accuracy of data submissions could be improved and their costs reduced, changes to regulatory requirements could be implemented more quickly, and the reduction in compliance costs could lower barriers to entry and promote competition.

1.10 The development of the DRR proof of concept has been characterised by strong collaboration between regulators and industry. We believe that this level of ongoing regulatory commitment has been a necessary catalyst for industry to invest time and effort in the investigative phase of this work, and will remain a key ingredient in any future implementation of a DRR regime. As well as the complimentary skill sets and understanding of regulatory requirements that collaboration between industry and the regulator brings, the development of potential elements of DRR implementation such as a common data model and data delivery mechanism will, we believe, require regulators and industry to continue to work together.

1.11 In February we published a call for input which provided details on the proof of concept, and sought feedback on how it could be improved. We also sought feedback on some of the broader issues surrounding the role technology can play in regulatory reporting. To support the call for input, a series of 8 industry roundtables were held to discuss some of the relevant legal, technological and regulatory issues involved in moving toward a DRR regime. (See **Annex II** for a list of roundtable hosts).

1.12 In addition to publishing the call for input, we have also been working with the BoE and various organisations (see **Annex I**) on a 6-month pilot to build upon the proof of concept. The purpose of the pilot is to evaluate the feasibility of expanding DRR beyond the proof of concept developed at the TechSprint by testing it with 2 different use cases. The pilot is discussed in further detail in Chapter 6. The responses to the call for input and the discussions held at the roundtables have significantly contributed to and influenced the design of the pilot.

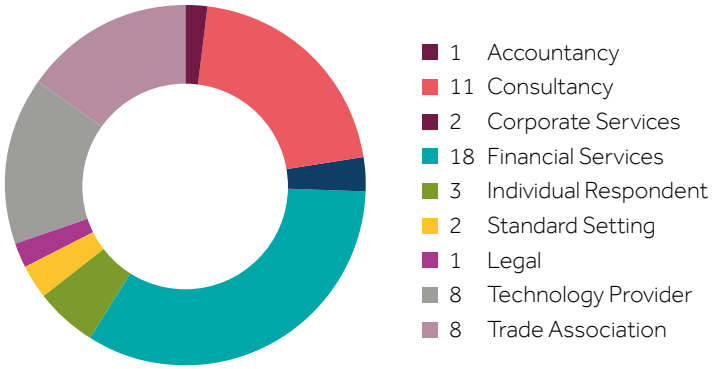
Who responded

1.13 We received 58 responses from a wide range of organisations including regulated firms, trade associations, technology providers, law firms and consultancies. Some respondents provided technical comments on the proof of concept while others focused on other questions raised in the call for input. The breakdown of these

responses by type of organisation is below. We would like to thank all the organisations for their feedback and for participating in the roundtable discussions and debates. The views expressed have helped to refine our thinking on next steps and future areas of focus.

1.14 A full list of the non-confidential respondents is available in **Annex II**.

Responses by Organisation Type



Respondent types have been defined as the organisation's primary area of business. 'Financial Services' refers to regulated firms and includes banks, building societies and investment managers.

1.15 In the subsequent chapters, we cover in more detail the following issues that respondents discussed:

- Chapter 2: Potential benefits of DRR
- Chapter 3: How to apply DRR to existing or future requirements
- Chapter 4: How the proof of concept could be improved
- Chapter 5: The role that the regulator should perform and potential funding model for developing and implementing DRR.

Next steps

1.16 Although our investigative work is at a preliminary stage, based on the feedback received to the call for input and the positive industry participation in the pilot, our current position is that implementing DRR is a concept that the financial services industry considers worth regulators investigating further.

1.17 Following the conclusion of the pilot work in November, the pilot participants will publish a technical paper in Q1 2019. This paper will provide an assessment of the technologies used to develop a DRR prototype during the pilot tests.

1.18 We will regularly publish updates on the pilots on our website. Please visit www.fca.org.uk/firms/our-work-programme/digital-regulatory-reporting for further information. We welcome the continued provision of feedback from interested parties.

1.19 The development work of the pilot, our previous TechSprints, the responses to the call for input and further industry engagement, will enable us to evaluate the feasibility and complexities of DRR. If these workstreams demonstrate the business case for a DRR regime, an appropriate consultation process and cost benefit analysis would be conducted to ensure that it could be implemented in a way which avoids disproportionate costs for firms.

2 Potential benefits of Digital Regulatory Reporting

2.1 In the call for input we expressed our belief that DRR could potentially provide significant benefits for both firms and regulators. The benefits that we identified were:

- a reduced need for firms to interpret our rules, making the information they send us more accurate and consistent
- increased efficiency, producing significant cost-savings for industry, freeing up resource and capital to innovate, improve products and services and reducing barriers to new firms entering markets
- changes to regulatory requirements being able to be implemented more quickly and cheaply
- higher quality data, allowing regulators to identify and monitor issues and risks more efficiently, diagnose harm and potentially intervene earlier.

2.2 We wanted to know whether respondents agreed with the potential benefits that we had identified. If so, how we could ensure that these benefits were shared appropriately across the industry rather than only providing advantage for certain types of firms. We were also interested in hearing views on any potential legal or unintended consequences that might arise with a move toward DRR.

2.3 To attempt to quantify the potential costs savings of introducing DRR, we asked respondents to provide indicative costs for them in meeting their regulatory reporting requirements. We also asked which aspects of the current approach, for example interpreting requirements, compliance and legal oversight, implementing system and process changes, etc resulted in the most significant costs.

Summary of responses

Potential benefits

2.4 Most respondents agreed that there are significant potential benefits to be gained by the introduction of DRR. The most commonly cited benefit was an increase in efficiency through reductions both in time and costs taken in complying with regulatory reporting requirements. This increased efficiency was also identified as potentially increasing the attractiveness of the UK regulatory framework for firms operating or considering operating in this jurisdiction.

2.5 Most respondents also agreed with our assessment that DRR could potentially increase the consistency of the information that regulators receive by reducing potential ambiguity within reporting requirements. The potential to implement future reporting requirements more quickly, and to improve the quality of data that are received, were also commonly noted benefits.

2.6 The provision of higher quality data was seen as a potential benefit for both firms and regulators. Responses noted that DRR could lead to a potential improvement in information sharing within firms, for example, the better use of regulatory data for internal risk and management purposes. For regulators it could potentially improve systemic risk analysis and the earlier identification of these risks.

2.7 However, agreement with the potential benefits of DRR was not unanimous. Several respondents stated that the effort and costs involved in implementing DRR would not be outweighed by the benefits. For example, 1 response noted that the potential difficulty in mapping regulatory reporting requirements to internal data sources and the nuances in data items may make it prohibitively expensive to achieve the standardisation that DRR is seeking to introduce.

2.8 Some responses also noted that DRR would be difficult to achieve for firms that store data in multiple legacy systems and in differing formats. The cost to replace or upgrade these legacy systems could be significant. So, a robust cost benefit analysis would be needed before any changes could be implemented. Concerns over implementation costs prompted several respondents to suggest that, if implemented, DRR should be optional or that a period of 'dual-running' should be introduced to help firms in the transition to a new approach to reporting.

Benefits of DRR being shared across the industry

2.9 We also asked for opinions on how we could ensure that the potential benefits and costs of introducing DRR could be appropriately shared across the industry. Many responses noted the need to consult widely before any changes were introduced, and the important role that regulated firms, trade associations, industry bodies, technology providers and international standard setters could play in this consultation process.

2.10 The potential for the implementation of DRR to be disproportionately beneficial for larger firms was raised. Some responses believed that those firms that stand to benefit the most from the introduction of DRR in terms of cost-savings should fund the majority of the development costs through, for example, a proportional contribution based on size. One response suggested that a staggered fee could be introduced based on permission types.

Current costs of regulatory reporting r`equirements

2.11 To ascertain the potential efficiency gains of introducing DRR we asked respondents to provide indicative costs of meeting their regulatory reporting requirements and which aspects of the current approach resulted in the most significant costs. We also asked whether the business case showed potential if firms were to move toward a DRR regime.

2.12 The cost of interpreting and removing ambiguity from regulatory rules and the collation of relevant data, were the most commonly referenced costs associated with the current reporting regime. Responses also highlighted significant costs related to updating systems to deal with new requirements and maintaining and reporting through multiple systems, particularly for firms operating in several jurisdictions. Ad hoc requests were seen by several respondents as compounding these costs. Some responses noted the fines associated for non-compliance or erroneous reporting have the potential to be higher than the cost of reporting itself.

2.13 However, respondents generally found it difficult to provide an indication of specific costs associated with the current regulatory reporting regime. Although a material reduction in costs was cited in several responses in terms of a potential business case rationale to move toward DRR. Some responses noted that these cost reductions would need to be fully analysed prior to implementation and demonstrated through further testing of any prototype solution that was developed. Increased clarity of the information that was being requested and the subsequent increased accuracy of the data provided were further benefits that were suggested. Several responses noted that an increased clarity in expectations could lead to a reduction in misreporting and associated fines.

2.14 Some responses noted that potentially the largest business case benefit would be if DRR was implemented across multiple jurisdictions. It was felt that, without this international aspect, firms that operate on a global basis would still be required to build and maintain multiple reporting systems, and duplicate resources interpreting multiple regulatory obligations.

Legal and Regulatory risk factors and unintended consequences

2.15 We also asked for views on any potential legal or unintended consequences that might arise with a move toward DRR. Many responses raised issues relating to liability connected to potential misreporting under DRR. Respondents were clear of the need for firms to retain responsibility for providing correct information to the regulator under a DRR regime. However, respondents felt there could be complications around the potential role of third parties providing technology solutions, the potential for erroneous code being provided by the regulator, or the potential for the interpretation of regulatory rules to effectively become crowd-sourced. For example, concerns were noted about the extent to which firms should be held responsible for incorrectly coded data requests originated by a regulator.

2.16 Alternatively, 'crowding-sourcing' interpretation was cited by many respondents as an efficient way to interpret rules, but if the regulator reviewed the data and regarded an interpretation as incorrect, firms would run the risk of being non-compliant. Responses highlighted that it was vital for there to be clarity on these points before a move to DRR could be made.

2.17 Associated concerns were raised that removing ambiguity from certain reporting requirements may constitute guidance, or that a narrower, ie disambiguated, interpretation of a rule may not capture the full or original scope of that rule. A related response questioned whether a move to DRR could impact the accuracy of what was being reported as it would not allow for the provision of manual review or consideration of contextual information. Several responses argued that introducing greater uniformity across what was being reported would magnify the implications if an error was made, for example through an incorrect rule implementation or a coding error.

2.18 Several responses raised the issue of data security and the need for appropriate measures to be put into place by regulators to guard against potential data breaches of commercially sensitive information. One response queried whether it was in fact permissible to allow the regulator direct access into a firms' databases which could, but may not necessarily need to, occur with a move to a DRR regime.

2.19 Further responses raised issues around the potential situation where both DRR and the current reporting regime were run in conjunction for the same requirements.

Responses queried which version of the reporting requirement would take precedence, and how would potential inconsistencies between the two be resolved or reconciled.

2.20 An additional concern over 'opting-in' to an optional DRR regime was that a firm using DRR could be subject to additional ad-hoc data requests than a firm that was not, due to the increased ease (and potentially lower cost) associated with such requests.

Our response

We are encouraged by the positive feedback to the call for input. Although our investigative work is at a preliminary stage our current position is that implementing DRR is a concept that the financial services industry considers worth regulators investigating further.

We are conscious of understanding the potential benefits or otherwise for smaller firms, and have engaged with bodies such as the Smaller Business Practitioners Panel to gain a fuller insight. We will continue this consultation process as further developments, particularly the output of the pilot, become available.

Our investigative work is at an early stage. If we decide to move toward a DRR regime, an appropriate consultation process and cost benefit analysis would be conducted to ensure that it would not result in a disproportionate cost for the firms that we regulate. This analysis would need to address any potential transition period required to allow firms to continue reporting under the current approach while they update their systems and processes to report under a DRR regime.

If there were to be a period of 'dual-running' during a transition period where firms could report under the existing regime and via a DRR approach, we are aware that there would need to be an appropriate level of consistency between the expectations on firms complying with a DRR regime and those operating under the current regime.

Similarly, in terms of the potential for increased ad hoc requests for firms reporting under DRR, we envisage that the current governance framework for issuing requests for information from firms would remain unchanged. Any request to a firm for information would still need to be considered proportionate, regardless of the ease or otherwise of how it can be provided.

Many responses raised potential unintended consequences that may arise from a move toward DRR. As stated, we are still in the investigation stage of this work, however we are conscious that a move toward DRR should not fundamentally change the relationship between ourselves and the firms we regulate. For example, we envisage the usual governance standards around data would still apply under DRR, and firms would still need to review and verify the information that they are sending to us to ensure that it is accurate.

Additionally, a move to a DRR regime would not change the current data protection laws that govern the way we use, manage and store the data

that we receive from firms. In terms of regulators having direct access to firms' data as raised by some responses, a move to DRR would not necessarily require that regulators 'pull' data directly from firms' systems. One option would be that we express requirements in a machine executable form which firms would then implement. In this scenario, firms' systems would continue to 'push' data to us in accordance with their scheduled reporting requirements.

Several responses raised the potential scenario of an incorrectly coded data request being issued by the regulator and who would be held responsible in this situation. As discussed in Chapter 3, we are conscious that a new reporting regime would need to be carefully considered and tested before being introduced. For example, the testing and reconciling of the reporting of information through DRR for an existing, less complex requirement would be an important part of assessing the accuracy of future coded requests. This issue would need to be further explored in any future consultation relating to the introduction of DRR.

We agree with respondents who noted the potential benefits of a cross-jurisdictional DRR regime. Currently we are focused on how DRR could be implemented in the UK, but have held discussions, which are continuing, with international colleagues on how DRR could apply internationally. We recognise that a multinational implementation could realise additional benefits for the industry, but would of course be more complex to implement.

3 How to apply to existing rules

3.1 Regulatory reporting requirements are expressed as rules within our Handbook, in domestic legislation or by virtue of EU regulations that are directly applicable. The rules apply to firms of specified type and/or within specified Regulated Activity Groups. The TechSprint proved the possibility of DRR using a very small sub-set of reporting rules. However, in theory, the approach could be expanded to a broader range of regulatory reporting requirements.

3.2 We were interested in hearing whether there are particular reporting requirements that could be most easily adapted to DRR, and whether respondents felt that there was a natural starting point to focus on.

3.3 For example, the proof of concept was developed using line 25 FSA001 which relates to retail customer liabilities. This rule was chosen as a test case as it applies to a wide range of firms and provides data of interest to both the FCA and PRA.

3.4 We wanted to understand whether respondents felt there are specific rules or policies that could act as barriers to implementing DRR, or conversely, if there were any specific rules or policies we could introduce to help implement DRR.

Summary of responses

Complex or simple requirement

3.5 Respondents expressed a wide range of views on what the natural starting point for DRR should be, including many specific areas of legislation. A number of regulated firms suggested that DRR should be piloted with a simple requirement that applies to a large range of firms in order to more fully prove the concept. Most agreed it was important to demonstrate the benefits in a short amount of time and then build out incrementally. There was a consensus that a granular data collection where there is little aggregation or calculation would be preferable. It was thought that beginning with complex reporting requirements that required aggregation, abstraction or significant judgement would present significant challenges unsuited to the beginning of the project. However, other respondents advocated the opposite, noting that starting with a complex requirement which required a large amount of manual work would better demonstrate the potential benefits of DRR.

Existing or new requirement

3.6 There were also differing views on whether the FCA should start any potential implementation of DRR with an existing or a new reporting requirement. Most respondents, representing a range of regulated firms, software vendors and trade associations, recommended starting with existing reporting requirements. Applying DRR to an existing requirement would allow for the impact to be fully understood, and for evaluation and benchmarking against a pre-existing, established process. This approach would allow both firms and regulators to clearly assess whether a DRR reporting requirement was resulting in the correct data being reported.

3.7 A minority of responses did suggest starting with new requirements. Their rationale was that firms would have little appetite to begin with regulations that they were already reporting and have already incurred cost in implementing. Instead an upcoming requirement would be the best candidate for a live implementation. One respondent also believed that having to write machine-executable rules in parallel with natural language rules would improve the quality of the written rules. Only 2 respondents thought that an ad-hoc data request would be a natural starting point. This was on the basis that an ad-hoc request for a small set of firms would fully prove the capability of DRR, going beyond the ability to just support standard regulatory reports.

3.8 Further responses suggested choosing an area where internationally recognised standards could more readily be applied, or setting-up a cross-industry group of subject matter experts to decide the starting point.

Introduction of rules or policies to assist the implementation of DRR

3.9 We asked respondents if there were any regulatory rules or policies that could be introduced to aid the implementation of DRR. Respondents did not indicate that there were specific rules which would aid implementation. They focused more on the need for regulators to set out a course of action and overall strategy and then implement it, rather than take a piecemeal (or rule by rule) approach.

Common data standards

3.10 The most common response to this question indicated that the most helpful policy would be a common data approach across regulatory reporting. Although there were many different suggestions on how this could be achieved. Some respondents suggested common data standards were the solution, with a standardised business glossary containing data definitions and rule specification language to reduce interpretation required by firms.[1] Other respondents believed a common data model or standardised data schema was needed.

3.11 Further responses suggested standard language developed via an ontology to ensure that a rule is both machine and human readable. Some specific methods were recommended such as publishing the Handbook in OWL or SBVR and accepting RDF[2] submissions for selected reports. Regardless of the technology used, the responses stressed the need for consistency between regulators and firms in their approach to data.

Regulatory commitment

3.12 More generally, a theme from responses was that regulators would need to demonstrate a clear commitment to a new DRR approach. Responses also noted a need for a closer collaboration between firms and regulators for this project than may be considered typical. This was articulated as a clear mechanism for firms to be involved in the development of the technology and standards to allow them to develop their system and data architectures in line with new reporting requirements. A clear timeline for when reports will be available as DRR and reassurance that the regulatory approach to this area will be stable were also raised.

1 One respondent suggested an extension of the Basel Committee on Banking Standards (BCBS) standard no. 239 to all layers in the industry. In the call for Input we also asked separately what existing industry standards could be leveraged for the DRR work. For a summary of the responses please see Chapter 4.

2 Ontology Web Language (OWL), Semantics of Business Vocabulary and Rules Specification (SBVR) and Resource Description Framework (RDF) were specifications used to develop the Proof of Concept at the Nov 2017 TechSprint.

Future proofing

3.13 Several responses spoke of the need to future proof new rules and those currently being drafted. Creating DRR versions of the rules upfront would avoid the need to 'retrofit' these rules to natural language versions. In the short term, even if new rules were not written in DRR form, a shift in regulatory policy to new requirements being defined with the concept of DRR taken into account, would help translation in the future.

Transition period

3.14 Several regulated firms also suggested that there should be a policy of leniency towards elements of any DRR transition. It was stated that firms are cautious about experimenting with new approaches to compliance. Some form of assurance from the regulator that errors and unintended consequences would be given special consideration would be necessary to incentivise firms to invest and support a transition to DRR. Some respondents thought this would be necessary for each report as it was migrated to DRR form, with 1 firm suggesting a 3-month minimum window giving an exemption from sanctions for errors. Others suggested a grace period for early adopters to embed and develop the new regime. There was a general consensus that there would need to be a commitment from regulators to work through unforeseen consequences with firms in the early stages.

Barriers to DRR

3.15 We also asked whether there were any regulatory rules or policies which could act as barriers to DRR. The most common feedback was that not all regulations could be translated into a machine executable format, namely those which were principles-based and required judgement. It was acknowledged that principles-based regulation is an effective tool. There was agreement that DRR should be narrowly focused on more specific and prescriptive regulatory reporting only, and not expanded to other parts of the Handbook.

3.16 Firms noted that there will always be a place for principle-based rules that require judgement. For example, defining a time period within a rule as 'reasonable' can be an effective and often desirable part of regulation, as it allows for flexibility depending on market or firm conditions. One firm commented that regulatory rules could be divided into 3 categories: precise specific and prescriptive rules that can be directly converted to DRR (regulatory reporting), less specific and prescriptive rules that could be inferred by machine-learning, and high-level principles. It was agreed that only some parts of the Handbook could be translated to machine executable code, and there should be a distinction between the rules that can be and those that cannot or should not be codified.

3.17 Two respondents noted the potential implications of allowing firms to opt-out of adopting common data standards, or segmenting certain firms out by size or other criteria. This would potentially split compliance into two approaches and impede industry-wide adoption of common standards. Respondents noted that the strength in common standards is twofold. Firstly, that the software vendors and the open source community would be able to leverage the commonality to produce widely applicable tools. Secondly, co-ordination is essential to address any potential interpretation conflicts or semantic inconsistencies across domestic or international regulatory regimes. In a similar vein, when asked what policies could be adopted to aid implementation, a consultancy and trade association suggested that the FCA should set a mandatory end date, some years in the future, for the adoption of standards. It was felt this would lead to industry convergence and greater consistency.

Relationship to European regulation

3.18 It was also noted that a number of reporting requirements originate from European Regulations, including templates, definitions and reporting periods set at the EU level. An FCA regime/approach that enables DRR would require the removal of all potential ambiguity for the rule to be clearly defined in a machine executable form. The respondent felt that the UK Regulator's interpretation would need to match the EU interpretation and so would need to be acknowledged by the EU or reflected in EU regulation.

Data protection

3.19 A final concern that a number of respondents felt could act as a barrier to implementing DRR was around the protection of sensitive data. This could present itself in multiple ways. Firstly, where multiple reporting obligations apply to potentially the same data set that is being read, the current implementation means that information is protected where necessary for different requirements. If DRR was implemented in a 'pull' based regime, it would need to be ensured that regulators could only access data specifically required for that obligation, as opposed to the whole data set. Secondly, some regulations permit delegated reporting services. Where a firm makes use of this service, the firm will need to ensure that only the data they approve to be shared can be accessed by the regulator. This adds a layer of complexity for firms using delegated reporting services. A further concern was around General Data Protection Regulation (GDPR) and privacy laws, and that data, particularly at granular level, may need to be anonymised.

Our response

Natural Starting Point for DRR

Regulatory reporting is critical to our objective to protect and enhance the integrity of the UK financial system. It is important that we can evaluate a potential new approach and ensure that the correct data is transferred under DRR, as well as firms being able to benchmark the DRR process against their existing reporting mechanisms. Given the potential for unintended consequences or errors, it is important to begin with a reporting requirement that is well understood. Therefore, we think that an existing reporting requirement is a necessary starting point.

Similarly, we believe that tackling a reporting requirement in its entirety is important to show the real-world application of DRR. This would naturally lend itself to a less complex requirement as opposed to one which involves large amount of calculation and aggregation. A complex requirement could demonstrate a fuller range of potential benefits. However, this is a new approach, untested elsewhere in the world, and we recognise that regulators and industry will need to learn through experimentation and iteration rather than a large-scale and complex implementation.

Introduction of rules or policies to assist the implementation of DRR

A common data approach across regulatory reporting would be a key component of introducing a DRR regime. Respondents suggested a number of ways that this could be achieved and we will continue

to explore the most efficient way to approach this. Common data standards are discussed in more detail below.[3]

We are aware that implementing a potential DRR solution would require upfront investment from firms before the long-term benefits of more efficient reporting can be realised. Given this return on investment period, the need for regulatory commitment to the project is clear. Any potential move towards a live implementation or testing phase would follow our normal process of consultation. Respondents also noted the need for close co-operation between firms and regulators to understand and work through the challenges of DRR. The pilot group, comprised of a number of regulated firms and the regulators, has been developing a prototype solution. All updates from the pilot work are available on our website and we have continued to run open sessions for stakeholders to review and input into the development of the pilot.[4]

It was also suggested that there should be leniency with regards to regulatory reporting for early adopters of a DRR regime. We understand that firms are cautious about experimenting with compliance and the risks of unforeseen consequences. We are committed to working through the potential challenges of DRR with firms. However, we do not anticipate a situation where we would relax our standards with regards to our expectations of firms or their reporting obligations. If we did explore an optional live testing environment, it is likely we would require firms that have opted-in to report using their existing systems in parallel to DRR, initially. We are investigating the implications of this mechanism in more detail.

Existing Barriers to DRR

We agree that principles-based regulations should not be the focus of DRR. The scope of the DRR project is to evaluate the feasibility of automating regulatory reporting only. This does not extend to areas of Handbook that include principles-based regulations. There is an important distinction between machine-readable and machine executable. While the full Handbook could be made more machine-readable, it cannot be made machine-executable.

For a potential move to DRR to be successful in the long term, we believe that it may need to become mandatory at some future point. However, we are unable to speculate further at this stage, other than this would be a long-time horizon (multiple years). Any steps towards a mandatory approach would be consulted on with the industry and subject to the appropriate and rigorous governance procedures.

Respondents also noted that a number of reporting requirement originate from EU rules and questioned how disambiguation by the UK regulators would interact with the directly applicable EU requirement. Whether disambiguation of rules can be considered to amount to a policy change has been discussed in more detail above. While the full

3 See chapter 4.

4 Details of the pilot including the Terms of Reference are available here www.fca.org.uk/firms/our-work-programme/digital-regulatory-reporting. We have run open days discussing the work of the pilots attended by over 200 external stakeholders. [totals to be checked following 2nd open day].

implications of exiting the EU are currently unknown, international collaboration, particularly on data standards, is one of the goals of DRR. We will continue to explore how this can be achieved. Our long-term priority is to maintain the FCA's role on the world stage, including through our contribution to common global standards and close cooperation with both EU and international regulators.

We do not envisage that a potential move to a DRR regime would change the current legal responsibilities of any organisation to ensure that they are taking appropriate measures to ensure their data is secure and protected. We believe that certain technologies suggested in response to the call for input and being considered as part of the pilot, such as distributed ledger and smart contracts, have the potential to improve data privacy and security if appropriately implemented.

As previously mentioned, several responses raised the potential scenario of an incorrectly coded data request being issued by the regulator and who would be held responsible in this situation. We are conscious that a new reporting regime would need to be carefully considered and tested before being introduced and that the potential issue of incorrect data requests would need to be further explored in any future consultation relating to the introduction of DRR.

4 The TechSprint proof of concept

4.1 In our call for input we detailed the steps we took to develop the proof of concept and the technologies that we used. Although a cross-section of participants were involved in the development of the proof of concept, we are aware that this is only 1 potential way to achieve DRR and that there are most likely other methods that could be used to achieve the same, or a similar, result.

4.2 In the call for input we sought opinions on ways to improve the proof of concept. We were particularly interested in views on:

- more efficient ways to achieve DRR
- other technologies that could be introduced into the process to improve it
- how to best use open standards to implement the underlying architecture and approach

Summary of responses

4.3 Many respondents believed that there were more efficient ways to achieve DRR and that different technologies could be used to more effectively achieve a similar outcome. However, while many specific technologies were cited by multiple firms, for no part of the process was there a singular technology approach that a majority of respondents supported.

4.4 There was, however, a broad consensus that DRR could be broken down into 4 stages: disambiguation of reporting requirements; building a common data approach; mapping requirements to firms' internal systems; and submitting data to the regulators. A number of existing standards were cited by a range of respondents, such as ISO 20022, the Financial Industry Business Ontology (FIBO) and the FIX trading protocol, which are explored in more detail below.

Disambiguation of reporting requirements

4.5 Among the most common feedback received was that DRR would only be successful if potential ambiguity could be removed from the rules thereby ensuring that firms and regulators were using the same definitions. Several respondents felt that machine learning and Natural Language Processing (NLP) techniques could be useful tools for disambiguating regulatory reporting requirements. These respondents stated that NLP could be used to help with the identification of whether a specific section or paragraph of a regulation was suitable to be translated to DRR code. For example, if the regulator initially manually classified a sample of sections and paragraphs of regulation as suitable for translation to machine executable form, a model could then be built to help with classification for bulk regulations.

4.6 Other respondents went further and suggested that identifying linguistic patterns via NLP or other forms of Artificial Intelligence (AI) technology could be trained to process regulatory text and extract the underlying regulatory intent and express it in

an unambiguous form. It was also suggested that recurrent neural networks or pre-defined NLP libraries could be used to help develop the AI for this type of mapping.[5]

4.7 A number of other respondents believed that regulatory ambiguity could also be removed by crowdsourcing interpretation. It was suggested that an interpretation could be put into the blockchain and other firms permitted to either agree or disagree with the interpretation. This would allow for consensus-based decisions to be made when a critical mass of firms agreed on the reporting interpretations, potentially with final approval from the regulator.

Common data approach

4.8 Many responses highlighted the need for the construction of a common data approach. There were a number of suggested ways that this could be achieved; such as a standardised glossary and rule language, a common data model, a semantic ontology, as well as various combinations of these.

4.9 Some respondents suggested developing common definitions through a 'business glossary', 'shared data standards' or a 'common industry-wide data dictionary'. Further responses agreed that this type of approach would be sufficient to implement DRR but an additional common data model would give greater clarity and reduce the implementation effort. Most respondents however, indicated that establishing a common data model would be the best approach. Many argued strongly that it was a critical to the potential success of DRR.

4.10 Data models can take many different forms and the term itself will mean different things to different people. In the call for input we asked if readers thought a common data model would need to be established. Multiple respondents made the point that it is not clear what is meant by 'common data model', or that the type of data model needed would be different depending on the objective of DRR. To a degree, some of the responses treated a 'common data model' as a catch-all term for common definitions between firms and regulators.

4.11 One respondent believed that a full 'relational data model' would only be needed if the objective of DRR was to go beyond reporting data specific to a given report (eg COREP), and was instead to define a common model that can reconcile different reports and become the single source for all reports.

4.12 A further response noted that a common data model would not, itself, be a single entity. While financial services may generally be thought of as a common 'domain', in reality it is composed of multiple domain subsets that do not necessarily share the same underlying concepts or composition. Not only could data dictionaries diverge between market sectors and products, but domain splits could also occur across different processes such as front and back office, and market activity. The meaning of a given word in a regulation would depend on the context and syntax, and could have many different meanings across different domain subsets.[6]

4.13 As mentioned above, many respondents suggested the need for a reference data model that would cover the full financial services reporting spectrum. One response

5 Some suggested semantic mapping techniques including AI algorithms built on the S-match Framework, or AI technologies such as Leiki.

6 For example, a definition of "lead" that worked in one domain subset would not necessarily work for another. The respondent suggested that an ontology overlay would be necessary to resolve this issue. However, they did also believe that the foundations had been laid with FIBO, discussed in more detail below.

gave the example of a hypothetical 'Universal Financial Institution' for which all the data in its systems and databases would cover all possible aspects of regulated financial activity. A technology provider stated that a 'common data model' would not be a physical data model, rather a logical data model that explains key regulatory concepts such as 'counterparty', 'reporting entity', 'instrument' etc. Implementing a common data model as a database schema was a further suggestion.

4.14 Other respondents, including regulated firms and software providers, felt that a common data model alone would be insufficient and instead a semantic ontology was needed, ie a detailed data specification supported by standards, a taxonomy and ontology. One response suggested that the common data model would serve as a foundation for a semantic ontology which would sit as an overlay on top of the data model. A separate respondent, however, agreed with the approach set out in the proof of concept, to develop a semantic ontology first and then map this to a common data model.

4.15 Generally, respondents who advocated the need for developing an ontology agreed that RDF and OWL were appropriate standards to use. However, 1 respondent believed that RDF was too niche and, given the wide range of stakeholders, more mainstream techniques[7] would be better to describe the reporting data set.

Mapping requirements to firms' internal systems

4.16 We also asked firms what technologies exist that could help automate the manual mapping work in Step 4 of the proof of concept developed at the TechSprint. Specifically, what technologies could support the mapping of terms defined in an FCA ontology to firms' own data models and systems.

4.17 Some respondents thought that NLP and machine learning tools could be used to map the DRR code onto a firm's internal databases and systems. Other respondents suggested that ontology mapping and alignment tools could help with this stage of the process. Although these suggestions presupposed that RDF was used as part of the disambiguation phase. Two tech providers cited the R2RML standard from W3C,[8] suggesting that it could be applied to achieve over 80% automation of data elements in relational databases to an RDF representation. Other tools and techniques cited included D2RQ, DB2OWL and BIAN.[9]

4.18 However, other respondents stated that even with an industry wide common data model, they did not believe it was possible to fully automate the mapping required for Step 4. Instead, mapping would still require some manual effort given the differences in data modelling, data descriptions and definitions within firms. It was noted that 'virtual' data dictionaries and other data discovery tools (mainly based on machine learning and AI algorithms) may be able to help, but would not eliminate the need for human interpretation.

Mechanism for firms to submit data to regulators

4.19 In terms of how firms could submit data to the regulator under a DRR regime, a common suggestion was to explore Application Programming Interfaces (APIs). It was suggested

7 In this instance, the respondent suggested that entity-relationship or class diagrams would be better understood and therefore more efficient.

8 World Wide Web Consortium, the main international standards organisation for the World Wide Web.

9 Banking Industry Architecture Network (BIAN) In 2008, BIAN published an updated version of its standardised global IT architecture model. The API definitions are compliant with the SWIFT ISO20022 open banking standardisation approach, recognised and compatible with banks universally.

that an API platform or 'layer' could sit between the regulators and firms. API endpoints could then be generated to expose the required data in terms of the common data model. Firms could then map the regulatory rule and its meaning to the firm's systems and databases through a common API. This would allow a gradual migration from the existing 'push' regime - where data are collated by firms and submitted periodically to the regulator - to a 'pull' regime where regulators can make real-time requests on individual API end-points made available by firms, or a mixture of the two.

4.20 A number of respondents suggested using distributed ledger technology (DLT) architectures for this stage of the process. Some responses suggested setting up a private/permissioned network of firms and regulators. One response stated that private blockchains appear to offer more potential than public blockchains due to the sensitivity of the data that would be shared between firms and the regulator. Private blockchains could create a closed network of 'peers' with permission required to join the network. As all network participants in a private network are validated as 'trustworthy', the verification for transactions is performed by 'network peers'.

4.21 A further dimension potentially enabled by a DLT-based solution would be the use of 'smart contracts'. Several respondents identified smart contracts as a potential method of confirming compliance with reporting requirements. One regulated firm proposed developing a proof of concept using DLT that would allow firms to demonstrate compliance via a cryptographic key following the execution of smart contracts. Such a contract would verify compliance with the rules of the Handbook (which would themselves be in codified form).

4.22 Under this approach, it was suggested that the underlying data would not be transferred, but the cryptographic key would demonstrate that the data in the firm's systems were compliant with the requirements. This data would then only be pulled by the regulator when required for analytical use.

4.23 A number of private blockchain options were suggested as this would enable the cost of development to be shared between institutions through the creation of a shared code. DLT could also remove the risk of each firm implementing DRR in different ways. It could be proven that all firms are using the same code if the code is distributed from the regulator. Other technologies that were raised by individual responses are being considered in the pilot.

Utilising Standards to Assist the Implementation of DRR

4.24 We asked firms which standards could assist the implementation of DRR. Firms agreed that the use of existing standards in the DRR architecture would remove the need and cost of developing new standards and minimise the implementation cost.

4.25 ISO standards were the most commonly cited standard suggested by firms, in particular ISO 20022. ISO 20022 is an open, free data standard for financial messages which is already being used by a number of UK and EU financial services institutions. Many respondents believed that ISO 20022 could be used to standardise or realise efficiencies of the common data model, referred to above and could serve as a fundamental building block of DRR.

4.26 Another standard that was commonly suggested was the FIBO. FIBO is an open-source, business conceptual model of the structure of financial instruments, business entities and financial processes. It is expressed in the OWL to enable inference processing. In other words, by applying logical rules to its knowledge base, the

processing engine could infer new information and conclusions. One respondent noted that the terms defined for the proof of concept for the TechSprint: 'retail'; 'customer'; 'account' and 'liability', had already been defined in FIBO, along with over 3,500 other high level financial classes.

4.27 Another respondent agreed that FIBO would provide a good foundation to begin to tackle the differentiation between the multiple domains that exist within financial services. Beginning with a dictionary and an ontology, initial efforts should aim to find agreement on the product domains to focus initial effort on. As discussed above, this would help solve the difficulty of reconciling the multiple domain subsets within financial services.

Standards and data formats suggested by respondents that could be leveraged to develop DRR. We are evaluating whether they can be applied to the DRR architecture as part of the pilot

ISO 20022	Financial Instrument Global Identifier (FIGI)	Legal Entity Identifier (LEI)
Financial Industry Regulatory Ontology (FIRO)	eXtensible Business Reporting Language JSON (xBRL-JSON)	CPMI-IOSCO (OTC derivative reporting work)
World Wide Web Consortium (W3C) standards	FIX Trading protocol	EU Commission Financial Data Standardisation Project
Financial Industry Business Ontology (FIBO)	European System of Central Banks (ESCB) BIRD Project	legal knowledge interface format (LIKIF)

Our response

Respondents provided many suggestions on how the proof of concept developed at the 2017 TechSprint could be improved, and the different standards we could leverage as part of the work. Suggestions raised in response to the call for input have been fed into the pilot working group and have helped to inform the development of the project to date. Regarding the various industry standards, we are committed to utilising existing standards where efficient to do so. These standards and data formats will be analysed for their potential applicability during the course of the pilot.

Common data model

The concept of a 'common data model' was interpreted differently by respondents and we received many nuanced suggestions on what a common data model could look like. We believe that a common data model would realise efficiencies in the current regulatory reporting process. Much of the feedback we received relates to the perceived high cost of disambiguation and subsequent data modelling internally within a firm. We believe that a common model, based specifically around domain subsets (eg mortgage reporting) could help reduce the cost to firms and improve the comparability and quality of data for the regulator. There has been a high level of emphasis placed on the need for a data model detailing granular concepts in the pilot. We believe the formation and accuracy of aggregate collections could be improved utilising this approach.

Application Programming Interfaces

We agree that APIs could play a critical role in achieving DRR and to potentially reduce the time taken to send data to the regulator. However, we

are also keen to acknowledge that there must be appropriate governance, consideration of burden and potentially that a degree of friction on the accessibility of data by the regulator may be helpful. For example, the capacity to call an API in a real-time environment is exciting from a regulatory standpoint however it opens up a number of issues for the firm in terms of capacity to review submissions before sending to the regulator.

DLT networks
We agree that DLT and smart contracts could help in the implementation of DRR and are keen explore the potential of this technology. Work undertaken in the pilot has proved that regulatory code can potentially be sent as a 'smart contract' and distributed to a population of firms. The potential for immutability, security and speed offered by a private DLT are attractive. Much of the pilot work has sought to re-use industry proof of concepts, of which much work has been done on the data delivery capabilities of DLT. However, we are also conscious that we must overcome some key issues such as the maximum capacity for transactions on specific blockchains and the capacity requirements of individual nodes on the network.

Disambiguation of Regulatory Text
A number of industry experiments have shown the potential for NLP to process large quantities of text and determine meaning from semantics. To this end, we feel that NLP can help to minimise the effort required to disambiguate regulatory text by reducing the number of human hours spent manually performing the task.

Utilising Standards to Assist the Implementation of DRR
The pilots re-used as much work and existing standards as possible, as attempts to recreate a new universal data standard often experience significant delays and scope creep. To this end, the pilots will attempt to incorporate existing standards where possible.

We believe that we can learn from existing initiatives such as the Banks Integrated Reporting Directory (BIRD) Project, the FIBO, the Financial Industry Regulatory Ontology (FIRO) initiatives, and the Financial instrument global identifier (FIGI) among others.

Pilot development
The focus of the DRR pilot represents a shift in thinking towards functionality and value of the regime over the exploration of emerging technologies. For example, while we acknowledge the potential benefits of semantic ontology technologies, we believe the emerging nature of the technology means that we should allow more development in this area before looking at implementation. Respondents believed the focus should be on reduction in time and cost for firms, not necessarily targeting the most technologically advanced solution. This said, there are many emerging technologies and standards that provide interest for the future. We are conscious of the need to develop something that can be further developed as relevant technologies mature.

5 The role of regulators & funding model

5.1 The development of the DRR proof of concept has been characterised by strong collaboration between regulators and industry. We believe that this level of ongoing regulatory commitment has been a necessary catalyst for industry to invest time and effort in the investigative phase of this work, and will remain a key ingredient in any future implementation of a DRR regime.

5.2 As well as the complimentary skill sets and understanding of regulatory requirements that collaboration between industry and the regulator brings, the development of potential elements of DRR implementation such as a common data model and data delivery mechanism will, we believe, require regulators and industry to continue to work together.

5.3 In the call for input we asked for views on the most useful and appropriate role that regulators could play in the further development of DRR, and how we could ensure that the initiative continued to benefit from diverse views and the participation of industry. We were keen to hear about examples of existing models of collaboration between industry and regulators that could be adopted, and how we could make the most out of collaboration with international regulatory counterparts.

5.4 In the call for input we advocated an open source model for the development of DRR. We do not believe that interpreting regulatory reporting requirements should deliver a competitive advantage to firms. Our preferred approach is therefore open source, allowing participants to tailor and adopt technology more easily and cheaply and adapt it to meet their specific needs. We asked if readers agreed with this view and how we could best use open standards and collaboration to agree and implement DRR.

5.5 As a move to DRR would inevitably have transition cost implications for both regulators and firms, we also sought views on the most appropriate type of funding model for both the development of an initial prototype design and the ongoing costs of a potential DRR regime.

Summary of responses

Role of the regulator & models of collaboration

5.6 Respondents agreed that close collaboration between regulators and industry remains key to any potential implementation of a DRR regime. Responses tended to suggest that regulators should take the lead role in these collaborative efforts. Whether this is by providing 'thought-leadership' to the regulated community on the standards and models that should be developed, or a more 'hands on' role in determining, for example, which rules should be included in DRR efforts and how they should be interpreted.

5.7 Several responses suggested that this collaboration between the regulator and industry should be formalised through the creation of an industry body or taskforce, for example a public/private model to provide oversight and governance of industry participants and technology providers.

5.8 Some responses noted the importance of commitment, given the potential for up-front investment required by industry. Some stated that a commitment from regulators, for example through the publication of a timetable to implementation, would provide certainty to firms and encourage and enable them to fully prepare for the establishment of a new DRR regime.

5.9 Several responses suggested the FCA should run a pilot to develop and test a prototype. This would then allow for the feasibility of DRR to be assessed, and then applied to a more sophisticated and complex reporting requirement than that which was used in the November 2017 TechSprint.

5.10 Many examples of existing models of collaboration between regulators and industry were provided. Among those referenced by multiple respondents were the Open Banking Implementation Entity (OBIE), the Global LEI Foundation and the FIX trading protocol.

Collaboration with international regulators

5.11 We also asked how we could ensure that the development of DRR could benefit from collaboration with international regulatory colleagues. Responses generally agreed that international collaboration was desirable, and leveraging the existing international organisations such as the International Organisation of Securities Commissions (IOSCO), the Financial Stability Board (FSB) and the European Supervisory Authorities (ESAs) were suggested as a useful starting point.

5.12 Respondents proposed that practical efforts on an international level could include mapping and creating a cross-jurisdictional common data ontology and data model. One response suggested that a proof of concept should be developed in conjunction with at least one other international regulator, whilst another respondent suggested that the outputs of the proof of concepts (and subsequent pilot) could be shared with global regulatory networks. A further response suggested that the Global Financial Innovation Network (GFIN)[10] could be used to support the development of a DRR regime.

Collaboration to address regulatory reporting ambiguity

5.13 As described above, an identified necessary step in the implementation of DRR and a key area of potential collaboration is how to address any potential regulatory ambiguity and arrive at a DRR ontology of relevant reporting requirements. In the call for input we asked what would be the most effective collaboration model that could be employed to achieve this.

5.14 The consensus view on this issue was that defining rules in a DRR format could only be achieved in collaboration with industry. Several responses suggested the creation of an independent standards body comprising regulators and industry experts. It was suggested that such a body could act as a single knowledge base tasked with, for example, publishing machine readable rules and data standards, with the ability to provide clarity on any industry queries. Most responses that advocated this approach suggested that the regulator should take the lead role in such a body. One response suggested that an international mediator, such as IOSCO or FSB, could be used to ensure that the approach arrived at would be compatible with relevant requirements in other jurisdictions.

10 www.fca.org.uk/publications/consultation-papers/global-financial-innovation-network

5.15 Less formal models of collaboration such as industry forums or working groups, as well as close consultation with representative bodies such as trade associations were also identified as ways of ensuring that the opinions of industry could be fed into the process. It was felt by some that an online forum, through the use of open source software such as GitHub or a wiki page, could allow firms to develop common approaches to common problems. As mentioned above, some responses suggested that blockchain could be used by industry to share and validate their interpretation of certain regulatory requirements.

Benefits of using open source model

5.16 Respondents generally agreed with our preference for DRR to be developed through an open source approach. Common reasons given for this view were a reduction in costs, an increase in flexibility and the avoidance of firms being dependent on a small number of technology solution providers. Existing approaches that it was suggested could serve as inspiration for the eventual model included FINOS, FIBO and Linux.

5.17 Several responses noted, however, that an open source approach and a commercial proposition did not have to be mutually exclusive, eg an open-source model with a commercial delivery of the technology solution. Some thought this would be important in ensuring that technology providers would be incentivised to invest in developing solutions for firms and that this in turn would stimulate competition, innovation and provide choice for firms. Several responses noted the importance of the model being open source to help ensure the development of 'off-the-shelf' solutions, particularly for smaller firms, at a reasonable price.

Funding model for initial prototype

5.18 We were also interested in receiving views on the most appropriate funding model to further the development of the proof of concept. Several funding models were suggested ranging from; the FCA fully covering the development costs to demonstrate leadership and provide regulated firms with evidence of the regulator's commitment, a shared funding model between FCA and voluntary collaborations from industry participants, and an industry body model fully funded by industry participants. Examples of an industry body model suggested by respondents were the R3 consortium and AuREP. As previously noted, some respondents believed that those firms that stand to benefit the most from the introduction of DRR in terms of cost-savings should fund most of the development costs through, for example, a proportional contribution based on firm size.

Funding model for further development and ongoing run costs

5.19 We also asked what would be the most appropriate model to fund the ongoing run costs of DRR should it be implemented. Again, there were a range of funding models suggested. This included: a levy on firms proportionate to the size and complexity of their business operations and/or the cost-savings available to them through DRR – effectively a 'user-pays' model; the cost being borne through the FCA's existing budget; or an open source foundation approach similar to FINOS or the Linux Foundation described above.

Our response

Industry collaboration has been fundamental to the development of the DRR proof of concept and subsequent pilot. We believe a similar

level of industry collaboration will be necessary for a DRR regime to be introduced.

To date, this collaboration has encompassed all aspects of the DRR process. It has included: removing potential ambiguity from existing rules, translating certain rules within the Handbook into code, and developing the technological system through which data would be provided by firms to the regulator. We recognise that, if it is decided that a move toward a DRR regime would benefit the industry, it may be necessary for the regulator to take the lead on certain aspects of DRR development. We also recognise that an appropriate consultation process and cost benefit analysis would need to be conducted. At this stage, we are open minded on what the governance model of a DRR regime would look like.

Similarly, it is too early to comment definitively on the funding model that would be required were a DRR regime to be introduced. As previously stated, we are conscious that the benefits and costs of a move toward DRR should be shared appropriately across the industry rather than only providing advantage for certain types of firms. This principle would guide the funding model that we would put in place should we adopt a DRR approach.

We are aware of the potential benefits of international collaboration and have held discussions with international regulatory colleagues on our DRR work to date. For example, we have presented this work to ESMA's Financial Innovation Standing Committee and FINRA's FinTech Forum. We will continue to engage with international colleagues as further developments, particularly the output of the pilot, become available. The GFIN proposal is still in the consultation phase. We will consider the appropriateness of DRR to the GFIN concept when the operating model of GFIN is finalised.

At this stage of our investigative work, we are of the view that open source is the most appropriate approach to take this work forward. Open sourcing encourages collaboration by freely sharing technological information to improve solutions. This approach also allows participants to tailor and adopt technology more easily and cheaply and adapt it to meet the specific needs of individual firms

We believe an open source approach could lead to the creation of an underlying open platform/architecture upon which additional proprietary solutions could be developed. This is the same model followed, for example, in the creation of computer networks, the internet and online payments infrastructure. Our expectation and hope is that if we do pursue a DRR regime, then technology and software companies would look to develop utilities to satisfy the needs of a range of firms including smaller firms, for example, through the development of new reporting functionality within accounting software packages.

6 The pilot & next steps

6.1 As noted earlier, this work-programme has implications for both regulated firms and regulators. Having collated and analysed the responses to our call for input, on balance we believe the responses were positive; particularly because of the expected cost reduction for regulated firms, the overall increase in implementation efficiency, and the improvement in the consistency and quality of data received by regulators. Based on this feedback, our overall conclusion is that this is a direction of travel that the financial services industry considers worth progressing.

6.2 In March of this year, the Chancellor announced that the FCA and BoE would run a pilot aiming to further explore whether digital regulatory reporting is possible and to further explore some of the issues that we identified in the call for input.

6.3 The overall purpose of the pilot is to evaluate the potential benefits and implications of DRR via the development of a minimum viable product. The pilot will develop a working prototype solution that demonstrates the end-to-end process for DRR and further evaluates the technological, legal and governance implications.

6.4 The pilot is considering 2 use cases, 1 focused on retail reporting and 1 focused on wholesale reporting[11]. Existing open standards for data are being used and extended for efficiency and to avoid duplication wherever possible. Options for further development and scaling of the pilot are also being explored, along with a more thorough assessment of a range of technological and operational matters. Responses to the call for input have been fed into the pilot, specifically those that have provided suggestions on how to improve the existing proof of concept.

6.5 Following the conclusion of the pilot work in November, the pilot participants will publish a technical paper in Q1 2019. This paper will provide an assessment of the technologies used to develop a DRR prototype during the pilot tests.

6.6 We will regularly be publishing updates on the pilots on our website, please visit www.fca.org.uk/firms/our-work-programme/digital-regulatory-reporting for further information. We welcome the continued provision of feedback from interested parties.

6.7 We are also aware of the BIRD Project, the FIBO, the FIRO initiatives, and the FIGI amongst others. These standards and data formats will be analysed for their potential applicability during the course of the pilot.

11 PSD001 mortgage reporting and COREP corporate loans have been selected as the two use cases.

Annex 1
Pilot participants

At the time of writing the following firms are participating in the Pilot:

Barclays

Nationwide

Credit Suisse

NatWest

Santander

University College Cork

University College London

Lloyds Banking Group

Annex 2
List of non-confidential responses to Call for Input & Roundtable hosts

Roundtable hosts

Grant Thornton	Governance and Oversight Roundtable
Willis Towers Watson	Industry Roundtable
Grant Thornton & Hitachi	Governance and Oversight Roundtable
Central Bank of Ireland & University College Cork	Technology Roundtable
Lombard Risk	Risk Roundtable
Burges Salmon	Technology and Regulation Roundtable
Wolters Kluwer	Industry Roundtable
PIMFA	Industry Roundtable

List of non-confidential call for input respondents

AFME

AIMA

Allatus

Anchura Group

Association of Mortgage Intermediaries

Bloomberg

Bruce Badger

Building Societies Association

Buzzacott LLP

City of London Law Society

CodeReg

Cordium

CoreFiling

CUBE Global

EDM Council

FIX Trading Community

FundApps

Global legal Identifier Foundtion (GLEIF)

Goldman Sachs

Grant Thornton

IHS Markit

International Standards Organisation ISO

Investment and Life Insurance Group

Investment Association

Jayzed Data Models Inc.

JWG

M&G Investments

Mikkel Bates

Model Office

Moody's Analytics

National Australia Bank

Nationwide Building Society

Performline

Redburn Europe

RegTech Live

RSA Group

Society of Pension Professionals

Standard Chartered

State Street

Tax Incentivised Savings Association

Vertex Incorporated

Worksmart Limited

Tata Consultancy Services

UK Finance

Glossary of terms

Application Programming Interface (API)	A set of protocols and tools for building software applications and gaining access to data.
Banking Industry Architecture Network (BIAN)	A not-for-profit organisation seeking to standardise core banking architecture.
Banks' Integrated Reporting Dictionary (BIRD) Project	A harmonised data model that describes the data which should be reported to regulators.
Common Reporting Framework (COREP)	The standard regulatory reporting framework for capital requirements and prudential information by regulated investment firms and credit institutions across the EU.
Distributed Ledger Technology (DLT)	A digital system for recording the transaction of assets in which the transactions and their details are recorded in multiple places at the same time.
Database Schema	A map of a database.
DB2OWL	A tool for automatically generating ontologies from database schemas.
D2RQ	A language that describes the relationship between a database schema and RDF or OWL ontologies.
eXtensible Business Reporting Language (xBRL)	An open source framework that allows the capture of individual reporting concepts as well as the relationship between concepts and other semantic meanings.
eXtensible Mark-up Language (xML)	A computer language that enables the transfer of data from one system to another in a standard format.
Financial Industry Business Ontology (FIBO)	An ontology that describes the structure and contractual obligations of financial instruments, legal entities and financial processes.
Financial Instrument Global Identifier (FIGI)	A global framework that standardises the way that financial securities are identified.
Financial Industry Regulatory Ontology (FIRO)	A semantic (word and meaning) map of different regulatory terms that covers several regulatory jurisdictions.
Financial Information Exchange (FIX) trading protocol	A protocol that allows the real-time exchange of information related to securities transactions and markets across international entities.

General Data Protection Regulation (GDPR)	An EU regulation on data protection and privacy for all individuals within the EU and the EEA.
ISO 20022	An international standard for financial messaging between financial institutions and market participants.
Legal Entity Identifier (LEI)	Creates unique identities for legal entities that engage in financial transactions.
Natural Language Processing (NLP)	A branch of artificial intelligence that helps computers understand and interpret human language.
Ontology	The formal naming and definition of the types and properties of entities and the relationships between them.
RDB to RDF Mapping Language (R2RML)	A language for mapping databases to RDF datasets.
Resource Description Framework (RDF)	A model that codes the semantic relationship between different data so machines can interpret them. The data relationships are presented as a graphical database.
Semantics	The analysis of the meanings of words and the relationships between them.
Semantics of Business Vocabulary and Business Rules	A standard language for describing the relationship between business rules and data.
Smart Contracts	Self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code.
Web Ontology Language (OWL)	A web language used to describe the meaning of terms in different vocabularies, and the relationships between those terms.
Wiki	A website or database allowing users to add and edit content.

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