FinCoNet
INTERNATIONAL FINANCIAL CONSUMER PROTECTION ORGANISATION

SupTech Tools for Market Conduct Supervisors

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Acknowledgements

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Disclaimer

This report is based on information and responses gathered between May and August, 2019. Information related to the specific SupTech tools cited in this report has been updated to the furthest extent possible during the drafting process. Nonetheless, subsequent changes in circumstances and practices may render some information out-of-date.

The opinions expressed and arguments employed herein do not necessarily reflect the official views of FinCoNet member organisations.

About FinCoNet

In November 2013, FinCoNet was formally established as a new international organisation of financial consumer protection supervisory authorities. FinCoNet is recognised by the Financial Stability Board and the G20.

The goal of FinCoNet is to promote sound market conduct and enhance financial consumer protection through efficient and effective financial market conduct supervision, with a focus on banking and credit.

FinCoNet members see the Organisation as a valuable forum for sharing information on supervisory tools and best practices for consumer protection regulators in financial services. By sharing best practices and by promoting fair and transparent market practices, FinCoNet aims to strengthen consumer confidence and reduce systemic consumer risk.

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Table of acronyms and abbreviations

AI	Artificial Intelligence
DLT	Distributed Ledger Technology
DevOps	Development Operations
FinCoNet	International Financial Consumer Protection Organisation
FSP	Financial Service Providers
ML	Machine Learning
NLP	Natural Language Processing
OCR	Optical Character Recognition
SupTech	Supervisory Technology
XBRL	eXtensible Business Reporting Language
XML	eXtended Markup Language

Glossary

Term	Definition
Advanced analytics	Autonomous or semi-autonomous examination of data or content using sophisticated techniques and tools, typically beyond those of traditional business intelligence; it is often based on ML, to discover deeper insights, make predictions, or generate recommendations.
Agile methodology	Iterative software development methodology which encourages rapid and flexible response to change. It advocates adaptive planning, evolutionary development, early delivery, and continual improvement in which incremental functionalities are delivered in short development cycles known as sprints.
Artificial Intelligence (AI)	Artificial intelligence is a field of computer science that allows computer programs to perform tasks such as problem-solving, speech recognition, visual perception, decision-making and language translation. AI can ask questions, discover and test hypotheses, and make decisions automatically based on advanced analytics operating on extensive data sets. Machine learning (see below) is one subcategory of AI.
Big data	Digital tools and information systems capable of analysing large volume of different types of data from varied sources often in real time. This capability is driven by the increased availability of structured data, the ability to process unstructured data, increased data storage capabilities, advances in computing power and specialized parallel computer architectures.
Blockchain / Distributed Ledger Technologies (DLT)	DLT such as blockchain are a means of recording information through a distributed ledger, i.e. a repeated digital copy of data at multiple locations. These technologies enable nodes in a network to securely propose, validate and record state changes (or updates) to a synchronized ledger that is distributed across the network's nodes.
Chatbots	Computer programs designed to simulate conversation with human users, widely used for online customer services at FSPs and beyond. More recent chatbots use ML for improved performance.
Cloud computing	Cloud computing refers to the use of an online network ("cloud") of hosting processors to increase the scale and flexibility of computing capacity. This model enables convenient on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage facilities, applications and services) that can be rapidly released with minimal management effort or service provider interaction.

Data warehouse	A central repository of structured data, usually gathered from several disparate sources, used for reporting and data analysis. They usually store current and historical data in one single place. Aimed at assuring the "Single Vision of the Truth".
Data visualization	Tools to help in the effective communication and clear understanding of data though the use of charts, plots and other graphical means. It makes complex data more accessible, understandable and usable.
DevOps	DevOps is a set of software development practices that combines software development (Dev) and information technology operations (Ops) to shorten the systems development life cycle while delivering features, fixes, and updates frequently in close alignment with business objectives.
Text mining	Process of deriving high-quality information from unstructured text, typically by finding patterns and trends.
Natural Language Processing (NLP)	NLP technology can transform natural languages into computer codes that can be understood by computers. This is the technology behind iPhone's Siri and Amazon's Alexa, for instance. It also allows for Topic modelling: Statistical models to identify recurring topics or themes across a collection of documents.
Innovation hub	A dedicated point of contact within a regulatory agency that provides guidance and assistance to market participants who seek to develop innovative financial products and/or services to navigate existing regulatory frameworks.
Intelligent automation platforms / frameworks	Business process automation technology based on the notion of software robots or AI workers.
Machine Learning (ML)	Ability to perform tasks by computer systems based on patterns and continuous inference. Supervised ML uses an approach based on training a model with already known inputs and outputs (e.g. list of customer credit status) which will result in a general rule to apply to future cases; unsupervised ML identifies complex processes and patterns without previous guidance or training datasets.
Optical Character Recognition (OCR)	OCR is the conversion of images of typed, handwritten or printed text into machine-encoded text, whether from a scanned document, a photo of a document, a scene-photo (for example the text on signs and billboards in a landscape photo) or from subtitle text superimposed on an image (for example from a television broadcast).
Predictive modelling	Techniques that use statistical models to predict outcomes.

RegTech	Technologies used to meet regulatory requirements, address regulatory changes and enhance risk management automatically, more effectively and efficiently.
Regulatory sandbox	A mechanism that enables market participants to develop, test and analyse financial services and/or products in a modified regulatory environment.
Structured data	Data that has been organized into a standardized format, typically in a database.
SupTech	Application and use of innovative or cutting-edge technology by supervisors to carry out their supervisory and surveillance work more effectively and efficiently.
"Waterfall" development model	The waterfall model is a relatively linear sequential approach for software development in which each phase must be completed before the next phase can begin and there is no or little overlapping in the phases: conception, initiation, analysis, design, construction, testing, deployment and maintenance.
Web scraping	Automated process to extract data from websites for later retrieval or analysis.
Workflow	Set of IT tools that provide an infrastructure for the orchestration, monitoring and automation of a pre-defined sequence of tasks (the workflows) directed towards specific goals and objectives. Automations in this category include: the automatic connection to third systems to obtain information needed for decision making, automatic routing the group responsible for specific tasks at each step, the automatic execution of some actions (such as email or letter composition and distribution) and the automated decision making based on traditional rule-based algorithms or newer machine learning algorithms.
Unstructured data	Data in non-standardized formats that cannot be automatically organized in traditional databases with predefined fields for easy sorting, extraction and analysis. This often refers to written documents, pictures and recordings.

Executive summary

The impact of technology in the financial sector has changed the way financial service providers operate and interact with their customers. Innovative applications and new technologies applied to financial services bring many opportunities for both financial service providers and consumers, though it may also encompass new risks and challenges. In this digital environment, market conduct supervisors need to adjust to the new paradigm adapting the way they supervise new products and new channels, and exploring ways to improve their processes by automating supervisory activities.

This report from FinCoNet's Standing Committee 4 presents findings on the use of Supervisory Technology (SupTech) by market conduct supervisors. The report is based on survey responses collected from 21 authorities and covers both cutting-edge technology for enhanced supervision as well as the use of more traditional technologies in ways that facilitate innovative supervision methodologies.

The rapidly evolving technological landscape of financial services provision requires a proactive and resolute **approach from supervisors** towards the use of digital technology. Chapter 2 elaborates on these different approaches. The approach of each supervisor will naturally account for individual factors, but according to most responses to the survey, a thorough planning is needed before launching SupTech projects, including a clear definition of objectives and expectations, and a clear approach to tackle the most frequent challenges. This should include structural issues such as the resources and skills needed, the involvement of top management and the relationship with stakeholders, as well as data-related problems.

According to a majority of responses, a formal **SupTech strategy** developed by the institution may mitigate any implementation obstacles and align efforts with the intuition's strategic objectives. Nevertheless, the existence of a SupTech strategy is not a precondition to develop successful projects. The first stages of SupTech development in each authority are often conducted without a formal institutional strategy and instead with a bottom-up approach that ensures flexibility and learning.

Every effort to develop SupTech tools should be understood as a continuous learning process, even if the tool has already been implemented, as it can always be improved and its architecture can be applied to other purposes.

The respondents' experiences show a wide variety of potential uses of SupTech applied to market conduct supervision. While the most frequent uses are those typically linked to supervisory activities such as on-site supervision or off-site surveillance, other interesting **use cases** are reported in activities like checking FSP's fulfilment of obligations to adequately inform consumers (pre-contractual or contractual information), checking the legal compliance of advertising activity, improving the interfaces for FSP's regulatory reporting or streamlining workflow processes.

Most responding authorities already use at least one SupTech tool. Nevertheless, responses indicate a continuous **implementation** process that favours further development of some tools after they are already in use. Reported SupTech projects are more frequently developed in-house (with or without contribution of external providers) based on a collaboration of the supervision and IT departments.

When implementing a SupTech tool, authorities face a series of **challenges**, the most common of which relate to data, strategic approach and technological complexity. The most frequently mentioned challenges are related to data availability, quality, standardization,

and representativeness. Respondents also mentioned resource constraints and the lack of specialized teams.

The **practical experience of a specific supervisor** is described in the report (section 2.2) to highlight applicable approaches to some of the aspects mentioned above. This authority has implemented a solid strategy that entails a formal process to identify the needs, select and prioritize the most valuable projects, and finally mobilize the resources to develop them. Among such projects, this authority shares some experiences related to AI.

The authorities responding the survey have reported 37 **SupTech tools**. The information on these tools is covered in chapter 3. In general terms, most of them are designed either to collect or analyse data. Responses suggest that while more traditional tools frequently process structured data, more innovative solutions increasingly involve the collection and analysis of unstructured data. Chapter 3 elaborates on some of these tools including e-reporting, web scraping and the application of Natural Language Processing (NLP) for text mining or topic modeling. Chapter 3 also highlights other categories of SupTech tools that automate workflows or that facilitate the development of ratings and automated warnings.

SupTech tools that provide **data collection** functionalities are describes in section 3.1. Supervisors obtain vast amounts of information through regulatory reporting (mainly structured), and the treatment of this information is frequently laborious and time-consuming. For this reason, supervisory authorities develop SupTech tools intended to reduce or even eliminate routine manual tasks related to report handling and, at the same time, improve the quality of data by mitigating human error with automated validations.

But data collection is not restricted to standardized and structured data. Web-scraping and social media monitoring applications, which collect information from non-structured sources, are promising SupTech tools in market conduct supervision. The use of machine learning-based systems and applications, specifically text mining applications, opens a broad spectrum of supervisory possibilities. The tools presented in this report are aimed at diverse areas such as the identification of potential violations of applicable advertising guidelines, identifying key issues of concern and interest for consumers or even predicting potential harm to consumers in real-time using information from social networks.

The **analysis of unstructured data** allows supervisors to obtain structured input from a wide range of data sources. These SupTech tools are analyzed under section 3.2. NLP provides mechanisms to read or hear language and perform tasks such as the identification of relevant topics and summarization of text. With NLP, the continuous and comprehensive supervision of the market is made simpler by automating or accelerating analysis of information contained in non-structured texts. This allows the supervisory authorities, for example, to shift from a manual sample analysis of sampled information to large volumes of information analysis covering all available data. Successful NLP applications include credit contract validation and monitoring of advertisements.

Also based on NLP, Topic Modelling tools play a significant role in the automation of some market conduct supervisory processes. These tools are especially relevant as they can quickly analyse great amounts of information (such as customer complaints, board of director or executive committee records, among others) to identify patterns and let supervisors analyse potential harmful market conduct practices.

In section 3.3, the report highlights a category of SupTech tools that automate workflows and improve day-to-day business processes by connecting various sources of data and managing communication among consumers, supervisors and supervised entities more quickly. **Workflow SupTech tools** support, streamline and expedite internal processes,

improving overall efficiency and enhancing the collection and analysis of structured and unstructured data. Some of the examples shown in section 3.3 refer to the management of complaints handling.

Finally, in section 3.4, consideration is given to another supervisory tool that increasingly relies on SupTech: the assessment of **conduct risk profiles**. Such profiles are key instruments for monitoring conduct behaviour of supervised financial service providers and detect early warning signals in the market. Developing automated systems that carry out efficient analysis on large numbers of FSPs in a short time can vastly increase levels of efficiency.

In this section, respondent authorities also reported on tools to access relevant information about supervised entities and their conduct of business through integrated databases for surveillance/supervisory purposes that facilitate the development of ratings and automated warnings.

To illustrate the SupTech tools in greater detail, chapter 3 contains a selection of case studies considered to be especially relevant and of interest for market conduct supervisors.

As a conclusion, a quick guide is offered in chapter 4 with some takeaways for supervisors' consideration in the race for SupTech.

1. Introduction

1.1 Background

Digital transformation of the financial sector over the last decade has significantly changed the way financial service providers (FSPs) interact with their customers. The emergence of new financial products and services on the market, new channels and new players, together with significant changes in major banks' business models similarly have a direct and profound impact on the manner supervisory authorities perform their activities.

Market conduct supervisors must keep pace with these technological developments, not only to improve the efficiency of their own internal processes, but also to identify, understand and address the impact of technology in the changing nature of financial markets, in order to mitigate the new risks that it may pose.

Consequently, supervisors are adapting their processes and techniques to efficiently and effectively undertake supervisory activities in relation to FSPs. To this end, most supervisory authorities have strategies in place to introduce innovative technology in their own activities, in order to ensure adequate and effective consumer protection in this new reality.

Most market conduct supervisors share common responsibilities, such as:

- Collecting and selecting relevant information for supervisory processes;
- Treating rapidly and in an efficient manner large volumes of data, both structured and, more frequently, unstructured in order to obtain valuable supervisory input;
- Automating supervisory processes and procedures in order to gain efficiency.

In this context, the development and application of innovative solutions by supervisors (including Supervisory Technology - SupTech) to address these responsibilities could result in a more efficient and effective supervision.

However, it should be stressed that innovation is not necessarily linked to the use of innovative digital technology. In fact, innovation may also encompass the application of new procedures or institutional arrangements. For the purpose of this report, SupTech solutions for enhanced market conduct supervision include not only the use of innovative and/or cutting-edge technology (for example, AI and NLP, among others), but also the use of more traditional technologies in a way that allows innovative supervision methodologies (for example, process digitalisation and automation, new ways of treating databases, among others).

