



Thematic Review on Technological Challenges to Effective Market Surveillance Issues and Regulatory Tools

FINAL REPORT

The Board of the
International Organization of Securities Commissions

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Chapter 1 – Executive Summary

This Report presents the observations and findings of the thematic review (“Review”) by the International Organization of Securities Commissions (IOSCO) of the recommendations from the 2013 IOSCO Report Technological Challenges to Effective Market Surveillance: Issues and Regulatory Tools (“the Market Surveillance Report” or “TCEMS Report” or “the Report”)¹.

This Review aims to assess the consistency of outcomes arising from the implementation by Market Authorities (“MAs”) of the eight recommendations of the TCEMS Report. 35 responses were received from 34 IOSCO member jurisdictions² who participated in the Review³. The Review examined the legislative, regulatory, and practical measures put in place by participants as of December 2023. A review team representing six IOSCO member jurisdictions and the IOSCO Secretariat (“Review Team” or “RT”) developed and applied a methodology to analyze responses and highlight key findings, as well as issues of concern for each Recommendation.

Chapter 2 of this report presents some background information on the TCEMS Report. Chapter 3 describes the Review process and the Methodology that was used by the Review Team. Chapter 4 describes participating jurisdictions and categorization of market complexity. Chapter 5 sets out the key findings and issues of concern. Lastly, the report is concluded in Chapter 6 with some recommendations.

A summary of the main Key Findings is listed below:

Recommendation 1 – Regulatory Capabilities

“MAs should have the organizational and technical capabilities to monitor effectively the Trading Venues they supervise, including the ability to identify market abuse and activities that may impact the fairness and orderliness of trading on such venues.”

- It was found that most jurisdictions have implemented Recommendation 1.
- 7 issues of concern were identified under this Recommendation:

¹ <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD412.pdf>

² For the purpose of the report, the participating jurisdictions are also referred to as “jurisdictions”, “participants”, or “authorities”.

³ The list of Respondents can be found under Annexure 2.

- Periodic testing and recalibration of automated systems is essential in order to ensure that market surveillance systems remain effective in the face of changing market conditions and trading behavior. 6 jurisdictions reported that they do not have regular testing or recalibration of their automated systems.
- Trading has become more dispersed across multiple trading venues. Automated market surveillance for products traded on multiple venues allows for more effective monitoring. However, 13 jurisdictions do not have automated surveillance of products traded on multiple venues, thus making it more challenging to monitor.
- The inability to analyze order and trade information on an integrated basis across multiple trading venues is an issue of concern. This is crucial for identifying market abuse, which involves manipulating orders, modifications, cancellations, and transactions to deceitfully portray market activity. 6 jurisdictions with multiple trading venues are not able to analyze order and trade information across their venues.
- Being able to monitor or supervise all marketplaces or trading venues is critical, given the growth of trading across various platforms and assets. Not being able to do so is an issue of concern. 5 jurisdictions have reported not monitoring or supervising some marketplaces or trading venues.
- Three jurisdictions reported that they do not have adequate funding and sufficient resources dedicated to market surveillance.
- Being able to identify whether trading conduct (orders or trades) is driven by algorithms is important for the investigation and analysis of improper market conduct. 19 jurisdictions have no formal or legal requirements for the identification of transactions (or orders) based on algorithmic execution.
- 10 MAs reported that there were limitations on their capacity to handle and/or analyze large data volumes generated by high frequency trading (“HFT”).

Recommendation 2: Review of Surveillance Capabilities

“MAs should regularly review and update as appropriate their surveillance capabilities, including systems, tools, and surveillance staff skills, particularly with respect to technological advances”.

- It was found that the most jurisdictions have implemented Recommendation 2, with most of the participants reporting that markets have undergone significant developments in the past 5 years such as cross-market trading, volume and range of products traded, trading methods, and market technology.
- 1 issue of concern was identified under this Recommendation:

- MAs should regularly review their surveillance capability. This is vital to keep pace with market developments and technological advances. 5 jurisdictions do not have either a formal requirement to review surveillance capabilities or an ability to demonstrate that reviews have in fact being conducted effectively.

Recommendation 3: Access to Data

“Within their jurisdiction, the relevant MAs should individually or collectively have the capability to access data in a way that enables them to conduct effectively their surveillance obligations.”

- It was observed that participating jurisdictions have implemented Recommendation 3, and all jurisdictions have legal authority to collect trading data.
- 1 issue of concern was identified under this Recommendation.
 - Jurisdictions with multiple trading venues should have a Central Reporting Point (CRP) or should adopt some alternative measures to allow MAs to surveil cross-asset and cross-market activity. Of the 25 jurisdictions that have not yet adopted a CRP, 15 have not adopted other measures to ease the collection or comparison of trade data across multiple trading venues. This is mainly an issue of concern for those jurisdictions with multiple trading venues.

Recommendation 4: Customer Identification

“MAs (individually or collectively) should have the capability to associate the customer and market participant with each order and transaction.”

- It was concluded that most jurisdictions apply Recommendation 4.
- 1 issue of concern was identified under this Recommendation.
 - MAs should have the ability to identify the customer and market participant with both orders and transactions across multiple markets for effective market surveillance. Having difficulties in linking customers/beneficial owners or market participants with individual orders and transactions is an issue of concern for 4 jurisdictions.

Recommendation 5: Data Format

“MAs should require that data required for market surveillance be reported to the requisite MA for use and storage in a usable format.”

- It was found that most jurisdictions have put Recommendation 5 into practice and have legally enforceable requirements in place regarding data format.
- 1 issue of concern was identified under this Recommendation.
 - Despite having formal requirements regarding data format in place, 5 respondents reported that they encounter practical difficulties in reconstructing and analyzing order books because of difficulties with data

format or quality issues. MAs should consider steps to enforce or improve data standards to reduce this.

Recommendation 6: Data Protection

“MAs should establish and maintain appropriate confidential safeguards to protect surveillance data that is reported to them.”

- It was observed that all jurisdictions apply Recommendation 6 and have taken significant measures to protect market surveillance data reported to MAs.
- No issue of concern was identified under this Recommendation.

Recommendation 7: Synchronization of Business Clocks

“MAs should consider requiring Trading Venues and their participants within their jurisdiction to synchronize, consistent with industry standards, the business clocks they use to record the date and time of any reportable event.”

- It was concluded that, in more-complex markets with multiple trading venues, Recommendation 7 has been implemented in most jurisdictions.
- No issue of concern was identified under this Recommendation.

Recommendation 8: Cross-Border Surveillance Capabilities

“MAs should at a minimum map and be aware of the extent of their cross-border surveillance capabilities. Market Authorities should also work collectively and take any steps that would be appropriate to strengthen their cross-border surveillance capabilities.”

- Most of the participating jurisdictions have not implemented Recommendation 8 and have not mapped their cross-border surveillance capabilities with regards to the interlinkage between domestic markets and those abroad.
- 1 issue of concern was identified under this Recommendation.
 - It is important that MAs ascertain their cross-border surveillance capabilities, especially with respect to interlinkages between domestic and international markets. The failure of most jurisdictions to map their the cross-border surveillance capabilities is an issue of concern, given the risk of trading misconduct from cross-border activities.

Chapter 2 – Background

2.1 IOSCO High Level Recommendations from Final Report on Technological Challenges to Effective Market Surveillance Issues and Regulatory Tools

Rapid technological advances and regulatory developments have fundamentally changed the structure of securities markets, the types of market participants, the trading strategies employed, the technology used, the speed of trading and the array of products traded. Securities trading has become more fragmented among exchanges and other trading venues. Exchanges and trading venues increasingly compete aggressively for order flow by offering innovative order types, new data products and other services, and through fees or rebates. More recent innovations include rapid increases in retail participation in some markets, along with no-fee brokerage services. Automation can increase the risk of illegal or otherwise inappropriate conduct, where market participants have the ability to trade large volumes of numerous products in just fractions of a second. The speed at which trading occurs also affects the ability to monitor markets effectively in the traditional sense.

The 2013 IOSCO Report *Technological Challenges to Effective Market Surveillance: Issues and Regulatory Tools*⁴ provides an overview of market surveillance regimes and identifies the main challenges that technological developments pose to these regimes. It sets out eight recommendations (the “Recommendations”) to help MAs develop the regulatory tools for addressing these challenges, particularly with respect to improving surveillance capabilities on a cross-market and cross-asset basis and making the data collected for surveillance purposes more useful to MAs. The eight recommendations are as follows:

1. Regulatory Capabilities

Market Authorities should have the organizational and technical capabilities to monitor effectively the Trading Venues they supervise, including the ability to identify market abuse and activities that may impact the fairness and orderliness of trading on such venues.

2. Review of Surveillance Capabilities

⁴ The report can be found here: <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD412.pdf>.

Market Authorities should regularly review and update as appropriate their surveillance capabilities, including systems, tools and surveillance staff skills, particularly with respect to technological advances.

3. Access to Data

Within their jurisdiction, the relevant MAs should individually or collectively have the capability to access data in a way that enables them to conduct effectively their surveillance obligations.

4. Customer Identification

MAs (individually or collectively) should have the capability to associate the customer and market participant with each order and transaction.

5. Format

Market Authorities should require that data required for market surveillance be reported to the requisite MA for use and storage in a usable format.

6. Data Protection

Market Authorities should establish and maintain appropriate confidential safeguards to protect surveillance data that is reported to them.

7. Synchronization of Business Clocks

Market Authorities should consider requiring Trading Venues and their participants within their jurisdiction to synchronize, consistent with industry standards, the business clocks they use to record the date and time of any reportable event.

8. Cross-Border Surveillance Capabilities

Market Authorities should at a minimum map and be aware of the extent of their cross-border surveillance capabilities. Market Authorities should also work collectively and take any steps that would be appropriate to strengthen their cross-border surveillance capabilities.

2.2 Scope

This Review focused specifically on how market surveillance functions have adapted in view of the technological challenges highlighted in the Market Surveillance Report. It is neither a review of the specific supervisory technology (“SupTech”) capabilities of the participating Mas, nor a review of the outcomes sought for market supervision and surveillance generally, as set out under Principles 33–37 of the IOSCO Objectives and Principles of Securities Regulation⁵.

⁵ The Principles can be found here: <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD561.pdf>
“Principle 33: The establishment of trading systems including securities exchanges should be subject to regulatory authorization and oversight.”

The Recommendations in the Market Surveillance Report are addressed to MAs. An MA is defined as the statutory regulator, a self-regulatory organization (“SRO”), or the operator of a Trading Venue which is responsible for conducting and/or overseeing market surveillance efforts. This recognizes that, in many jurisdictions, responsibility for market surveillance is divided among these organizations. The Review sought to assess the consistency of outcomes employed to address the technological challenges of market surveillance, regardless of the supervisory arrangements in place in any jurisdiction. As such, each participating jurisdiction was invited to provide a single response on behalf of all MAs in the jurisdiction.

Principle 34: There should be ongoing regulatory supervision of exchanges and trading systems which should aim to ensure that the integrity of trading is maintained through fair and equitable rules that strike an appropriate balance between the demands of different market participants.

Principle 35: Regulation should promote transparency of trading.

Principle 36: Regulation should be designed to detect and deter manipulation and other unfair trading practices.

Principle 37: Regulation should aim to ensure the proper management of large exposures, default risk and market disruption.”

Chapter 3 – Objectives, Methodology, and Review Team

3.1 Nature of the Review and Objectives

This Review focuses on the consistency of outcomes achieved by MAs in the implementation of the recommendations of the Market Surveillance Report across the group of participating MAs as a whole, rather than on each individual MA's specific implementation outcomes.

Participating jurisdictions are not formally rated on their implementation. