FINANCIAL CONDUCT AUTHORITY

Call for Input: Using technology to achieve smarter regulatory reporting

February 2018

How to respond

We are asking for comments on this Call for Input by 20 June 2018.

You can send them to us using the form on our website at: www.fca.org.uk/call-input-smarter-regulatory-reporting-response-form.

Or in writing to:

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London E14 5HS

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020 7066 1000

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regtech@fca.org.uk

How to navigate this document onscreen

returns you to the contents list

takes you glossary of terms

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1 Summary

Why we are issuing this paper

1.1 All regulators need to ensure that those they regulate are complying with the rules; public confidence in regulation depends on it. However, the resulting collective burden on firms is significant. Every year we receive over 500,000 scheduled regulatory reports from firms, as well as additional ad hoc reports.

1.2 We regularly explore how technology can make our regulation more efficient. One of the ways we do this is through 'TechSprints' that bring together financial services providers, technology companies and subject matter experts to explore technological innovations. In November 2017, one of these events developed a 'proof of concept' which could potentially make it easier for firms to meet their regulatory reporting requirements and improve the quality of the information they provide.

1.3 This Call for Input outlines the technical steps that developed this proof of concept and asks for views on how we can improve this process. We are also seeking feedback on some of the broader issues surrounding the role technology can play in regulatory reporting.

Who this applies to

1.4 This Call for Input will be of interest to:

- regulated firms
- RegTech (technology that helps meet regulatory requirements) and FinTech (technology that helps deliver financial services) firms
- technology and software providers
- professional services providers
- academics with interests in technology and financial regulation
- financial services regulators

1.5 Other financial service practitioners, professional bodies and individuals may also be interested in this paper.

1.6 Section 1 of this paper outlines the FCA's approach to encouraging the adoption of technologies specifically designed to overcome the regulatory challenges firms face.

1.7 Section 2 gives a detailed explanation of the results of the TechSprint. While this section will mainly be of interest to organisations and individuals familiar with

technology and programming, we are happy to discuss the technological steps involved with any interested parties.

1.8 Section 3 discusses some of the implications and challenges involved in implementing changes to the ways firms report regulatory information across the financial services industry.

Next steps

1.9 We want to know what you think about the ideas and questions in this Call for Input. To respond, please use the online response form or write to us at the address on page 2.

1.10 There will be a series of roundtables hosted by TechSprint participants to further discuss some of the relevant legal, technological and regulatory issues. If you would like to attend any of these roundtables please contact RegTech@fca.org.uk using 'Machine Executable Roundtables' in the subject heading.

1.11 In summer 2018 we will publish a feedback statement bringing together the results of these roundtables and further industry discussions, as well as the feedback from this Call for Input.

2 Introduction

How technology can help regulation

2.1 Technology now plays an increasingly fundamental role in financial services and is also a catalyst for change and innovation. It can increase competition in markets, whether through start-ups introducing new business models or established businesses developing new products and concepts.

2.2 Technology is also a powerful shaper of financial regulation – it can make regulation more efficient and compliance simpler. As outlined in our Mission, we aim to regulate efficiently and cost-effectively, using our finite resources to deliver the greatest public value. Regulation that involves high costs and inefficient processes can inhibit competition and mean firms pass higher costs on to consumers. By using technologies specifically designed to overcome the regulatory challenges faced by firms we can add to the public value we deliver as a regulator.

2.3 We see three broad types of RegTech solutions. Those that:

- help firms meet their regulatory obligations
- help our supervisory and market monitoring functions
- re-shape current regulatory processes and systems.

2.4 This Call for Input looks at how this third RegTech category can potentially help firms meet their regulatory reporting requirements·

Our role

2.5 Responses to our 2015 RegTech Call for Input[1] clearly showed that industry believes we should support initiatives that encourage the adoption of RegTech, whether at idea, development or exploration stage.

2.6 We do this by encouraging people and institutions from across financial services to work together to generate ideas and concepts to solve common problems. Our competition remit limits how we offer help and we cannot generally endorse specific technology or solutions. Instead, we encourage firms to innovate, adopt and collaborate to address the complexity and cost of regulation in new, creative ways.

1 www.fca.org.uk/publication/call-for-input/regtech-call-for-input.pdf

2.7 An important part of our RegTech strategy is to hold TechSprint events. These bring together financial services providers, technology companies and subject matter experts to develop solutions that solve regulatory challenges. This Call for Input explains the result of our TechSprint on Model Driven Machine Executable Regulatory Reporting.[2]

2 www.fca.org.uk/events/techsprints/model-driven-machine-executable-regulatory-reporting-techsprint

3 Regulatory reporting

3.1 One of the areas raised in the feedback[3] to our original Call for Input is how RegTech could help firms meet their regulatory reporting obligations.

Current reporting challenges

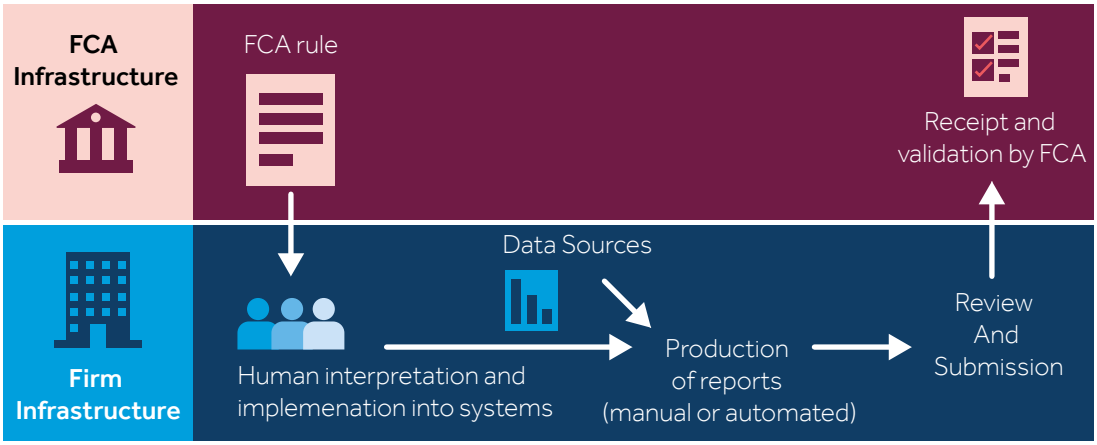
3.2 Every firm we regulate is required to send us reports. Regulatory reporting requirements are specified in rules in our Handbook as well as in domestic legislation or in applicable European Union regulations; the type and amount of information that a firm must send us varies significantly depending on its type and size. The data received from regulatory reporting are critical to our market integrity objective; assisting our ability to deliver effective supervision, monitor markets and detect financial crime.

3.3 Firms can find it difficult to meet these obligations. Many tell us it takes them significant effort to navigate and interpret the Handbook and instead rely 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. Each firm does this manually, creating the risk of different interpretations and inconsistent reporting.

3.4 One of our current challenges is that we cannot change our reporting requirements quickly. Firms need time to interpret and implement our policy changes and make the necessary alterations to their reporting systems. This creates an unavoidable delay between the point when we decide we need specific information from firms on an ongoing basis and actually getting that information. This delay also increases the need for us to make additional, ad hoc requests for information from firms, adding to their compliance burden.

3 www.fca.org.uk/publication/feedback/fs-16-04.pdf

Diagram 1: Currently firms manually interpret the regulatory reporting rules and then manually input this into their systems. Many firms then have automated processes which produce the reports for submission.



Exploring how technology can help

3.5 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. We were also interested in how we could help firms implement changes to our rules more quickly.

Creating machine-executable reporting regulations

3.6 In November 2017, we held a two-week TechSprint with the Bank of England (BoE). We wanted to explore the potential for a fully automated process that firms could use to provide their regulatory returns.[4]

3.7 The event developed a proof of concept that proved we could turn a set of reporting rules[5] within both the FCA and the PRA Handbooks into a machine-readable language. In other words, we could create a language that machines could understand and so remove the need for human interpretation.

3.8 Machines could then use this language to automatically carry out (execute) the rules. Once the rules were translated, machines were able to fulfil the requirements by assessing the information required and then pulling this information directly from a firm's databases.

4 Participants at the TechSprint included attendees from our November 2016 Unlocking Regulatory Reporting TechSprint, as well as stakeholders who had presented ideas to us during our 2017 engagement programme. (A list of the TechSprint participants can be found in Annex 2).

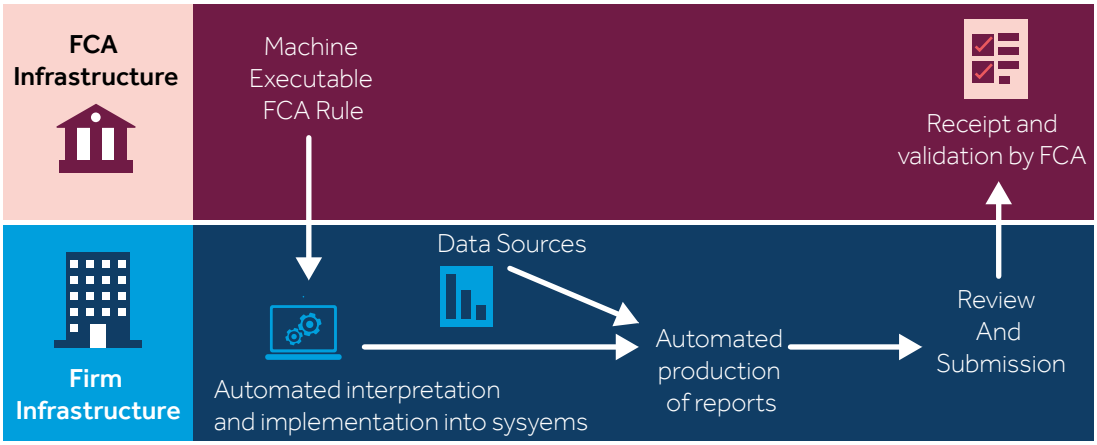
5 In this case line 25 of Sup 16.12 FSA001 which relates to retail customer liabilities. This rule was chosen as a test case as it applies to a wide range of firms and provides data of interest to both the FCA and PRA. is the data required by this rule is also submitted to Gabriel and therefore could be used to inform the FCA's future data collection strategy.

3.9 The TechSprint also demonstrated the potential flexibility of this approach by simulating a rule change in the Handbook in real time and seeing the machine automatically changing the reporting data.

3.10 We called this TechSprint 'Model Driven Machine Executable Regulatory Reporting'.[6] The 'model' dimension of the TechSprint refers to the collaborators semantically modelling the relationships between the data. The point of this is that it allows firms to map their data schemas to more than one reporting regime. In the case of this TechSprint, these were the regulatory reporting rules of the FCA, the BoE as well as the International Financial Reporting Standards. This dimension of the TechSprint means firms are able to more effectively manage and comply with multiple regulatory reporting requirements.

3.11 Although the event proved the possibility of machine readable and machine executable regulatory reporting using only this small sub-set of reporting rules, the approach could be expanded to a broader range of regulatory reporting requirements.

Diagram 2: The proof of concept model removes the need for human interpretation and manual execution of the regulatory reporting rules contained in the Handbook



How we did it

3.12 Below we outline the steps the TechSprint participants took to develop the proof of concept:

Step 1: Creating a directory for the regulatory reporting rule

3.13 **What we achieved:** We created a linked directory of all relevant regulatory requirements and information about a specific rule (Sup16.12 FSA001).

3.14 **Why we did it:** Our Handbook can be difficult to navigate with information, including guidance on a particular rule, found in many places. We needed to ensure all language used for the rule was captured and arranged in one location.

3.15 **How we did it:** Subject matter experts identified all parts of the FCA/ PRA Handbooks covering the specific rule, including any associated guidance. We then loaded the

6 www.fca.org.uk/events/techsprints/model-driven-machine-executable-regulatory-reporting-techsprint

relevant xml files into a directory that would allow existing software programmes to translate the language of the rule into a machine readable format.

Step 2: Creating a specific version of the rule

3.16 **What we achieved:** We converted the regulatory reporting rules into the Semantics of Business Vocabulary and Business Rules (SBVR) format, ensuring that the legal and regulatory meaning of this language stayed accurate.

3.17 **Why we did it:** A rule in the FCA/ PRA Handbook can include many requirements, statements and legal concepts that need human interpretation for a firm to decide how that rule applies to them. We needed to remove any potential ambiguity in the actual language of the rule in order for it to be converted into a codified format that machines could understand and apply consistently through an automated process.

3.18 **How we did it:** The rule in its original form was not specific enough to enable it to be automatically translated into SBVR. We needed to bring more clarity to the definitions in the rule before it could be converted. Subject matter experts from the FCA and BoE created a more detailed definition of a 'retail customer account' so that the rule contained enough information to be converted into SBVR[7]. We then applied the Financial Industry Regulatory Ontology (FIRO) which incorporates the OWL (Web Ontology Language) and Resource Description Framework (RDF) standards.

Step 3: Converting the regulatory rule into a machine executable format

3.19 **What we achieved:** We created an RDF file to describe the relationship between the different verb and noun concepts in the rule. In this case, the words were 'retail', 'customer', 'account' and 'liability'.

3.20 **Why we did it:** The FCA and PRA Handbook's do not define 'retail customer liabilities', so different firms define this term differently for their internal information purposes. We created an RDF file which we populated with the FCA meaning of financial terms (the FCA Ontology). The FCA Ontology effectively defines retail customer liabilities for regulatory reporting. Integrating this ontology gives firms a consistent definition of a rule, allowing the firm to take this standard rule and effectively match it to their individual internal policies, processes and databases. While these will vary between different firms, imposing the FCA Ontology means the definition will always be the same.

3.21 **How we did it:** We exported the output of the previous steps in an RDF xml format.

Step 4: Mapping the FCA's meaning on to a firm's database

3.22 **What we achieved:** Using the FCA Ontology we matched the meaning of a limited amount of the rule's noun and verb concepts to a firm's data schemas. Essentially, this means linking specific words to a firm's data using linguistic techniques.

3.23 **Why we did it:** This step is effectively a 'meeting in the middle' between the FCA Handbook and the firm's databases. The FCA's meaning was mapped to a representative version of a firm's data schema and each FCA term has a specific data requirement for the firm. Each specific word in the rule holds data specifications so that a portion of regulatory text can instantaneously pull the relevant data from a firm's database.

7 This additional step for enrichment/clarification of the rule may or may not be required for other rules within the FCA/ PRA Handbook depending on their existing structure and the extent of further guidance and interpretative information that is already contained within these Handbooks.

3.24 **How we did it:** Because time was limited, we manually carried out this step using mocked-up versions of firms' data schemas. While semantics and ontologies can potentially remove more of the manual nature of this step, we did not have enough time to fully explore this. We would be interested in feedback on how this step could become more automated as we believe it is a vital part of being able to scale machine executable regulatory reporting.

Step 5: Delivering machine executable requirements

3.25 **What we achieved:** The machine executable version of line 25 of rule FSA001 developed at the TechSprint was automatically carried out.

3.26 **Why we did it:** This step achieved our objective. We were able to successfully demonstrate we could create a machine executable regulatory rule. Once the rule was implemented, machines were able to fulfil the requirements automatically by assessing the information required and then pulling it directly from the firm's databases.

3.27 Another goal was to understand if firms were able to report data directly from their data systems. This would enable firms to better understand how they arranged and sourced data within their firm and give all parties confidence in the consistency and accuracy of what was being reported. From a regulatory perspective, it would also provide greater consistency of information received from across all firms.

3.28 **How we did it:** Using the mocked-up database schemas, we created 250,000 retail customer accounts with balances. We then built technical architecture to separate the RDF file into more easily processed components, which are analysed for correct syntax and then attached to tags that define each component. Machines can then process each component and transform it into machine language. Once 'translated', the architecture can evaluate which customer accounts match the definition. Once the query had automatically selected the customers that we were interested in, we then pulled the data from the firms' customer databases which we then refined. Again, using semantic techniques, we aggregated this customer information and automatically populated line 25 of the FSA001 form.

Step 6 – Execution of a rule change in real time

3.29 **What we achieved:** We simulated a rule change in the Handbook in real time and saw this automatically change the data that was reported. This demonstrated that a firm's systems could automatically execute a change to the regulatory rule without any human interpretation and without having to change a firm's information systems.

3.30 **Why we did it:** Firms continue to tell regulators about the time and costs involved when implementing rule changes. Although we had successfully completed the objectives of the TechSprint, the participants wanted to demonstrate the full potential of machine executable reporting.

3.31 **How we did it:** We re-ran steps 3 and 5, placing additional semantic filters (altered thresholds) on the rule provided. We did not need to re-run step 4 as the mapping had already been completed. This data was then used to populate line 25 of the FSA001 form. Although the total liabilities remained unchanged the proportion that was defined as retail was different to that given earlier in step 5 above.

Additional insight

3.32 As well as demonstrating that machine executable reporting was possible, other activity at the TechSprint also has the potential to improve the regulatory reporting regime.

3.33 For example, a wiki (a crowdsourced website) was created. This could act as an industry-wide body of knowledge, allowing firms to effectively crowdsource regulatory discussions to clarify and agree various definitions.

3.34 The wiki used ontological models, similar to those that were created at the TechSprint, so could be used to help implement and scale machine executable reporting across the financial services industry.

3.35 We also saw participants deciding that retail customer accounts should include additional semantic filters, such as **balance** or **turnover**. This approach could effectively crowd source the interpretation of regulatory rules where there is potential ambiguity. Rather than each firm undertaking this activity themselves, the TechSprint demonstrated that there is considerable potential for collaboration across regulated firms, regulators and technologists, if an appropriate forum or mechanism existed.

Q1: **Are there more efficient ways to achieve machine executable reporting? Are there better ways to achieve the desired output at each step?**

Q2: **What technologies exist that would mean that the manual mapping work in Step 4 could be automated?**

Q3: **What is the most effective mechanism for collaboration by firms for addressing potential regulatory reporting ambiguity?**

Q4: **Are there particular regulatory reporting requirements that could most easily be adapted to machine executable reporting? For example, is a natural starting point to focus on existing requirements that apply to a small set of firms or to a large group of firms? Would a new reporting requirement or an ad hoc data request be more appropriate?**

Q5: **Are there any regulatory rules or policies that could be introduced to help implement machine executable reporting?**

Q6: **Are there any specific regulatory rules or policies that could act as a barrier to implementing machine executable reporting?**

Open source model

3.36 In keeping with the working principles[8] that govern our RegTech work, this proof of concept was industry-led and characterised by multi-firm collaboration and participation. We believe the next stage of development needs to follow a similar process.

3.37 We are making the findings of this work public so that other participants with interest and contributions to make can be involved. As we do not believe that interpreting and meeting regulatory reporting requirements does or should deliver a competitive advantage to firms, we will continue to follow an open source approach to take this work forward.

3.38 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.

Q7: What are the opportunities in developing an open source rather than a commercial solution? How can we best use open standards and open collaboration to agree and implement the underlying architecture and approach?

Potential benefits

3.39 The TechSprint has proven that technologies exist and can be effectively combined to make machine-readable and machine executable regulatory reporting a reality. We believe that introducing this technology to our regulatory reporting process could provide significant benefits for regulators and firms:

3.40 **Increased clarity** – Reducing the ambiguity of our reporting rules would also reduce the need for firms to interpret them and make the information they send us more consistent. Firms could be more confident about what we expect from them and that they are complying with our rules.

3.41 **Increased efficiency** – Automated 'straight through' processing of regulatory reporting could save the industry significant costs. This could free up human resource and capital to innovate, improving the products and services they offer to consumers. Greater efficiency and the removal of the need for human interpretation could also help competition by reducing the barriers to new firms entering markets.

3.42 **More responsive regulation** – machine executable reporting creates the potential for firms to automatically update current rule requirements and future changes in their systems much more quickly and cheaply.

3.43 **Higher quality data** – this technology provides the potential for regulators to collect more detailed, granular data. This would allow us to analyse more areas of the market in greater depth and variety. Higher quality, more consistent data, collected more

8 www.fca.org.uk/firms/regtech/working-us

quickly, would enable us to identify and monitor issues and risks more efficiently, diagnose harm and potentially intervene earlier.

Q8: **Do you agree with our view of the potential benefits of machine executable reporting?**

Q9: **How do we ensure that the potential benefits and costs are appropriately shared across the industry?**

Q10: **Can you provide indicative costs of the current expense of regulatory reporting to your firm? It would be helpful if you are able to separate these costs by specific reporting requirements.**

Q11: **Which aspects of the current system (interpreting reporting requirements, changes to systems and processes, ongoing data submission, compliance and legal oversight) result in the most significant costs for firms?**

4 Future challenges

4.1 Implementing machine executable reporting across the financial services industry, whether in the UK or other jurisdictions, involves major challenges. In this section we briefly outline some of them.

Governance

4.2 This proof of concept has demonstrated that machine executable reporting is possible. If this is scaled across the industry, we need to consider the most effective governance mechanism to decide, and then manage, the implementation. We want to understand how governance can work in an environment where the participants are effectively co-creating the final solution. We are also interested in views on how to decide the most appropriate route to implementation. As we note earlier, our starting assumption is that the most enduring and sustainable infrastructure would be open sourced.

Q12: **What role would it be most useful for us to play in the progress of this work? Who should take the lead: FCA, industry or a combined approach?**

Q13: **Are there existing models of collaboration between industry and regulators, both within and outside financial services that could be adopted?**

Q14: **Do you have a view on what kind of funding model would be the most appropriate to progress the further development of the initial prototype design?**

Business case

4.3 To take this work forward, the industry needs to be convinced that there is a compelling business case. This case would need to explain and quantify the benefits of machine executable reporting, as well as any risks and costs.

4.4 We understand that the business case for implementing this approach would be different for firms of different sizes and technological capability. While we would prefer an open sourced core approach, developed through collaboration, we are interested in whether this is a viable solution. If it is, we also want to know whether that would be the case for all regulated firms. If not, would further market innovation be required, most likely through commercial solutions to service some regulated firms?

Q15: **Can you provide detail on the business case potential of a move toward machine executable reporting for your firm or for firms of different sizes in general?**

Legal/liability

4.5 Adopting a machine executable reporting regime could impact the legal and liability positions of regulators and regulated firms. Stating our reporting rules in a machine executable way would require us to publish rules in both their current form and in a machine executable format.

4.6 Assuming the solution did not suit all firms, or was one where firms could opt in, the liability for those providing and assuring commercial solutions, or providing aggregation and reporting services on behalf of a regulated firm, would need to be clear.

4.7 Regulated firms may also want to seek permission to deviate from the current regulatory reporting regime in order to implement machine executable reporting, rather than run in parallel. We would need to consider these requests carefully, and at this stage we do not have a position.

Q16: Are there any potential legal or unintended consequences associated with a move toward machine executable reporting?

Changes to the role and responsibilities of the FCA

4.8 We would need additional capability to implement machine executable reporting, which would require both upfront and ongoing funding. We would also incur transition costs in moving to a more technology driven regime, which would form part of the costs that we recover from industry. Our assumption is that these costs would be offset by other cost savings to regulated firms.

Q17: What is the most appropriate model to fund the development and ongoing run costs of machine executable reporting?

International Collaboration

4.9 We work with regulators in other jurisdictions in most of our activities. We are publishing this Call for Input to share what we have done, and invite comments and contributions from others. We would be interested in understanding the extent to which other regulators wish to contribute to this work programme.

4.10 Another area we are interested in exploring is whether international collaboration depends on, for example, a common data model or similar. While we are not a standards setting body, we would be interested in hearing the perspectives of standard setters on what would help the implementation of a machine executable reporting regime across different jurisdictions.

Q18: How can we ensure that the development of this proof of concept benefits from collaboration with international regulatory counterparts?

Q19: **What kind of standards would assist the implementation of machine executable reporting? For example, would a common data model need to be established?**

5 Next steps

5.1 We want to know what you think about the ideas and questions in this Call for Input. To respond, please use the online response form or write to us at the address on page X.

5.2 There will be a series of roundtables hosted by TechSprint participants to further discuss some of the relevant legal, technological and regulatory issues. If you would like to attend any of these roundtables please contact RegTech@fca.org.uk using 'Machine Executable Roundtables' in the subject heading.

5.3 In summer 2018 we will publish a feedback statement bringing together the results of these roundtables and further industry discussions, as well as the feedback from this Call for Input.

Annex 1
List of questions

Q1: Are there more efficient ways to achieve machine executable reporting? Are there better ways to achieve the desired output at each step?

Q2: What technologies exist that would mean that the manual mapping work in Step 4 could be automated?

Q3: What is the most effective mechanism for collaboration by firms for addressing potential regulatory reporting ambiguity?

Q4: Are there particular regulatory reporting requirements that could most easily be adapted to machine executable reporting? For example, is a natural starting point to focus on existing requirements that apply to a small set of firms or to a large group of firms? Would a new reporting requirement or an ad hoc data request be more appropriate?

Q5: Are there any regulatory rules or policies that could be introduced to help implement machine executable reporting?

Q6: Are there any specific regulatory rules or policies that could act as a barrier to implementing machine executable reporting?

Q7: What are the opportunities in developing an open source rather than a commercial solution? How can we best use open standards and open collaboration to agree and implement the underlying architecture and approach?

Q8: Do you agree with our view of the potential benefits of machine executable reporting?

Q9: How do we ensure that the potential benefits and costs are appropriately shared across the industry?

Q10: Can you provide indicative costs of the current expense of regulatory reporting to your firm? It would be helpful if you are able to separate these costs by specific reporting requirements.

Q11: Which aspects of the current system (interpreting reporting requirements, changes to systems and processes, ongoing data submission, compliance and legal oversight) result in the most significant costs for firms?

Q12: **What role would it be most useful for us to play in the progress of this work? Who should take the lead: FCA, industry or a combined approach?**

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Annex 2
November 2017 TechSprint participants

Bank of England

Burges Salmon

Credit Suisse

Governance, Risk and Compliance Technology Centre (GRCTC)

Governor Software

Grant Thornton

Hitachi Vantara

HSBC

Immuta

JWG

Linklaters

Lombard Risk

Model Drivers

Regnosys

Santander

Stanford University

The Information Society Project at Yale Law School

Willis Towers Watson

University College Cork

Annex 3
Glossary of terms

Database Schema	A map of a database.
Extensible Mark-up Language (XML)	A computer language to enable the transfer of data from one system to another in a standard format.
Financial Industry Regulatory Ontology (FIRO)	A semantic (word and meaning) map of different regulatory terms that covers several regulatory jurisdictions.
Gabriel	The FCA's online system for collecting and storing regulatory data reported by firms.
Ontology	The formal naming and definition of the types and properties of entities and the relationships between them.
Resource Description Framework (RDF)	A model that codes the semantic relationship between different data so machines can interpret them.
Semantics	The analysis of the meanings of words and the relationships between them.
Semantics of Business Vocabulary and Business Rules (SBVR)	A standard language for describing the relationship between business rules and data.
Web Ontology Language (OWL)	A web language used to describe the meaning of terms in different vocabularies, and the relationships between those terms.

We have developed this work in the context of the existing UK and EU regulatory framework. The Government has made clear that it will continue to implement and apply EU law until the UK has left the EU. We will keep the proposals under review to assess whether any amendments may be required in the event of changes in the UK regulatory framework in the future.

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Pub ref: 005593

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