In light of the impact of digital technology on the marketing of banking products, FinCoNet has recognized the importance of analysing the impact of technological tools in market conduct supervision. As a consequence, and building on the findings of the FinCoNet Standing Committee 4 (SC4) report published in November 2018 on "***Practices and tools required to support risk-based supervision in a digital age***", SC4 was directed to continue exploring tools that support risk based supervision by taking an in-depth analysis of innovative SupTech tools. Thus, the topic selected for the SC4 work presented in this report is "**SupTech tools for Market Conduct Supervisors**".

In the above mentioned SC4 study, about one-third of respondents to SC4's survey in 2017 confirmed the use or development of SupTech solutions, while other responding authorities were still exploring their application. At that point, respondents applying SupTech mentioned the use of AI, Distributed Ledger Technology (DLT), and cloud computing, among others.

Following these findings, SC4 developed a follow-up survey with the purpose of collecting information from supervisory authorities on new, innovative and relevant SupTech tools, related practices, resources and processes used in their jurisdictions. Through the follow-up survey, SC4 aimed to gain insight about the current SupTech landscape and focus on detailed case studies on the most significant SupTech tools.

This report draws heavily on the responses received to such survey distributed by FinCoNet to the community of conduct supervisory authorities. The content of the survey is included as Annex 2 of the report. Whenever deemed necessary, bilateral contacts have been made to clarify or gain deeper insights into different aspects of the most relevant tools.

The survey was developed to encourage authorities to report on their more innovative SupTech tools and provide a wide range of information on each tool reported: the supervisory need, the level and model of development, the technology used and main features of the tool, a self-assessment of the performance of the tool, and a description of the challenges encountered. In addition, more general questions about the global approach of each authority to the phenomenon of SupTech were included to gain insight on the strategy followed and the level of reliance on SupTech.

The survey collected information on SupTech tools with the following scope:

- SupTech tools specifically applied to market conduct supervision for banking and credit products as well as SupTech tools used for other products' supervision (insurance or investment products) or other supervisory areas (like prudential supervision) that have the potential to be used in market conduct supervision.

  Market conduct authorities might be structured differently in different jurisdictions, including areas or activities such as on-site inspection, off-site surveillance, advertisement analysis, complaints handling and ombudsman schemes, data reporting, AML, financial education, data privacy and/or competition.

- SupTech tools that have already been implemented and SupTech tools that are being considered, planned, developed, or even those that were planned but have been paused for the time being.

- SupTech tools that are designed to be used in any of the phases of the supervisory work, i.e. data collection, data analytics, complaints handling.

Contributions were requested before the end of August 2019. Taking into account the elapsed time since then (mostly due to the impact of COVID-19 in the finalization of this report), the information related to those concrete tools covered in more detail in the report, has been updated.

A total of 21 responses to the survey were received, corresponding to 20 jurisdictions representing five continents. Annex 1 details all the responding authorities. The answers have been provided by central banks and financial service authorities, with 17 responses from FinCoNet members. The answers to the survey contained information about 37 specific SupTech tools. According to the supervisory experience of the FinCoNet SC4 members, the most relevant tools were selected to form the basis of the report.

The use of SupTech is increasingly raising interest among the supervisory community. In particular, as regards SupTech applied to market conduct supervisors, not only FinCoNet, but other international organizations are focusing on this topic. The World Bank has been working on a technical note on SupTech solutions in parallel to the development of this report and, in the spirit of collaboration and coordination between both organizations, FinCoNet and the World Bank have maintained communication to highlight complementary aspects and avoid overlaps.

Technical Note by the World Bank (Forthcoming)

The Next Wave of SupTech Innovation: SupTech Solutions for Market Conduct Supervision

This forthcoming publication by the World Bank's Financial Inclusion and Consumer Protection (FICP) Team is intended to assist market conduct authorities, particularly those in low- and middle-income countries, in building supervisory capacity through the implementation of SupTech solutions.

The World Bank's note is based on extensive research on the experiences of 14 financial authorities in implementing 18 SupTech solutions that can be used for market conduct supervision. The solutions focus on four major areas of supervisory activity: (1) regulatory reporting, (2) consumer data collection and processing, (3) non-traditional market monitoring, and (4) document and business analysis, including of unstructured data.

For each SupTech solution, the note discusses how the solution works, its benefits, and considerations for implementation. The note examines practical considerations for implementation, including covering people, process, and underlying enablers for technology infrastructure. Finally, the note presents common approaches authorities have adopted that accelerate SupTech adoption, such as formal data or SupTech strategies, internal innovation hubs, and adaptive technology development.

1.2 Purpose, scope and structure of the report

The purpose of this report is to explore the innovations in the area of market conduct supervision based on the implementation of SupTech tools and innovative procedures that assist market conduct supervisors in performing their work.

SupTech has been frequently defined in the framework of FinCoNet as the application and use of innovative or cutting-edge technology by supervisors to carry out their supervisory and surveillance work more effectively and efficiently. The Basel Committee on Banking Supervision defines SupTech as the use of technologically enabled innovation by supervisory authorities,[1] while for the World Bank "SupTech is used to refer to the use of

[1] Broeders, Dick and Jeremy Prenio. "Innovative technology in financial supervision (suptech) – the experience of early users." 16 July 2018. FSI Insights No 9. Financial Stability Institute. https://www.bis.org/fsi/publ/insights9.pdf

technology to facilitate and enhance supervisory processes from the perspective of supervisory authorities".[2]

Which tools a jurisdiction considers "innovative" or "cutting-edge" may vary depending on the extent to which they have advanced in implementing SupTech solutions. Nevertheless, SC4 has left it to the discretion of respondents and encouraged them to share as many SupTech tools as possible, especially if those tools are being used or developed for market conduct supervision, or are somehow applicable for this purpose.

The report is organized in the following sections:

- **SupTech in market conduct supervision (chapter 2)**: which includes general information about the development and use of SupTech tools, an aggregated analysis of the SupTech tools reported by the responding authorities and the description of a possible institutional approach for the development of SupTech tools by a supervisory authority.
- **Specific SupTech Tools for market conduct supervision (chapter 3)**: which includes the most relevant SupTech tools currently in use or under development in the respondent jurisdictions, classified in multiple categories, with a special focus on tools applied to market conduct supervision.
- **Conclusions and takeaways (chapter 4):** which offers a quick guide with key takeaways for supervisors' consideration in the race for SupTech.

[2] Boeddu, Gian Luciano, Laura Brix Newbury, Nomsa Lutepo Kachingwe, Ligia De Souza Neves Lopes, and Douglas Randall. From spreadsheets to suptech: technology solutions for market conduct supervision. No. 127577. The World Bank, 2018. https://openknowledge.worldbank.org/handle/10986/29952

2. SupTech in market conduct supervision

This chapter describes the general approach of market conduct supervisory authorities toward SupTech and provides an overview of the use and the development of SupTech tools. It includes topics such as SupTech strategy, supervisory needs covered by the SupTech tools, level of use and operational readiness of SupTech tools, together with areas of application and certain organizational aspects. Finally, an outline of the main challenges related to all the stages of the development of SupTech tools is provided, using a practical example covering their planning, design and implementation phases.

2.1 General approach of conduct supervisors

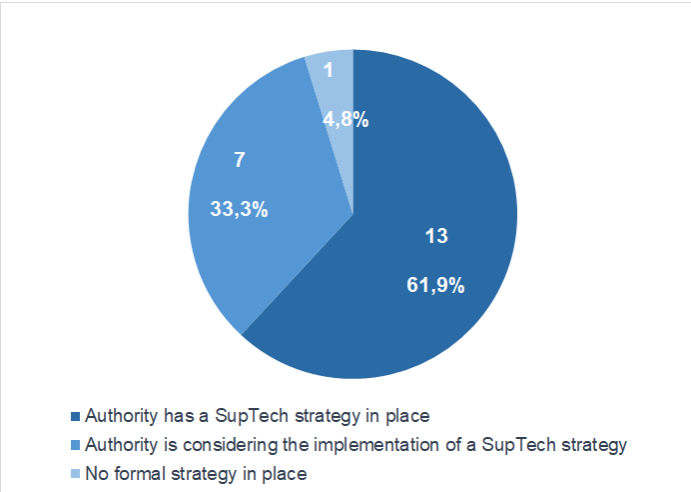
The objective of this overview is to summarize supervisors' approaches to the SupTech phenomenon. This chapter is based on 37 specific SupTech tools which have been reported by 17 of the 21 respondents. The remaining four respondents have only completed the questions related to the general framework for SupTech in the survey, without reporting any concrete SupTech tools.

2.1.1 SupTech strategy

In order to gain insight into the strategic approach of respondents to the use of SupTech, supervisory authorities were asked whether they had a SupTech strategy in place or whether they were considering to develop and implement one, and how it fit into the overall organization strategy.

Respondents to the SupTech survey could interpret the term "SupTech strategy" in different ways depending on whether the strategy is formulated at board level or at lower levels within the organization, whether the strategy is formalized and approved in a written document, and whether specific SupTech developments have been initiated or not. In any case, a SupTech strategy is to be considered as an explicit institutional definition of the targets to be achieved, their prioritization, the elements available to support the SupTech tools (mainly data), the technical developments and planning.

Figure 1. SupTech Strategy



Most responding authorities have a SupTech strategy in place and almost all remaining authorities are considering introducing such a strategy. Although one authority has reported that it does not have a strategy in place, it has reported specific SupTech tools already in use.

A closer look shows that the approaches reflected in those SupTech strategies vary significantly. Many strategies seem to outline an authority's approach to deal with an ever-evolving digitalisation. Other strategies are more dedicated to organizational or institutional aspects and concentrate more on possible improvements in carrying out supervisory tasks.

On the other hand, many authorities have introduced dedicated organizational functions (e.g. a dedicated task force or working group, a Chief Digital Officer or innovation facilitators like innovation hubs and regulatory sandboxes) and have emphasized their strategic role in proactively fostering innovation.

In those authorities that balance a market conduct supervision mandate with additional mandates it can be observed that there is not a clear a distinction between SupTech tools that relate directly or have uses in the field of market conduct supervision and SupTech tools in other areas of financial supervision.

The existence of a defined SupTech strategy may help supervisory authorities to encourage the deployment of SupTech tools within the organisation. The development of SupTech tools usually involves the participation of different departments within each authority, from human resources to IT, including the supervisory areas that may be interested in a specific tool. The participation of external stakeholders also has important organizational implications. In order to coordinate this task and ensure full institutional support, the existence of a formal SupTech strategy may be an organizational option.

Nevertheless, the implementation of SupTech tools might depend on a range of factors in each authority, including its mandate with respect to market conduct supervision (e.g. whether the authority is a specialized or integrated supervisor), its supervisory culture (e.g. more quantitative or qualitative supervision, sensitivity to technology-driven changes) and external factors, especially market-related (e.g. digital transformation of the banking sector, market development of FinTech, complexity, size, "openness").

The existence of a SupTech strategy is not a precondition to develop SupTech tools successfully. The first stages of SupTech development in each authority are often conducted without a formal institutional strategy and instead with a bottom-up approach that ensures flexibility and learning.

2.1.2 Supervisory needs

One basic aspect related to the use and development of SupTech tools refers to the supervisory needs authorities seek to address with such tools.

Some authorities reported their supervisory needs defined at a general authority level while others reported concrete supervisory needs related to more specific tasks and tools at an operational level (described in chapter 3 of this report on Specific SupTech Tools for market conduct supervision).

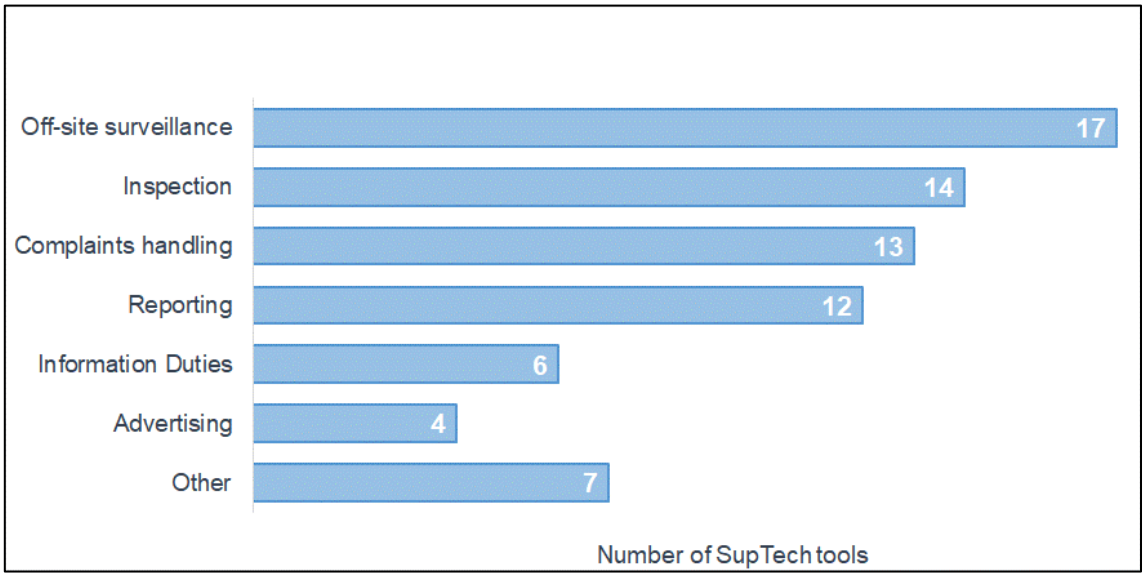
In more general terms, supervisory needs, which authorities seek to address with SupTech tools, are quite similar. Most respondents explained that they seek to improve efficiency and effectiveness by automating (or speeding up) labour-intensive tasks and processes, by implementing technological improvements in the execution of supervisory tasks with new

solutions such as XBRL, interactive visualizations and intelligence capabilities for assessing the supervisory data. Nevertheless, as indicated before, it should be noted that a great variety of detailed and operational business-cases have been mentioned by respondents referring to specific needs.

2.1.3 Use Cases of SupTech Tools

The following chart represents the distribution of the 37 tools reported by the authorities that have indicated they are developing SupTech tools among various areas of market conduct supervision (one SupTech tool can be applied to more than one area of activity).

Figure 2. Use cases of SupTech tools



Respondent authorities reported 37 different tools, which they were then requested to identify with one or more typical supervisory use cases. While 19 tools were linked with only one area of activity, the remaining 18 tools were linked with two or more (e.g. one tool related to credit contracts is only applied to *Inspection* while another tool on reporting is applied to four different areas of activity: *Inspection*, *Off-site surveillance*, *Reporting* and *Complaints handling*).

In the figure above, different categories of supervisory use cases were grouped according to supervisory experience. *Off-site surveillance* may include thematic reviews, early warning and other alerts monitoring. The *Inspection* category refers to review (mainly on-site) of FSP systems, information duties, processes and controls. *Complaints handling* may refer to both the workflow tools for managing and responding to individual complaints for those supervisory authorities whose mandates include this activity or to analysing complaints data for supervisory purposes. The *Reporting* category refers to the legal requirements on the submission of information from FSPs to their supervisors. The *Information duties* category refers to the supervisory review of pre-contractual and contractual information, and the *Advertising* category refers to the supervision activity to check that FSPs follow the regulation applicable to advertising. The "*Other*" category includes AML, financial education, data privacy and/or competition.

Off-site surveillance is a broad concept that can include different functions, depending on how market conduct supervision is organized within one authority. Thus, it is not surprising that this area was the most commonly indicated by respondent authorities, with 17 authorities reporting it as a SupTech use case. (Although 19 authorities declared that they are using, experimenting, or developing SupTech tools, only 17 of them provided descriptions of one or more such tools). Advertising, on the other hand, was only reported by four authorities as a SupTech initiative.

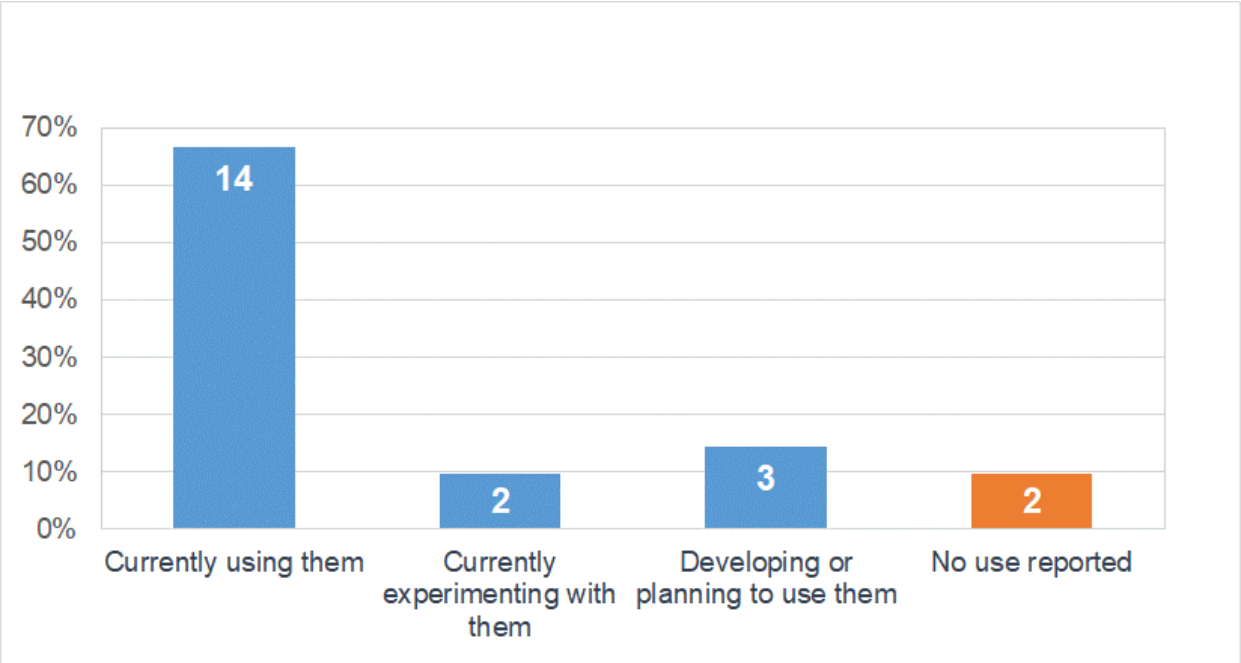
The information provided shows that two core supervisory activities are the most frequent responses: off-site surveillance and inspection. It is interesting to note that two activities that can be considered as ancillary to these supervisory functions are also commonly reported: information duties and reporting. Complaints handling is an activity that is suitable to incorporate technological developments and the supervision of advertising is becoming relevant following the technological developments that enable the analysis of unstructured data analysis.

2.1.4 Level of use and development of SupTech tools

Authorities have shown different levels of development and implementation of SupTech tools that range from tools that have already been implemented but remain in continuous development, to tools that are planned or even paused for the time being with the possibility to reconsider them for future projects.

The following figure illustrates that almost all responding authorities are already using tools; experimenting with tools in one or more pilot programs; and/or developing/planning to use SupTech tools.

Figure 3. SupTech Tools: Highest level of implementation reached



Moreover, 14 of 21 responding authorities stated that they are already using at least one SupTech tool, while 19 out of 21 authorities indicated they are using, testing or developing

SupTech tools. Another common observation is that some tools, which are already in use, are nevertheless being developed further.

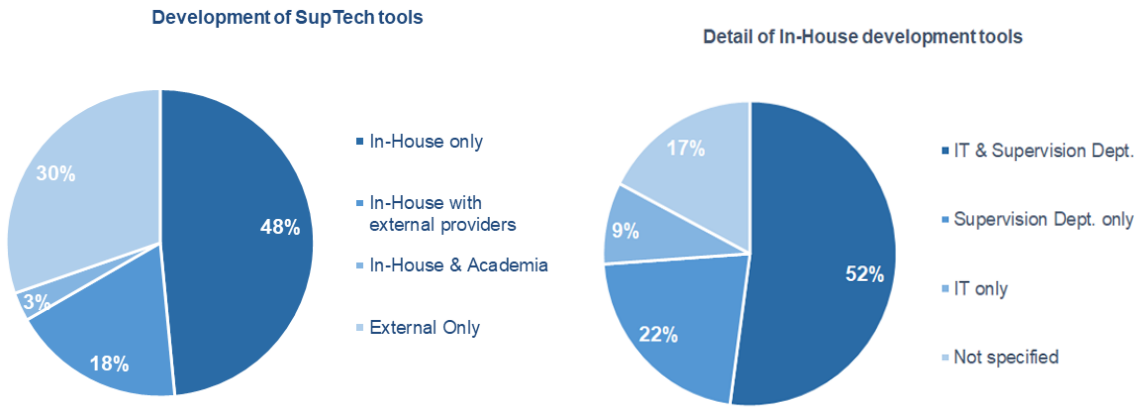
The answers to the survey suggest that the SupTech tools which rely more on conventional technology are more widespread across supervisory authorities and are more often already in use than those tools which rely on cutting-edge technology (e.g. AI / ML).

Supervisory authorities indicated that reported tools are at various stages of operational readiness, ranging from fully implemented, under agile development, piloted, under "waterfall" development, planned or abandoned.

It has been noted that when a tool has been implemented, the process of development does not always cease and therefore, some tools have been implemented, are still being improved through agile methodologies or traditional waterfall development.

The majority of the SupTech tools are being developed internally – either exclusively in-house or in-house with the assistance of external providers or academic partners. The remaining 30% are developed exclusively via external providers. When the tool is built at least partially in-house, the development is executed primarily in collaboration between the IT department and the relevant Supervisory department. Only ten of 33 tools are developed exclusively by external providers (Figure 4). Please note some tools might fall in more than one category while for other tools, information on development has not been reported.

Figure 4. SupTech Tools: Development



More than 75% of the described tools are hosted in-house (on-premises) while the remaining tools are hosted by external providers. Only one tool is hosted in a combination of in-house and external providers.

2.1.5 Main challenges in the development of SupTech tools

Authorities face a range of challenges related to the planning, designing and implementation of SupTech tools. The most commonly reported challenges stem from data, strategy and technical complexity.

The most commonly mentioned challenge relates to data problems such as data quality (e.g. FSPs have different interpretations of the information called for, migration of data to new systems), data standardization and data availability among others.

Another group of challenges mentioned just as often relates to strategic questions, including aspects such as resources, expertise, prioritization of use cases, adaptation of legacy processes and other strategic obstacles.

Resource constraints frequently make it difficult to have a team specifically dedicated to a SupTech project. In addition, the development of such tools requires a high degree of technological expertise (e.g. expertise in data science, advanced analytics and data visualization), meaning that supervisors often face a lack of resources and more specifically a lack of specialized resources. To address this challenge, one responding authority indicated it has started to create groups of data scientists to develop forms of machine learning code.

Complexity is also mentioned as an important challenge. This covers several aspects related to technical complexity, as well as complex and time-consuming preparations, e.g. working with algorithms.

2.2 Practical experience

The design, planning and implementation of a SupTech application is a challenging task that requires significant resources, a long process, and possibly the involvement of different actors within the supervisory authority (IT staff and supervisors, at a minimum). For this reason, the entire process should be carefully designed, and it is essential to ensure that all relevant stakeholders are involved.

L'Autorité des Marchés Financiers (AMF) in Québec, Canada, has been considered as a valuable example of the implementation of SupTech tools. The input provided by the AMF is based on a well-defined strategy and follows a clear methodology. Therefore, the AMF was asked to share its approach and strategy towards the development of SupTech tools. Section 2.2 describes the main elements of the AMF approach.

The AMF has an established strategy regarding FinTech, which is articulated around three pillars: proactivity, proximity and agility. This approach aims to foster both innovation and consumer protection.

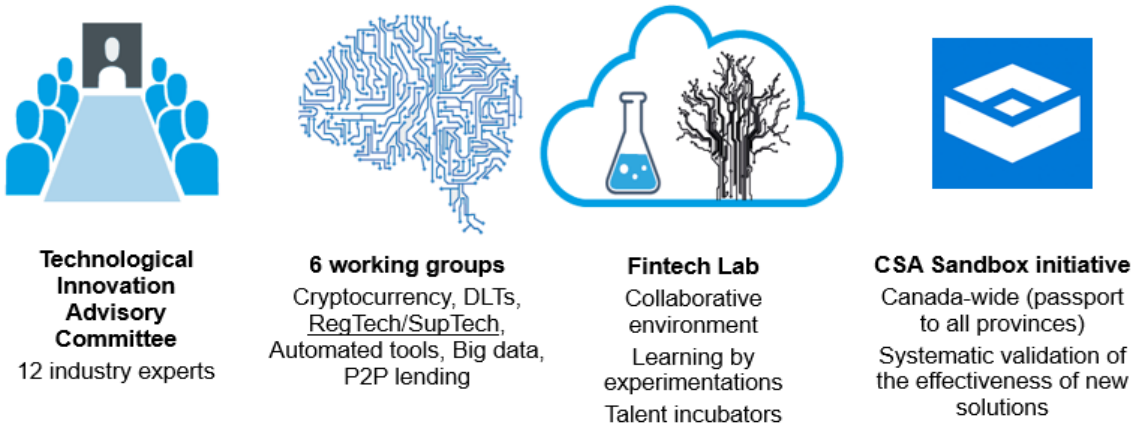
For a supervisory authority wanting to implement SupTech solutions, Canada AMF considers a clear SupTech strategy as essential. Within the process of determining a SupTech strategy, the supervisory authority will set goals, determine adequate resources to reach these goals and exclude objectives that do not fall within its strategy. Implementing a SupTech strategy, as opposed to simply purchasing SupTech tools, provides several benefits amongst which:

- Gaining maturity in terms of SupTech and RegTech development in general;
- Having a better understanding of what is essential and what is not, which facilitates selecting amongst competing projects or solutions to purchase;
- Building a solid in-house knowledge base and know how that can be mobilized for future projects and challenges.

The supervisory authority must develop a formal process to determine its needs, selecting the most valuable projects and prioritizing them. Sufficient financial and human resources, with the appropriate skillsets, are key factors for success.

AMF´s Fintech strategy is driven by six working groups, including the RegTech group, which oversees the development of SupTech tools.

Figure 5. Holistic view of the Canada AMF`s FinTech strategy



According to the AMF strategy, in the first stages of a SupTech tool design, and before facing technical challenges, other types of organizational requirements must be properly addressed, including:

1. Identification of needs:

   The different stakeholders within the organization must collectively identify and share their needs for developing and implementing new SupTech tools. Coordination and participation of all stakeholders are key at this stage to centralize the requirements, avoid duplication of projects and allocate resources efficiently.

2. Prioritization of initiatives:

   This step consists of prioritizing the identified initiatives and filtering out the ones that are unrealistic, inefficient or too costly for the value they can bring to the organization. This stage requires the involvement of developers and other more technical participants to assess and validate the feasibility of the chosen projects.

3. Mobilization of resources:

   Depending on the selected projects, authorities will need to mobilize appropriate resources (technical, as well as content specialists) and allocate adequate tools. All individuals involved in the project must be allocated sufficient time to achieve their respective tasks.

   A project manager or a committee should diligently monitor the project, ensure that the project is on track (on time, on budget, and within the agreed scope). A designated staff person should report to the appropriate governing bodies on the status and progress of the project.

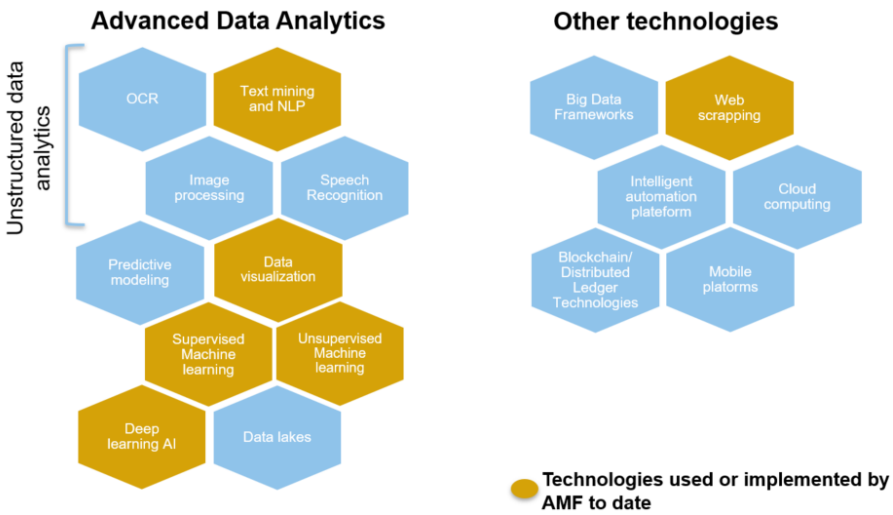
Based on the AMF's experience, challenges related to the planning, design and implementation of SupTech tools depends on many factors, including the type of technology used and the complexity of the project. One of the most recent developments at AMF concerns SupTech tools using AI. The following are specific challenges faced by the AMF related to these AI tools:

- Technologies based on AI need significant amounts of data to be effective. The AI algorithms are "trained" using data that should replicate as much as possible the real conditions in which the algorithm will operate.

- In order to properly train this SupTech tool, the teams working on it need to first build a database with enough data (generally very large volumes of data).
- The data is then classified according to the needs of the SupTech tool (e.g. a username, account number, number of transactions, volume of transactions, type of transaction, etc.).
- Based on this classification, data are then regrouped in datasets (e.g. grouping by province).

- Dataset creation is time consuming, especially labels (labelling typically takes a set of unlabelled data and augments each piece of that unlabelled data with meaningful tags that are informative, e.g.: labelling of suspicious transactions). AI algorithms need to have the data structured with labels in order to use the information as a training and validation dataset.
- Despite recent academic successes, ML still requires in practice significant manipulation of the data. In theory, once a large amount of data is available, datasets have been created and the data have been properly labelled, the AI will operate with a minimal number of mistakes. In fact, technicians and stakeholders must allocate substantial amounts of time to ensure that the SupTech tool is working properly, and they must constantly adjust its functionality.
- Solutions require an iterative development process with input from analysts.

Figure 6. Technologies used or implemented by Canada AMF



One example of a successful project would be the development, by the AMF, of the SupTech tool on topic modelling, described in more detail in chapter 3.2.2.

Takeaway

Potential approaches to SupTech	The rapidly evolving technological landscape of financial services provision requires a proactive and resolute approach from supervisors towards the use of digital technology, which can make the supervisory function even more efficient and effective. Although the approach of each supervisory authority will naturally account for individual factors, the following considerations are likely to apply globally:
	• A formal SupTech strategy for the institution may mitigate any implementation obstacles and align efforts with the intuition's strategic objectives. Nevertheless, the existence of a SupTech strategy is not a precondition to develop successful projects. The first stages of SupTech development in each authority are often conducted without a formal institutional strategy and instead with a bottom-up approach that ensures flexibility and learning.
	• In any case, thorough planning is needed before launching SupTech projects, including a clear definition of objectives and expectations, and a clear approach to tackle the most frequent challenges, including:
	  ○ Structural issues (resources and skills needed, involvement of top management and relationship with stakeholders)
	  ○ Data-related problems (quality, availability and representativeness)
	• Every effort to develop SupTech tools should be understood as a continuous learning process, even if the tool has already been implemented. The tool can always be improved and its architecture can be applied to other purposes.

3. Specific SupTech tools for market conduct supervision

This chapter describes the most relevant SupTech tools currently in use or under development reported in the survey, with a special focus on those applied to market conduct supervision. The criteria for the relevance of each tool has been decided by the respective authority when responding to the survey. The information received has been reviewed by the FinCoNet SC4 members, who then selected the most relevant tools according to their supervisory experience.

A detailed description of the tools is provided including the underlying technology, main features and current use of the SupTech tools, explaining how they enhance supervisory processes and the main challenges faced. For tools that have already been implemented, such description includes an assessment of the outcomes provided by these tools, where available. Nevertheless, a more structured review could be performed in the future when more perspective is gained on their evolution.

A general classification of the reported tools helps to frame their analysis. Most of the SupTech tools reported are designed to collect or analyse data, both structured and unstructured, often supporting one or more specific processes. Moreover, workflow automation solutions intend to improve day-to-day business processes and connect various sources of data and end-users. Finally, integrated databases for surveillance/supervisory purposes provide insight into supervised entities and their conduct of business. The "general similarity" of tools detailed by respondent authorities is driven by broadly and basically similar supervisory needs: gather and analyse data/information and automate supervisory procedures.

The following matrix reflects the relation among the main SupTech developments, combining technology employed and areas of supervision. The structure of this chapter and the following sub-chapters are based on this matrix. In order to gain insight into each combination of technology and use, please refer to the corresponding chapter of the report.

Table 1. SupTech Tools: Technology employed and uses

	3.1.1. Structured data collection	3.1.2. Unstructured data collection	3.2.1. Unstructured data analytics (AI)	3.2.2. Unstructured data analytics (AI)	3.3. Workflow	3.4. Risk profile/ early warnings
	E-reporting	Web Scrapping	NLP Text Mining	NLP Topic Modelling	Workflow	Integrated Databases
Advertising	✗	✓	✓	✗	✗	✓
Information duties monitoring (Pre-Contractual / Contractual Information)	✗	✗	✓	✓	✗	✗
Inspection	✗	✗	✓	✓	✓	✓
Off-site Surveillance	✓	✓	✗	✗	✓	✓
Reporting	✓	✗	✗	✗	✓	✓
Complaints handling	✗	✗	✓	✓	✓	✓
Other	✗	✓	✓	✗	✗	✗

Looking at the matrix, with a special focus on technologies employed in the development of the reported tools, the picture looks very diverse. As stated previously, many tools are designed to collect or analyse data, and the technologies used by those tools are specific to the nature of the underlying data that is to be collected and analysed: structured or unstructured data.

Structured data, for the purpose of this report, refers mainly (but not only) to the information reported by supervised entities in a tabular form. As this information pertains mostly to the FSP, conclusions regarding customer protection is generally extracted in an indirect way (e.g. number of new contracts to value the impact on consumer protection) and not from the consumers themselves. In case market conduct supervisory authorities want to gain information directly from consumers they frequently resort to alternative, irregular information sources (e.g. consumer complaints filed with the authority, consumer surveys) or to information which is publicly available (e.g. on the internet). This sort of information tends to consist of unstructured data.

The nature of unstructured data, as well as its diversity of sources, represents challenges both in its collection and analysis for the identification of potential risks. The unstructured nature of this type of data and its lack of standardization may not only refer to the format but also to the regularity with which it may be obtained and the sources. In the field of

market conduct supervision, there is ample opportunity to obtain and analyse unstructured data, as far as frequent sources of information that are suitable to be treated with these technologies (contracts, claims, advertisements, social networks, etc.).

The nature of the underlying data determines whether this data can be collected and analysed with more traditional tools or must be processed with more innovative tools. According to the responses to the survey, the most innovative technological solutions are now being applied to the processing and analysis of unstructured data, while the processing of structured data more often relies on traditional tools.

This is the case of AI solutions that play a major role in SupTech to improve and optimize supervision tasks, allowing the standardisation of such unstructured sources of information. The goal of AI is to transpose human reasoning to machines allowing for a wider range of process automation, from data manipulation to knowledge representation, with continuous learning capabilities. A particular subfield that supervisory authorities have been leveraging is NLP, as the quantity of documents supervisory authorities receive is vast.

Takeaway

Frequent uses of SupTech for Conduct Supervision purposes	Most of the SupTech tools reported are designed to collect or analyse data. While more traditional tools frequently process structured data, more innovative solutions increasingly involve unstructured data. Another frequently used category of solutions comprises those focused on workflow automation that intend to improve day-to-day business processes and connect various sources of data and end-users. The most frequent example of this category is complaints handling, among those supervisors with such a mandate. Finally, most authorities access relevant information about supervised entities and their conduct of business through integrated databases for surveillance/supervisory purposes that facilitate ratings and automated warnings.

3.1 Data collection

3.1.1 Structured data: e-reporting

The most traditional use of technology performed by a conduct supervisor has been the gathering or collection of structured data in the form of regulatory reporting provided by supervised entities. Innovation in this regard stems from the use of new interfaces with supervised entities.

The tools described by authorities in this category share a common approach in that they implement a reporting taxonomy that clearly defines each regulatory report in a structured, machine-readable way, create secure channels in which those reports are sent to supervisors, apply automatic validations and transformation to ensure the quality of the reported information and give end-users powerful means to analyse and use the reported data.

In this category, e-reporting (Electronic reporting system) is the process of collecting and submitting data electronically in a format that is readable by computers. Regulatory reporting is thus defined as the submission or reporting of raw information by supervised institutions (banks, deposit taking institutions, trusts etc.) to their regulators, who evaluate

the operations carried out to determine the institution's compliance with relevant rules and use the reported information as an input for the risk identification assessment.

Regulators intend to have centralized structures that function not only as a common database for reported data but also as a repository for reporting rules. This could help with data governance and aggregation and reduce the costs and inefficiencies of having several different systems, each adapted to different institutions. E-reporting also helps regulators with data transformation, a step that is generally time consuming.

Different technologies can be used for e-reporting, and these technologies can be separated into two components: tools to fill in the data (Extensible Business Reporting Language (XBRL), xml, excel spreadsheets, csv for source data or granular data) and tools to exchange the data (web-based systems and portals, server to server encrypted channels, ad hoc APIs, etc.). Choosing one technology over another depends on data volume and rapidity of exchange, but also technological and financial resources of both the supervisory authorities and the FSP as a whole.

The main requirement of reporting is data availability and accuracy, since supervisors must justify decisions based on disclosed data. One example of challenges conveyed is insufficient data granularity, which can require the supervisor to creating its own indicators. Other challenges include data redundancy (different disclosures or templates providing the same information), manual data aggregation (especially with large financial institutions that can have several systems that generate different templates), lack of data quality (missing data points and errors in calculations and coding), and data validation.

Various supervisory authorities described tools in the area of data collection e-reporting. This category, together with the development of conduct profile/early warnings, contains by far the highest number of tools in the survey. Most of them have been developed in-house in collaboration with external providers. The following descriptions are a representative example of these e-reporting tools.

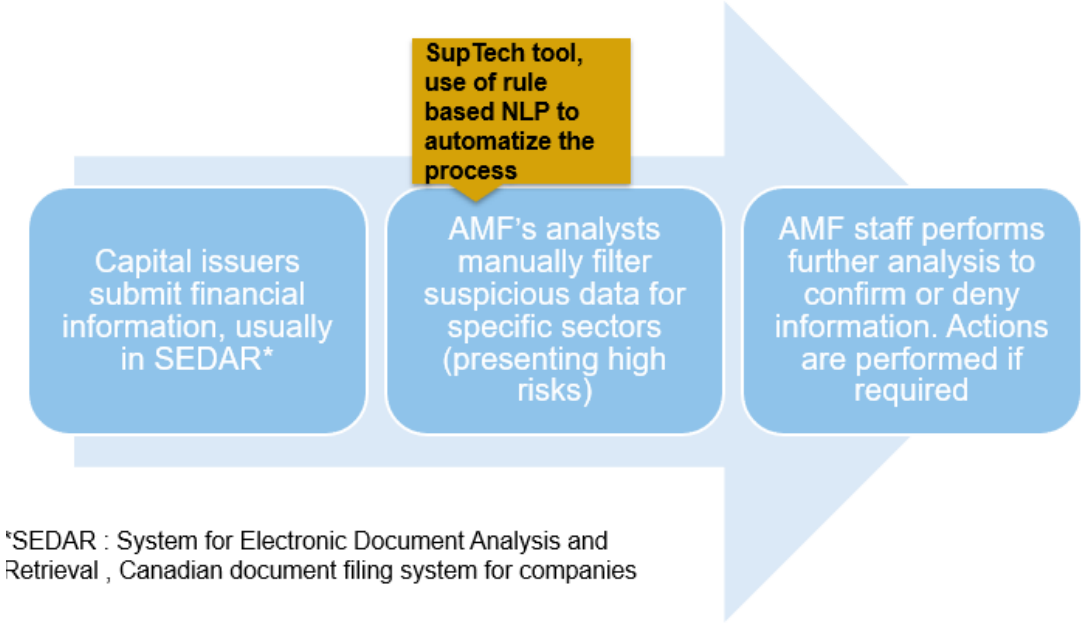
Banco de Portugal ESC Reporting system is based on Advanced Data Analytics with additional functionalities added on a semi-continuous basis through Agile / DevOps methodologies. The supervisory authority receives a considerable amount of data from each supervised institution on a regular basis (micro data regarding mortgage and unsecured credit contracts, data on arrears procedures applied to individual credit contracts, and other aggregate data on basic bank accounts and overall banking activity). Previously, this information was validated, treated and aggregated manually, before being disclosed to the public and used for supervision purposes. Consequently the authority designed this SupTech tool to address operational risks associated with handling large amounts of information and to minimize the time that is spent treating and aggregating huge volumes of data.

The ESC reporting system monitors XML files (standard eXtended Markup Language) sent by supervised institutions and identifies which ones comply with their reporting obligations. The tool validates the information received against a set of well specified rules, identifying errors that are automatically sent to the supervised institution for correction and alerts to internal users informing them which data is missing or inconsistent.

The Canada Québec Autorité des Marchés Financiers (AMF) Market Surveillance Tool is powered by AI and ML, and was developed to enforce regulatory supervision and to monitor systemic risk in the derivatives market. The tools used are intended to address the following needs: automate data collection, perform data analysis and visualization and database integration. It enhances the supervisory process by allowing the regulator to:

- Better identify market patterns and market share concentration held by some participants;
- Obtain better visibility of the risk existing in its market and the main types of products traded by the participants;
- Assess the impact of certain regulations; and
- Establish financial thresholds to scope-in or out certain type of entities.

Figure 7. Market Surveillance tool



The Bank of Mauritius XBRL Reporting system platform has been implemented for filing regulatory returns. In its current version, several validation checks have been incorporated to minimise the possibility of misreporting. The XBRL portal enables the Bank to extract consolidated positions as well as other specific trends and dashboards. Cash dealers are also connected to an Automatic Reporting Module system to capture their transactions on a real time basis. Through the implementation of XBRL, the Bank sought to reduce manual intervention by automating the process for the analysis of returns. This has freed up resources for more urgent tasks.

The Central Bank of Brazil (BCB) Integrated System for Supervision Support and Communication (APS SisCom), is a web-based system that facilitates easy and secure sharing of information. It is a communication platform, which supports a process for collecting data and documents through a web portal in a cost-effective way and performs remote inspections.

In addition to quantitative data, the APS also collects qualitative data (for example, information on governance, systems, and controls to mitigate the conduct risks). The information is collected using questionnaires and forms developed by supervisors as well as uploaded documents and databases, according to the planned supervisory activity.

Indonesia Financial Services Authority (OJK) launched a digital technology-based financial services application called **OJK-Box** or abbreviated as OBOX to strengthen the supervision of the financial services sector in the banking sector.

The OBOX application was designed to complement the previous supervision information system of OJK. Their previous information system was limited to monthly data in an aggregated form and therefore, the supervisors were obliged to request additional data from the financial institution (e.g.: transactional data) to perform their supervision activities. Through OBOX, the supervisor is now provided with more granular transactional data whereas previously they only received data related to credit, market and liquidity activities. Supervisors can now easily indicate irregular transactions conducted by financial institutions and take immediate actions to mitigate potential issues that may arise.

Furthermore, OBOX data can be used as a preliminary input for on-site supervision (examination), so the supervisor can conduct their activities in a more efficient and effective manner. OBOX development is the first step for OJK toward adopting an information technology-based supervisory paradigm. In the future, on-site examination activities will focus more on confirming results identified by data analysis and information generated by the application at the first stage.

The Central Bank of Nigeria's Agent Banking Management System (ABMS) is a SupTech tool that aims to monitor transaction performance that occurs at agent locations under the agent banking scheme. It is intended to monitor mobile money transaction reports and performance across service types and digital channels and is designed to identify breaches and predict behaviours using trend analysis.

The Estonia Finantsinspektsioon – Data submission portal has been implemented to enable its supervised entities to submit on an ongoing basis statistical and supervisory reports. Through this tool, the entities are able to see an overview of their reporting obligations and due dates, and they can enter the reports into a specific form, manually or automatically. The system automatically checks and displays whether the entity has correctly entered the data, which are then displayed to Finantsinspektsioon.

Takeaway

Structured data: e-reporting	Supervisors obtain vast amounts of information through regulatory reporting, and the treatment of this information frequently implies laborious and time-consuming activities. For these reasons, supervisory authorities are developing SupTech tools intended to reduce or even eliminate routine manual tasks related to report handling and at the same time improve the quality of data by mitigating human error.

3.1.2 Unstructured data: web-scraping /social media monitoring

New technologies are enabling supervisors to obtain relevant insights from unstructured data. The use of new technologies allows the conversion of unstructured data into structured data, which may then be included in the workflow of analysis of supervisory information. In the field of unstructured data collection, web scraping techniques and social media monitoring are the most frequently reported tools. Such applications permit supervisors to obtain insights in almost real-time.

The common features of SupTech tools in the web-scraping and social media monitoring-category are their comparable data sources: the information source is publicly available,

mostly from the Internet and social media platforms, as well as from other public sources, such as publications in digital media.

These sources represent huge pools of potentially useful information with frequent updates that could reflect pressing matters of interest for conduct supervisors. As the information is already publicly available, privacy concerns are not likely to arise. The information obtained from the Internet and social media platforms most frequently stems from the broad public and thus reflects opinions which are largely independent from supervised entities. In cases where regulated entities themselves disseminate information via such platforms, it is likely that such information is directly addressed to potential customers - e.g. through advertisements.

However, such data sources also have certain disadvantages. The internet and social media access and usage patterns vary significantly among different socioeconomic groups within a jurisdiction—and even more so across different jurisdictions. For example, older or less affluent people are frequently underrepresented on social media platforms, which could undermine the utility of such tools vis-à-vis groups that may be of particular concern for conduct supervisors. Moreover, the data pool may be large in principle, but information relevant to prudential or market conduct supervision only accounts for a certain and possibly small proportion of this. There may also be concerns about the reliability of the information. Finally, there are of course no format restrictions on the information in this vast pool, either by type (e.g., text, image, spoken word, language) or by size – which means that the underlying information consists, by its nature, of unstructured data.

As such, the main purpose and challenge for SupTech tools in the area of web-scraping and social media monitoring is, therefore, to collect information from a vast and ever-changing pool of unstructured data and extract relevant insights.

To meet these challenges, such tools usually require cutting-edge technological solutions. Ideally, publicly accessible information, mostly focused on social media platforms, should be automatically searched and analysed. This automated analysis involves machine learning-based systems and applications, specifically text mining applications since the information mainly consists of unstructured text.[3]

Supervisory authorities have reported SupTech tools for web-scraping and social media monitoring with a primary focus on data collection, though they usually also contain certain capabilities or applications for data analysis purposes.

The United Kingdom Financial Conduct Authority (FCA) has developed a **web-scraping** tool, which allows users to specify search terms and gather related information programmatically from the web. The tool has been developed in-house and is hosted within the FCA's cloud environment. Additional functionality is being added on a semi-continuous base through Agile / DevOps methodologies.

The **Indonesia Financial Services Authority (OJK) – SupTech tool on advertisement** uses an in-house built dashboard, which indicates potential violations of OJK's Financial Services Advertising Guidelines. Currently, advertising and marketing information about financial services, which are used for this purpose, are obtained from more than 80 Indonesian print media outlets, with which OJK cooperates. The information (texts and images) is categorized by key-words and is, hitherto, still manually entered into the system

[3] BaFin, 2018, Big data meets artificial intelligence, Challenges and implications for the supervision and regulation of financial services, chapter 3.4, page 33 ff. (https://www.bafin.de/SharedDocs/Downloads/EN/dl_bdai_studie_en.html).

on a quarterly basis. This market conduct supervision-tool allows users to classify violations as inaccurate, unclear, misleading or falling under other advertisement violations.

The system is currently being developed further. OJK is planning to extend the data sources to social media and other online sources. OJK also plans to automate the process where the unstructured data is currently selected and collected manually by using advanced data-analytics methods to select / collect such data in real-time.

The **Central Bank of Ireland (CBI)** has implemented a SupTech tool for **Social Media Monitoring**. The tool was developed in collaboration with external providers and employs advanced web-scraping technology. It is being used to identify and understand real-time issues affecting consumers in the market.

The Central Bank monitors publicly available social media platforms, blogs and online content such as webpages and forums. These are monitored in real-time against a list of approximately 50 key words and a mention is recorded if the key words are matched.

To summarize, the SupTech tools / initiatives in the field of web-scraping and social media monitoring appear promising. This applies particularly to the field of market conduct supervision, as the information sources from broad public must often directly reflect the interests or concerns of consumers in real time. Comparable information is otherwise scarcely available for supervisors.

However, web-scraping and social media monitoring-tools must handle unstructured data, mainly in the form of text. Among other things, data-related challenges are therefore not surprisingly identified as important obstacles by all three authorities, both in terms of consistency and quality of information.

Takeaway

Unstructured data: web-scraping and social-media monitoring	Web-scraping and social media monitoring applications are promising SupTech tools in market conduct supervision. The use of machine learning-based systems and applications, specifically text mining applications, opens a broad spectrum of supervisory possibilities. The tools presented in this report are aimed at diverse areas such as the identification of potential violations of applicable advertising guidelines, identifying key issues of concern and interest for consumers or even predicting potential harm to consumers in real-time.

3.2 Data analytics

3.2.1 Unstructured data: NLP Text Mining

Natural Language Processing (NLP) is an area of AI that aims at understanding and processing human language in its different formats. Among possible applications, regulatory text can be converted into a machine-readable format, both in a rule-defining stage and in an analysis stage, necessarily improving the manual-intensive supervisory processes.

The data gathered from the survey distributed to Market Conduct Supervisors confirms that some SupTech projects are leveraging NLP technologies for the development of new and more efficient tools. In particular, NLP tools have been most commonly deployed in the validation, analysis and visualization of unstructured data.

When monitoring the compliance of market participants with conduct regulation, the data used is often unstructured and usually comprise different documents types: client complaints, advertising materials, client contracts, supervised entities' internal policies, etc. Analysis of these documents poses a challenge for supervisory authorities. Through NLP solutions, these labour-intensive tasks are made simpler by being either fully automatized or accelerated.

Indeed, several NLP tools are being used to automate supervision tasks as respondents of the SC4 survey have reported. The successful deployment of NLP technology tools related to contract analysis and advertising material monitoring are two such examples.

The first example of NLP text mining tools is used in the analysis of credit contract models that, in some jurisdictions, financial institutions must submit to supervising authorities before they can be widely used. Another type is used by supervisors to help them analyse samples of consumer credit contracts and inspect their transparency and marketing processes.

Unstandardized contracts pose a challenge to these tasks, which must assure compliance, transparency and a level playing field among FSPs. Analysing and validating the unstructured data of credit contract drafts or signed credit contracts is a highly manual and labour-intensive task that consists of reading each document individually and confirming whether their clauses are compliant with the regulation in place.

Some supervisory authorities' mandates include the analysis and monitoring of advertising material, in light of applicable regulation. Like credit contract drafts, advertising material is non-standardized, of a considerable volume and requires manual review.

Currently, Banco de Portugal has an ongoing initiative undertaken by its own Innovation Lab.

Case study: Banco de Portugal's SupTech tool for credit contract models analysis

Banco de Portugal's market conduct supervision Department collects drafts submitted by FSPs for different types of credit contracts. Validation of the provided information, mainly against regulatory rules, has proven to be highly time consuming and complex, entailing the manual treatment of a considerable volume of data, since each draft is individually analysed). As such, the implementation of an automatic process would bring substantial efficiency gains.

The Market Conduct Supervision Department and the newly created Innovation Lab partnered to test the feasibility of using NLP to automate the validation of draft contracts, with the potential to apply the technology to other use cases.

This experiment consisted of defining a set of rules for the analysis of the credit contract clauses, by identifying clause-specific terms that meet a specific regulatory rule. Then, it processed the credit contract documents and assessed the achieved results by identifying which rules have been fulfilled in the submitted documentation, removing human intervention from the process. On top of the processing tool, some analytics dashboards were built to aid in a global analysis.

The idea was proposed to the Innovation Lab and, after its approval, a proper Innovation initiative was launched. The operating model of this initiative consisted of 4 steps: Plan, Ideate, Execute and Adopt. In the first step, the team defined the utility of the proposed

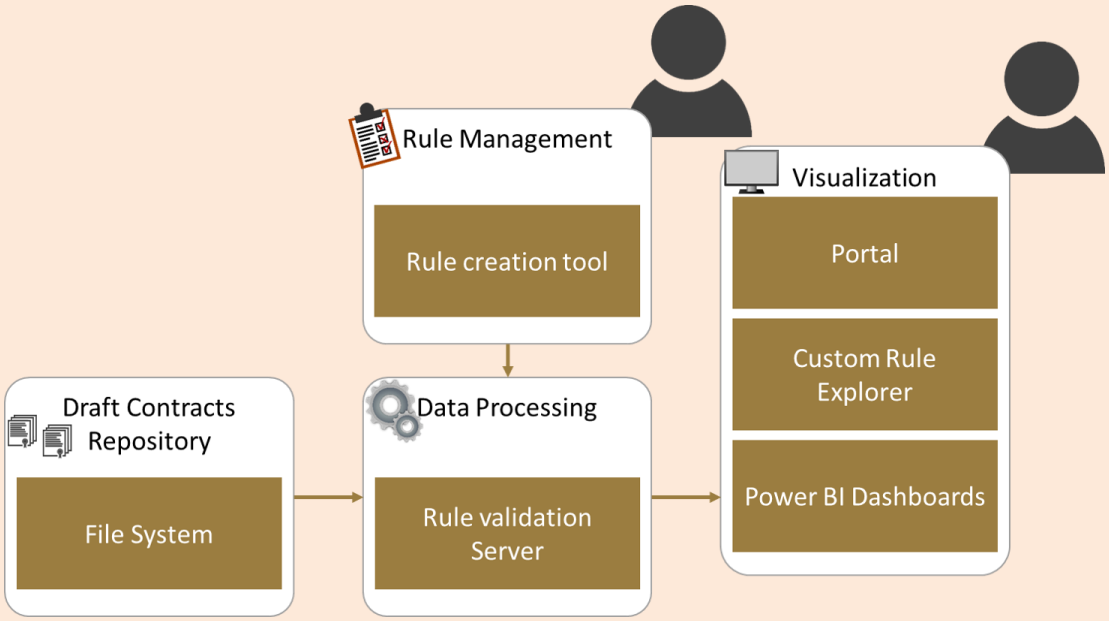
activity, selected the people to involve, identified the necessary resources and agreed on the desired timescale. In the following step, Design Thinking sessions were conducted to provide further clarity on the foreseen benefits of and obstacles to the project. The Design Thinking sessions allowed business users to share ideas quickly and visually, which helped define the overall concept and agree on the goals to be achieved.

Once the goals were agreed upon, the team moved to the execution stage, and a decision was made to initially narrow the scope of the experiment to one credit type, Personal Loan, using a checklist for 20% of the rules. Given the positive results obtained, the initiative was perceived to have strong potential to be integrated throughout the organization's processes, and the adoption stage followed. It was then agreed to explore possible additional usages and to fine-tune the existing method before proposing integration across the bank's ecosystem, which would necessitate additional investment.

As such, once this tool evolves to a production environment, high efficiency gains are expected, mostly due to an acceleration in the analysis of a considerable volume of documents, as well as a reduction of the error margin associated with manual tasks. Further, the human labour needed for low-value tasks will diminish, allowing supervisors more time to consider the information and give critical contributions rather than simply gathering and validating data.

The development of the experiment provided a framework for rule creation, document processing and navigation. A more intuitive navigation web interface was developed and some dashboards were built to allow for extended analytical capabilities. The picture below depicts the components used and developed:

Figure 8. Framework of Banco de Portugal's NLP tool for contract analysis



The application of this tool to the specific task of contract draft analysis poses two main challenges. One is the transposition of regulation, which is textual, into concrete rules the program can acknowledge and apply. The other is how to analyse the fulfilment of said rules, as this documentation is not standardized and there are many possible ways

to comply with the regulation. In this experiment the latter was the main challenge addressed.

Combining NLP with learning models allows business processes to advance from a stage of mere data analysis into advanced patterns discovery in data. When experimenting with NLP with the expectation of building learning models, the data volume is essential, as the more documents available for training, the more accurate the model may be.

Despite the limited set of documents used in this experiment, its great added value was noticeable, as this development allowed for an instantaneous first level validation when credit draft contracts are submitted, which reduces not only the time frame for analysis but also the human effort involved in said validation.

Banco de España is also developing a **SupTech tool on Contract Analysis** based on NLP text mining with a focus on the analysis of consumer credit agreements. The aim of this NLP tool is to identify the presence of specific mandatory clauses that require explicit consent and confirm whether the associated services were actually requested and accepted by the client, by identifying the manual customer signature and hand-ticked checkboxes. Despite manual review still being required with this approach, the proof of concept carried out by Banco de España achieved significant productivity gains by giving an accurate evaluation of the document contents in approximately 70% of the cases and by facilitating document handling and manual validation.

The Australian Securities and Investments Commission (ASIC) introduced an **NLP tool on Advertising** to more easily automate the detection of content in breach of compliance with regulation in advertising materials. Due to the high volume of material, ASIC's mandate of monitoring both compliance with the Australian Consumer Law and adherence to the National Credit Code with respect to advertising is only possible either by targeting a random sample or by following specific consumer complaints.

ASIC has conducted trials to explore the potential to use NLP to improve the scope and efficiency of its monitoring of financial advertising. In 2019, ASIC worked with a third party to develop NLP rules to assess advertisements for non-compliance. In 2020, ASIC conducted a further trial using NLP to identify probabilistically risky advertisements on the internet. While ASIC continues to explore the potential application of NLP in monitoring financial advertisements, ASIC has not yet deployed NLP technology internally for operational use.

Takeaway

Unstructured data analytics: NLP Text Mining	Natural Language Processing (NLP) provides mechanisms to read or hear language and perform tasks such as the identification of relevant topics and summarization of text. With NLP, the continuous and comprehensive supervision of the market is made simpler by automating or accelerating analysis of information contained in non-structured texts. This allows the supervisory authorities, for example, to shift from a manual analysis of sampled information to large volumes of information analysis covering all available data. Reported NLP applications include credit contract validation and monitoring of advertisements.

3.2.2 Unstructured data: NLP Topic Modelling

Topic Modelling is a collection of NLP algorithms that enable the classification of large quantities of documents into a predefined number of topics, thus facilitating the examination, organization and retrieval of information from those large quantities of documents.

The tools based on this technology are used to manage enormous amounts of unstructured information received by different units within the supervisory authority, such as customer complaints, whistleblowing, parliamentary questions, anonymous reports, press articles, documents received from supervised institutions like the Board of Directors and committees of the Board meetings or Minutes of the Executive Committee meetings (Senior Management).

According to survey respondents, the tools using NLP for Topic Modelling can be employed for extracting the main topics from documents for analysis purposes (e.g. identifying and classifying documents with similar characteristics) or intercepting warning signals concerning FSPs by simulating knowledge processes through the execution of algorithms.

The SupTech tools on Topic Modelling reported in the survey are at different stages of development, ranging from a stage of under traditional "waterfall" development, concretely under technical development, to implemented and being used on an ongoing basis.

The authorities using Topic modelling tools classify them as serving the purpose of data collection (structured and unstructured data), data analytics and complaints handling.

Various technologies are employed for these tools. Big Data Frameworks, Advanced Data analytics, Supervised ML – and intelligent automation platforms / frameworks can be employed in the development of these tools.

The challenges associated with NLP Topic Modelling relate to the necessity of periodically re-running the clustering algorithms and possibly retraining the classification models to take into account new phenomena that could potentially emerge over time. In this regard, it could be appropriate to provide specific monitoring features for the models (model monitoring) that allow the quality of the outputs to be kept under control despite the inevitable changes in the inputs.

The following paragraphs include examples of various SupTech tools on NLP Topic Modelling reported by various authorities.

Case study: UK FCA Tool on Natural Language Processing

The UK Financial Conduct Authority (FCA) ingests a large amount of text-based data from the firms it regulates. The number of firms and volume of the datasets received by the organization means that the manual review of the entirety of this unstructured dataset poses significant challenges.

To address this, FCA has created a proof of concept application that allows supervisors to quickly search through documents in bulk by using NLP techniques that facilitate programmatic text based analysis across a much larger dataset than previously possible. These techniques include TFIDF (a measure of the importance of a word in a collection

of documents used to detect relevant keywords automatically), Word2vec (context-sensitive representation of the semantic similarity of terms) and others.

Using this tool to search through multiple documents for sections of relevance is easier and more meaningful for the supervisor by taking context into account. This is achieved by calculating the importance of different sections of text with respect to multiple keywords at a time, suggesting additional keywords that are related in a specific regulatory context.

The tool can be applied to any corpus of regulatory documents that a supervisor wishes to analyse and search through in bulk. The tool allows the user to gain invaluable insight into the text with just the click of a few buttons via an easy-to-use web based interface.

Case study: Banca d'Italia (Bank of Italy) on Topic Modelling

Banca d'Italia (Bank of Italy) is working on a project on an NLP Topic Modelling tool with the objective to promptly intercept warning signals concerning banks and other supervised intermediaries. In a first phase, the focus is on consumer complaints that are received with a large variety of formats, structure and content. The number and complexity of operational processes makes it difficult to connect documents, which are not readily linked to each other, but still pertain to the same issue. The tool (called Esptech) could be useful for investigating anomalies and detecting common phenomena based on the set of information received. The tool is designed to support supervision analysts by giving quicker and easier access to information on private complaints, and by autonomously enhancing available data with machine learning techniques.

The tool is based on the following elements:

1. a flow consisting of three sub-processes, aimed at preparing the information necessary for the analysis phase, consisting of:
    i. data preparation (document extraction, text recognition by an Optical character recognition),
    ii. pre-processing (removing stop words, dictionary matching and correction, stemming) and feature extraction,
    iii. building the network of relationships;
2. a process to train and update the algorithmic model over time, supporting both the sub-processes mentioned and the analysis process;
3. an ICT service that offers six services (feature extraction, clustering, classification, knowledge graph management, network visual analysis, model monitoring) to support analysts.

A part of these techniques is constituted by ML, which concerns the construction of algorithms that can learn from a set of data and make predictions based on these. The result of the learning process is a model able to provide business decisions starting from new input data and, at the same time, improving its performance in a continuous process.

A further kind of technique is represented by Semantic Networks, in which knowledge is represented through a network of semantic relations between concepts. In particular, this representation of information allows users to highlight and analyse with algorithms phenomena otherwise difficult to identify.

The final product is a set of features that potentially describe the phenomenon to be investigated and which must then be appropriately selected (feature selection) manually or automatically by the ML algorithms in the subsequent phases.

An important phase for the construction of the model is the "feature selection" aimed at obtaining a set of significant features. In the context of textual analysis, where information is not available in structured format and expressed in natural language, a preliminary phase of feature extraction is required to extract the variables of interest to be supplied as input to the algorithms. For this operation another class of Artificial Intelligence techniques is applied, which are referred to as Text Mining.

The Autorité des Marchés Financiers (AMF) of Canada has also developed a tool on **NLP Topic Modelling** to extract and organize (by importance) topics addressed in large volumes of data primarily coming from complaints, news and social media.

The AMF capitalized on its SupTech strategy, which allowed it to identify needs and prioritize them. Subject experts collaborated with the appropriate technical experts and with the appropriate FinTech working groups within the AMF. As part of this project, content specialists (analysts) worked closely with data science experts and NLP experts.

Once the model was calibrated, it was possible to identify trends in different types of data and to choose the topics on which the analysts should focus (e.g.: trends in complaints, buzz word in board meeting minutes, emerging risks (key words: cyber, cloud, etc.)]. The approach of using the "bag of words model" was added on top of topic modelling to define subjects more specifically and specify the outputs (create of the equivalent of a "FIND / CTRL+F" function but in a more powerful way).

More recently, the Fintech Lab of the **Autorité des Marchés Financiers of Canada** (**AMF**) has created a database for NLP research that is used for honing the Topic Modelling tools and other uses. More precisely, the AMF sought to find innovative ways to better exploit the multiple documents filed in SEDAR, the official site that provides access to most public securities documents and information filed by issuers.

The AMF's Fintech Lab saw in SEDAR data the raw material that can be used for research in NLP. Therefore, the Fintech Lab worked to extract and align the sentences contained in more than 250,000 pairs of documents in French and in English. The resulting database now includes more than eight million pairs of sentences, which represents about 25% of all the data available for research.

With this initiative, the industry stakeholders gain better translation tools and reduced compliance burden for issuers who need to translate their documents. In turn, Quebec investors can benefit from having the information necessary for their investment decisions in the language of their choice, which is central for the mission of the authority.

Takeaway

Unstructured data analytics: NLP Topic Modelling	NLP Topic Modelling tools can play a significant role in the automation of some market conduct supervisory processes. These tools are especially relevant as they can quickly analyse great amounts of information (such as customer complaints, board of director or executive committee records, among others) to identify patterns and let supervisors analyse potential harmful market conduct practices. The results of the application of these tools should be closely monitored in the future.

3.3 Workflow SupTech tools

Efficiency gains are mentioned among respondents to the survey as one of the most relevant goals for the use of SupTech. The possibility to gain efficiency is particularly possible in the complex workflows with significant workload, which is the case of complaints handling among others.

Respondent authorities frequently have a mandate for complaints handling, and the operation of this function is particularly suitable for automation. Although complaints handling is not specifically a supervisory tool, for those authorities that have such a mandate, complaints handling contributes to the general objective of consumer protection while providing very relevant information on FSP performance for supervisory purposes.

Workflow SupTech tools should be set apart from the data collection and data analysis tools mentioned above, due to their specificities. They are often used to obtain a valuable input for the various conduct supervision areas. Indeed, workflow tools support processes and supervisory activities in an agile way, are able to connect multiple sources of information and manage communication between consumers, supervisor and supervised entities.

The technological evolution and the emergence of SupTech related to complaints handling workflow promotes the optimization of internal practices, as traditional processes are largely based on paper documents. The development of digital channels through which customers present complaints, as opposed to the traditional channels, provides better quality data to the supervisor, which can subsequently be incorporated in the analysis carried out with the tool.

With SupTech, supervisors are able to automate the manual stages of handling customer complaints by using a document and workflow management system, allowing for the visualization and analysis of data.

Some complaints handling tools, such as the one used by Central Bank of Nigeria's Consumer Complaints Management System, provide a platform where supervisors, supervised entities and consumers are able to interact. As a result, claimants are able to access the real-time status of their complaint through the internet, promoting a higher transparency of the process and reassuring claimants on the certainty that their needs are being treated or receiving attention.

Case study: Central Bank of Nigeria's Consumer Complaints Management System

Central Bank of Nigeria's Consumer Complaints Management System (CCMS) is an example of a SupTech tool that has been deployed and is currently used to assist in the

complaints handling workflow. CCMS enables the supervisor to track the complaint from the moment it is uploaded into the system by the FSP and to monitor the complaint's resolution stages, while also allowing the operator to analyse the complaints data. The CCMS also incorporates a Pubic Portal which allows bank customers to escalate complaints that were neither treated nor satisfactorily resolved to the CBN for intervention.

Although CCMS does not automatically analyse complaints, the tool is structured to automate the manual processing stages of complaints handling as to facilitate all the workflow. To do so, CCMS assigns a unique identification number for each complaint, tracks its status and stores all of the complaint data, not only the data provided by the FSP but also the data from the client.

Its web-enabled solution allows complaint submission and interaction among the Central Bank, the FSPs and the consumers, enhancing the transparency of the process among all parties involved.

Despite this tool currently only covering commercial banks, it is expected to be extended to other FSPs within the next few years, promoting the information and knowledge of the Central Bank of Nigeria while also providing high-quality industry-wide complaints data for market conduct supervision.

This tool has some challenges which include low digital literacy and awareness of the solution, limited internet penetration, and absence of multilingual chatbot facilities to enable escalation of complaints by members of the public in the local languages.

Although CCMS has proven results with complaints handling, this SupTech tool may also be applied to other conduct supervision activities, such as off-site surveillance, reporting and analytical reporting, which may result in policy refinements and in an improved supervision activity.

Treating consumer complaints efficiently is also a concern for **Germany Federal Financial Supervisory Authority (BaFin)**, which is working on a project for the optimization of the workflow and the internal process of consumer complaints and, more generally, to carry out supervisory and surveillance work more effectively and efficiently with a new **SupTech Tool on Complaints Handling**. This SupTech tool will improve current processes by achieving more standardization, establishing an automated workflow and strengthening analytical functions.

Moreover, **Banco de Portugal's tool on Customer Complaints (Complaints Management System)** provides an interface with users that allows them to filter complaints by subject and financial service provider, for instance, and supervisory measures by the applicable regulatory framework, thus enhancing supervision in inspection and advertising.

Complaints handling is also a use case for innovative tools such as chatbots. Indeed, **Peru's Superintendency of Banking, Insurance and Private Pension Funds Administrator** has a virtual assistance program, currently in its pilot stage, that interacts with consumers through social media, answering queries or complaints while collecting information that could signal potential areas of concern.

As mentioned above, SupTech technologies are also being used as a way to improve workflow for the various conduct supervision areas, separately from complaints handling.

In particular, the **Central Bank of Brazil** is developing a tool called **Integrated System for Supervision Support and Communication (SisCom)**. In addition to its role in data collection, SisCom facilitates the entire supervisory process by allowing inspectors to carry out remote supervision. This is achieved by automating some interactions with FSPs, either by creating formal letters to assist in the communication or sending information requests directly to the FSP, as well as by supporting the follow-up process of the enforcement measures issued. Further, final supervision reports are automatically generated based on the information in the system. This workflow improvement in the Central Bank of Brazil has proved to increase the consistency and efficiency of the supervision process.

On a similar note, **Banco de Portugal's** process management tool (**Conduct Supervision Process Management**) integrates all stages of the inspection workflow, comprising the planning, on-site and off-site inspection analysis, findings report and following up on the enforcement measures applied to the FSP after the inspection. This tool also supports the registration process of credit intermediaries, including the interactions with the firms.

Last, **Japan FSA** indicates that it is currently working on **Digitalization of Financial Administrative Services**, with the following objectives:

1. Consider the future establishment of a RegTech ecosystem that enables (a) financial institutions to decrease system expenditures and (b) the authority to grasp the actual state of financial institutions in a timely manner; and
2. Offer disclosure information via open API of EDINET (Electronic Disclosure for Investors NETwork).

In sum, several respondents are using workflow SupTech tools as a way to assist in the supervision process, namely in the handling of complaints, communication with the supervised entities and consumers, and in the optimization of internal processes, by moving from the paper-based traditional process to the integration in innovative digital platforms.

Takeaway

Workflow SupTech Tools	Supervisory authorities implement workflow SupTech tools in order to streamline and speed up internal processes. Indeed, supporting supervisory processes with these workflow tools improves overall efficiency and enhances the collection and analysis of structured and unstructured data. Workflow tools can, for example, connect multiple sources of information and manage communication among consumers, supervisor and supervised entities more quickly. Respondents whose mandate includes complaints handling are frequently applying SupTech tools to manage the full complaints handling workflow. The automation of administrative processes or routine tasks like complaints handling and on-site and off-site surveillance are good and frequent examples of the application of SupTech solutions to workflows.

3.4 Development of conduct risk profiles/early warnings

One of the essential tasks for market conduct supervisors is the definition of supervisory priorities in order to determine the supervision planning and future monitoring activities. To establish these priorities, competent authorities frequently use risk profile tools that combine integrated databases and specific methodologies for the creation of a conduct risk

profile/matrix for the supervised FSP. These tools are used to collect data, integrate different sources of information, organize it, rate the conduct risk of each FSP and keep regulated entities profiles up to date. From this perspective, it can be said that these types of tools combine multiple uses of the previously mentioned categories of data collection and data analytics. Nevertheless, this report intends to recognise its specificities as an integrated product with a specific supervisory purpose.

The two main components of the risk profile are the data employed and the technology used to standardize, label, categorize, organize, and process this information. With these two elements, it is possible to produce managerial and statistic outputs.

The sources of data that can be used to feed a risk profile system are vast. Apart from information obtained through regulatory reporting, there are other sources of information available within a supervisory authority like information on complaints handling, data collected through agreements with third parties (e.g. payment chambers, Taxpayers registry), breaches of law and sanctions, information obtained on the compliance culture, internal risk assessments, etc. Availability of data very much depends on the institutional and organizational architecture within the jurisdiction. For example, more data can be frequently obtained on consumer complaints if alternative dispute resolution sits within the supervisory authority.

The second main component of the risk profile is the technology that interacts with and integrates different supervisory systems and treats the data obtained to assist in the integration of processes in a reliable way. This type of tool sometimes automatically pulls information from various sources, enabling data visualization on the SupTech tool screens. The most frequent technologies supporting the SupTech tool are the following: advanced data analytics, data visualization, predictive modelling and automated queries on internal databases to calculate risk indicators periodically.

For the development of these tools, Supervisory Departments are in charge of providing initial specifications related to the indicators, drafting the requirements and testing the tools, while IT teams or external providers are responsible for developing the information systems deployed and provide a proper interface. Moreover, the usage of the market conduct profile tools may require some degree of technological expertise. Therefore, supervisory departments often opt for training their staff and working closely with Information Technology teams to better implement them.

Some supervisory authorities monitor all regulated FSPs under this methodology while other authorities only create risk profiles for certain segments of their financial sector (e.g. entities which engage in activities that include market conduct risk or top entities based on the availability of more granular information). Reports can be made available to supervisory teams for both individual reviews of supervised entities and the planning of periodic inspection work.

There are many challenges that supervisory authorities face when planning, designing and implementing these tools.

One of the main challenges during the planning phase is standardizing the requirements for data coming from different sources and the frequency with which this information from different sources is provided. During the implementation phase, the main challenge is data quality and data standardization. Depending on the institutional architecture in each jurisdiction and different supervisory requirements, some processes might be very complex. Last, the indicators proposed for the calculation of the risk profiles cannot always be implemented due to the lack of available, recurrent and reliable data.

Other difficulties encountered may refer to internal and external database update issues. These difficulties can stem from different frequencies of the updating process or delays in the delivery of data by supervised entities. Such challenges can create distortions in the indicators or complicate outsourcing processes that involve the need to explain the requirements and the strategy to external people involved and risking losing valuable data.

To conclude, all responding authorities using market conduct profile tools have indicated that they plan to add new functionalities and extend the tool's scope to more supervised entities in the near future. Some of these functionalities include: secure portals to collect data automatically from regulated entities; improvements in the communications channels with supervised entities; graphic interfaces showing the chronological evolution of indicators; an appropriate basis of comparison between supervised entities; and the follow-up processes of the inspection enforcement actions. There are also plans to reduce manual inputs, in order to make the process increasingly automated, thus allowing supervisors to track more up-to-date results.

The following authorities reported the development and implementation of SupTech tools related to market risk profiles:

Canada's FCAC has recently introduced, as part of its Supervision Framework, a **Market Conduct Profile tool (MCP),** where numerous enhancements have been introduced in relation to their risk profile determination. They have also created a technology tool to collect, organize and store relevant information about regulated entities.

Indonesia Financial Services Authority (OJK) uses a digital technology-based financial services application called **OJK-Box** or abbreviated as OBOX. This application was introduced as an OJK effort to strengthen supervision of the financial services sector that will begin with an initial trial in banking sector. In the future, on-site examination activities will focus more on confirmation of the results based on data analysis and information generated by the application at the first stage.

In 2018, the **Central Bank of Brazil's** Conduct Supervision Department developed a Priorities Matrix to prioritize supervised entities (and/or financial sectors) for supervisory actions related to the relationship between supervised entities and their clients, in order to provide input for annual supervision planning in the following year. Based on ten indicators drawn from several BCB databases—including client complaints—this matrix provided a comprehensive overview of the behaviour and practices of supervised entities, allowing supervisors to improve the quality and timeliness of risk identification and monitoring.

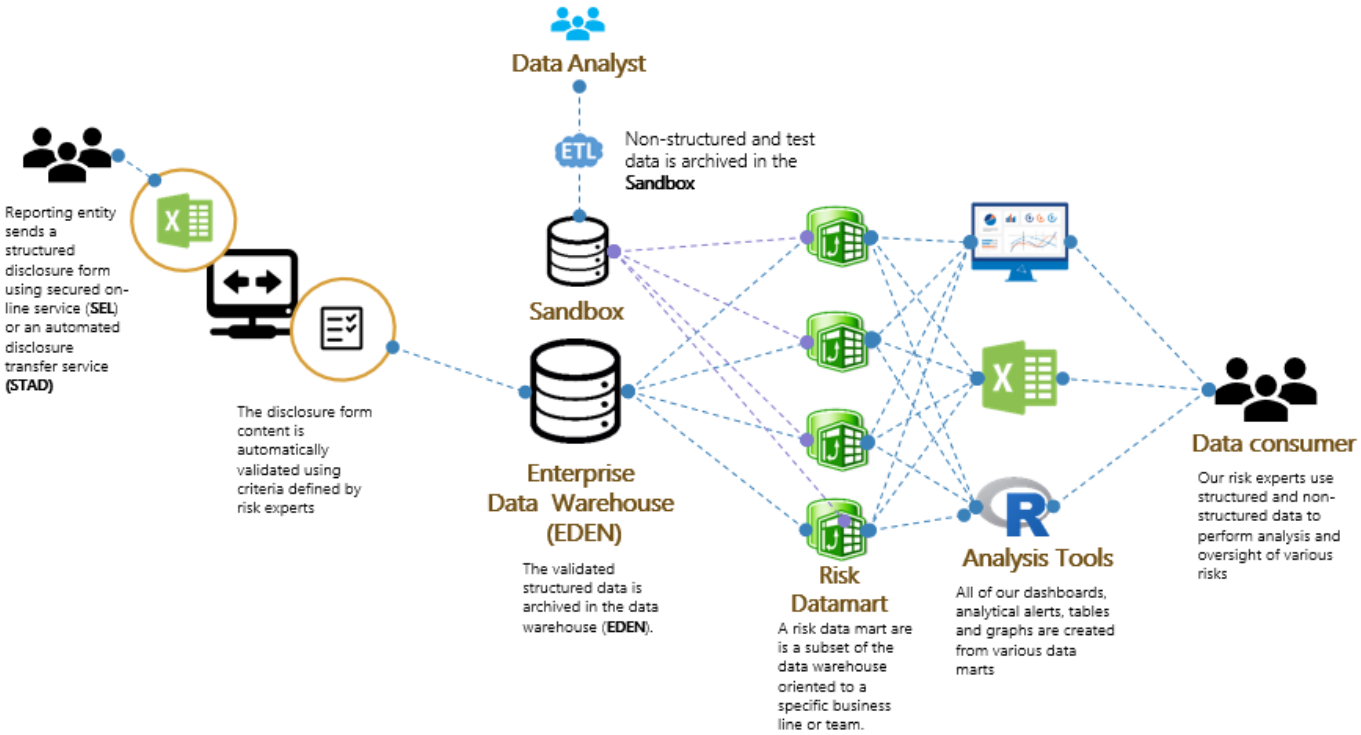
Similarly, between the end of 2019 and the beginning of 2020, a Priorities Matrix was developed for AML/CFT supervision. It will be used this year to provide input for annual supervision planning for 2021. For this purpose, fourteen indicators were developed as proxies for measuring the conduct risks incurred by supervised entities (e.g. proportion of clients of supervised entity that have made high amount of funds transfers, relative to their monthly income).

Canada Québec AMF (Autorité des Marchés Financiers) – Off-site supervision tool. AMF's off-site supervision reporting tool, developed to support its offsite supervision activities, uses a set of risk indicators and warnings. At the AMF, the offsite supervision framework can be divided into three steps:

- Step 1: Analysis of data and information disclosed by financial institutions, with the goal of producing dashboards and monitoring early warning indicators;

- Step 2: Interaction with institutions' technical teams for each risk, to address issues considered in step 1, in issues outstanding in the industry;
- Step 3: Interaction with upper management to ensure effective communication of strategic messages and recommendations.

Figure 9. Data flow for the AMF off-site supervision process



The main component of the off-site supervisory process is data collection and storage. The "risk datamarts" follow a top-down structure, starting from data warehouses and constructing smaller sets of data and are generally modelled based on the star scheme. Each "datamart" must answer a business need (risk, institutions etc.) and the granularity is constantly evolving due to cyclicality and new data. Some of the "datamarts" are currently shared through SharePoint to encourage cross-departmental collaboration.

Takeaway

Development of conduct risk profile/early warnings	Respondent authorities have reported a set of tools that not only use data collection and data analysis but also add value by supporting a typical supervisory need: the development of risk profiles or identification of early warnings. Tools that assess conduct risk profiles are key instruments for monitoring conduct behaviour of supervised financial service providers and detect early warning signals ion the market. Developing automated systems that carry out efficient analysis on large numbers of FSPs in a short time can vastly increase levels of efficiency.

4. Conclusions and takeaways

Market conduct supervisors must continuously adapt to the changing landscape of digitalisation with adequate resources and knowledge. The development and implementation of SupTech tools is changing the way supervisory processes and tasks are being carried out in order to obtain more efficiency and ensure consumers are adequately protected.

By reviewing the most frequent and relevant SupTech experiences among respondents, this report aims to foster the sharing of knowledge and experiences. In conclusion, a quick guide is offered with some takeaways for supervisors' consideration.

Table 2. Key considerations and takeaways

Potential approaches to SupTech	The rapidly evolving technological landscape of financial services provision requires a proactive and resolute approach from supervisors towards the use of digital technology, which can make the supervisory function even more efficient and effective. Although the approach of each supervisory authority will naturally account for individual factors, the following considerations are likely to apply globally:
	• A formal SupTech strategy for the institution may mitigate any implementation obstacles and align efforts with the intuition's strategic objectives. Nevertheless, the existence of a SupTech strategy is not a precondition to develop successful projects. The first stages of SupTech development in each authority are often conducted without a formal institutional strategy and instead with a bottom-up approach that ensures flexibility and learning.
	• In any case, thorough planning is needed before launching SupTech projects, including a clear definition of objectives and expectations, and a clear approach to tackle the most frequent challenges, including:
	  ○ Structural issues (resources and skills needed, involvement of top management and relationship with stakeholders)
	  ○ Data-related problems (quality, availability and representativeness)
	• Every effort to develop SupTech tools should be understood as a continuous learning process, even if the tool has already been implemented. The tool can always be improved and its architecture can be applied to other purposes.

Frequent uses of SupTech for conduct supervision purposes	Most of the SupTech tools reported are designed to collect or analyse data. While more traditional tools frequently process structured data, more innovative solutions increasingly involve unstructured data. Another frequently used category of solutions comprises those focused on workflow automation that intend to improve day-to-day business processes and connect various sources of data and end-users. The most frequent example of this category is complaints handling, among those supervisors with such a mandate. Finally, most authorities access relevant information about supervised entities and their conduct of business through integrated databases for surveillance/supervisory purposes that facilitate ratings and automated warnings.
Structured data: e-reporting	Supervisors obtain vast amounts of information through regulatory reporting, and the treatment of this information is frequently laborious and time-consuming. For these reasons, supervisory authorities are developing SupTech tools intended to reduce or even eliminate routine manual tasks related to report handling and at the same time improve the quality of data by mitigating human error.
Unstructured data: web-scraping and social-media monitoring	Web-scraping and social media monitoring applications are promising SupTech tools in market conduct supervision. The use of machine learning-based systems and applications, specifically text mining applications, opens a broad spectrum of supervisory possibilities. The tools presented in this report are aimed at diverse areas such as the identification of potential violations of applicable advertising guidelines, identifying key issues of concern and interest for consumers or even predicting potential harm to consumers in real-time.
Unstructured data analytics: NLP Text Mining	Natural Language Processing (NLP) provides mechanisms to read or hear language and perform tasks such as the identification of relevant topics and summarization of text. With NLP, the continuous and comprehensive supervision of the market is made simpler by automating or accelerating analysis of information contained in non-structured texts. This allows the supervisory authorities, for example, to shift from a manual analysis of sampled information to large volumes of information analysis covering all available data. Reported NLP applications include credit contract validation and monitoring of advertisements.
Unstructured data analytics: NLP Topic Modelling	NLP Topic Modelling tools can play a significant role in the automation of some market conduct supervisory processes. These tools are especially relevant as they can quickly analyse

	great amounts of information (such as customer complaints, board of director or executive committee records, among others) to identify patterns and let supervisors analyse potential harmful market conduct practices. The results of the application of these tools should be closely monitored in the coming future.
Workflow SupTech Tools	Supervisory authorities implement workflow SupTech tools in order to streamline and speed up internal processes. Indeed, supporting supervisory processes with these workflow tools improves overall efficiency and enhances the collection and analysis of structured and unstructured data. Workflow tools can, for example, connect multiple sources of information and manage communication among consumers, supervisor and supervised entities more quickly. Respondents whose mandate includes complaints handling are frequently applying SupTech tools to manage the full complaints handling workflow. The automation of administrative processes or routine tasks like complaints handling and on-site and off-site surveillance are good and frequent examples of the application of SupTech solutions to workflows.
Development of conduct risk profile/early warnings	Respondent authorities have reported a set of tools that not only use data collection and data analysis, but also help fulfil a typical supervisory need: the development of risk profile or identification of early warnings. Tools that assess conduct risk profiles are key instruments for monitoring conduct behaviour of supervised financial service providers and detect early warning signals ion the market. Developing automated systems that carry out efficient analysis on large numbers of FSPs in a short time can vastly increase levels of efficiency.

Due to the rapid evolution of SupTech initiatives, it will be useful to review this report within a few years to analyse new developments and assess adequately the success of the tools mentioned in this report.

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Appendices

Appendix A: List of responding jurisdictions

Jurisdiction	Respondent authority
Australia	Australian Securities and Investments Commission (ASIC)
Brazil	Central Bank of Brazil (BCB)
Canada	Financial Consumer Agency of Canada (FCAC)
Canada	Autorité des Marchés Financiers (AMF)
Estonia	Finantsinspektsioon
Germany	Federal Financial Supervisory Authority (BaFin)
Greece	Bank of Greece
Hong Kong	Insurance Authority
Indonesia	Indonesia Financial Services Authority (OJK)
Ireland	Central Bank of Ireland (CBI)
Italy	Banca d'Italia - Bank of Italy
Japan	Financial Services Agency (FSA)
Mauritius	Bank of Mauritius
Nigeria	Central Bank of Nigeria
Peru	Superintendency of Banking, Insurance and Private Pension Funds Administrator
Portugal	Banco de Portugal
Russia	The Central Bank of Russia Federation
Slovakia	National Bank of Slovakia
South Africa	Financial Sector Conduct Authority
Spain	Banco de España
United Kingdom	Financial Conduct Authority (FCA)

Appendix B: Questionnaire

FinCoNet Survey *on SupTech*

Introduction

FinCoNet is an international organisation of supervisory authorities responsible for financial consumer protection with a special focus on banking products and services. Its aim is to enhance the protection of consumers and strengthen consumer confidence by promoting effective supervisory standards and best practices, and sharing them among supervisors. It also advocates fair and transparent market conduct and clear disclosure of financial services to consumers.

Background

Building on the findings of the FinCoNet Standing Committee 4 report published in November 2018 on "***Practices and tools required to support risk-based supervision in a digital age***", SC4 will continue to explore tools to support risk based-based supervision by taking an in-depth and focussed look at select innovative SupTech tools. The topic selected for the future SC4 work is "Targeted review: **SupTech tools for Market Conduct Supervisors"**.

According to the 2017 questionnaire that helped inform the development of the 2018 report, about one-third of jurisdictions indicated that they have implemented some form of SupTech application, while others were exploring implementing SupTech applications [the use of artificial intelligence (AI), DLT, cloud computing, big data, etc…].

SupTech definition

SupTech has been frequently defined in the framework of FinCoNet as the application and use of innovative or cutting-edge technology by supervisors to carry out their supervisory and surveillance work more effectively and efficiently (e.g. big data usage, machine learning). On the other hand, the Banking Committee on Banking Supervisors defines SupTech as the use of technologically enabled innovation by supervisory authorities, while for the World Bank "Suptech is used to refer to the use of technology to facilitate and enhance supervisory processes from the perspective of supervisory authorities".

As far as all supervisors use supervisory tools based on technology, it is a question of nuance whether supervisors consider these technical solutions to be SupTech tools. For the purpose of this survey, it obviously remains at the discretion of each respondent whether the tools reported are innovative or cutting edge. Nevertheless, SC4 encourages respondents to share as many SupTech tools as possible – especially if those tools are being used or developed for Market Conduct Supervision, or are somehow applicable for this purpose.

Scope of the Survey

The survey aims to capture information about the following:

- SupTech tools specifically applied to Market Conduct Supervision[4] (mainly for banking and credit products), and also other SupTech tools used for other products' supervision (insurance or investment products) and other supervisory areas (like prudential supervision) that have the potential to be used in Market Conduct Supervision.

- SupTech tools that have already been implemented and SupTech tools that are being considered, planned, developed, or even those that, were planned but have been abandoned for the time being.

- SupTech tools that are designed to be used in any of the phases of the supervisory work, i.e. data collection, data analytics, review of the users' interfaces, complaints handling.

This survey includes some general and qualitative questions, followed by a request to describe in detail specific SupTech tools, providing (where available) links to more technical and detailed information. In a subsequent phase, after analysing the responses, bilateral contacts may be held to clarify or get a deep insight in different aspects of the most relevant tools, if needed.

Purpose of the Survey

The Survey has been developed to collect information from supervisory authorities on new, innovative, and relevant SupTech tools, related practices, resources and processes used in their jurisdiction. The purpose of this research is to produce a short and targeted report for the interest of market conduct supervisors, including general and aggregated data to summarize the current SupTech landscape, with a focus on detailed case studies on the most significant SupTech tools.

Confidentiality issues should be clearly noted by respondent authorities.

Instructions for responding to the Survey

- Please answer each question with reference to your own authority within your jurisdiction – understood as the territory over which the respondent's supervisory authority is exercised.

- The survey questions frequently ask respondents to share case studies from their jurisdiction that highlight the effectiveness (or ineffectiveness) of different approaches. Please provide as much detail as possible, as well as relevant links or documents to complement the information.

- Please include any statistical or numerical information that supports your responses.

- Kindly return the completed survey to sally.day-hanotiaux@oecd.org, Peter.GILLICH@oecd.org by **June 28th 2019**.Should you require any further information or guidance to complete the survey, please contact the FinCoNet Secretariat at sally.day-hanotiaux@oecd.org.

[4] Market Conduct Supervision might be structured differently in different jurisdictions, including areas or activities such as on-site, off-site, surveillance, complaints handling and ombudsman schemes, data reporting, AML, financial education, data privacy, competition, etc.

SECTION 1: GENERAL FRAMEWORK FOR SUPTECH APPLICATIONS

The purpose of this section is to gather general information about how far advanced jurisdictions currently are with the development and use of SupTech tools. This information will help inform to what extent supervisors are leveraging SupTech solutions for Market Conduct Supervision and to assess the level of development of these tools.

Question 1. Does your supervisory authority have a SupTech strategy?

☐ a) Yes

☐ b) No

If "Yes", please briefly describe such strategy and how is it integrated in your organization

If "No", is your supervisory authority considering a SupTech strategy?

☐ c) Yes

☐ d) No

If "Yes", please briefly describe

Question 2. Does your supervisory authority currently use SupTech tools?

☐ a) Yes

☐ b) No

If "Yes", please list and briefly describe each tool, keeping in mind that a detailed description of the most relevant tools is required in section 2

Question 3. Is your supervisory authority currently experimenting with SupTech tools?

☐ a) Yes, we are experimenting with SupTech tools in one or more pilot programs.

Please list and briefly describe each tool, keeping in mind that a detailed description of the most relevant tools is required in section 2

☐ b) We have experimented with SupTech tools but we are not currently exploring their implementation further.

Please list and briefly describe each tool, explaining why the tool is not being explored further.

☐ c) No.

Question 4. Is your supervisory authority in the process of developing/planning SupTech tools?
☐ a) Yes

☐ b) No

If "Yes", please list and briefly describe

Question 5: Please describe the main supervisory needs that your supervisory authority seeks to address through the implementation of SupTech tools.

Question 6: Please describe the main challenges related to the planning, design and implementation of SupTech tools by your supervisory authority? (for example, data standardization, data quality, relevant/appropriate expertise, etc.)

Question 7: Could you please provide a global assessment of your supervisory authority approach to the use of SupTech.

SECTION 2: CASE STUDIES ON SPECIFIC SUPTECH TOOLS

In this section of the survey, please describe up to five of the most relevant SupTech tools currently in use or under development in your jurisdiction, keeping a special focus on those applied to market conduct supervision. Please provide as much detail as possible, following the structure provided hereafter, where possible. Where available, we would also ask respondents to provide links to documents with more detailed information that can be shared.

SupTech tool 1

1. What supervisory need is this SupTech tool designed to address? How did you identify and prioritize the supervisory need?

2. If applicable, what area of activity of conduct supervision is or could be impacted by this SupTech application?
   - ☐ Advertising
   - ☐ Information duties monitoring (pre-contractual)
   - ☐ Inspection
   - ☐ Off-site Surveillance
   - ☐ Reporting
   - ☐ Complaints handling
   - ☐ Other (please specify)

3. Please describe this SupTech tool's main features and how the supervisory authority is currently using, or is planning to use the tool.

4. How is this SupTech tool enhancing (or intended to enhance) the supervisory process?

5. If applicable (for example in case of integrated platforms for enabling data collection), please provide details about the interaction with the supervised entities and the percentage of the market that is covered by this SupTech application.

6. Level of development of the SupTech tool:
   - ☐ Implemented and being used on an ongoing basis.
   - ☐ Limited functionality implemented in production environment, with additional functionalities being added on a semi-continuous base through agile / devops methodologies.

☐ Pilot program implemented

☐ Under traditional "waterfall" development
- ☐ In course of implementation (being tested in pre-production environment)
- ☐ Descriptive manual provided (in course of approval by High Management)
- ☐ In technical development
- ☐ In design phase

☐ Planned
☐ Abandoned for the time being

Please provide any relevant additional detail

7. Technology supporting the SupTech tool:
   - ☐ Big Data Frameworks
   - ☐ Advanced Data analytics
     - ☐ Data lakes / Data Warehouse Infrastructure
     - ☐ Unstructured data analytics
       - ☐ OCR
       - ☐ Text Mining / Natural Language Processing
       - ☐ Image processing / Computer Vision
       - ☐ Speech Recognition
     - ☐ Predictive modeling
     - ☐ Data visualization
     - ☐ Supervised Machine Learning
     - ☐ Unsupervised Machine Learning
     - ☐ Deep Learning AI
   - ☐ Web scraping
   - ☐ Intelligent automation platforms / frameworks
   - ☐ Cloud Computing
   - ☐ Blockchain / Distributed Ledger Technologies
   - ☐ Mobile platforms
   - ☐ Other (please describe)

Please give additional details on technologies used.

8. The SupTech application was/is being developed:
   - ☐ In-house
     - ☐ IT department
     - ☐ Supervisory Departments

☐ In collaboration with external providers
☐ In collaboration with academic community, etc.;

Please describe

9. The IT platform is hosted:
☐ In-house
☐ Outsourced to an external provider;

Please describe

10. SupTech tool classification:
☐ Data collection

☐ Structured data
☐ Unstructured data

☐ Automated regulatory reporting
☐ Consolidation
☐ Validation of data
☐ Virtual assistance to consumers (i.e. chatbots)
☐ Data management and storage
☐ Platform and database integration
☐ Other (please specify)

☐ Data analytics
☐ market surveillance,
☐ real-time supervision/monitoring
☐ misconduct analysis,
☐ Intensive and intrusive supervision,
☐ Other (please specify)

☐ Digitalization of processes and working tools
☐ Complaints handling
☐ Interfaces of digital commercialization (tools to supervise that digital commercialization of banking products fulfils all the regulatory requirements)
☐ Other (please specify)

Please describe

11. Describe any challenges encountered during the development and implementation stage.

12. Please provide an assessment of the outcome and lessons learned.

13. For projects under development, please describe the expected next steps and the expected date for launch.

14. Please attach relevant documents or links where more information can be found.

SupTech tool 2: (Please use the same template as above).

SupTech tool 3: (Please use the same template as above).

SupTech tool 4: (Please use the same template as above).

SupTech tool 5: (Please use the same template as above).

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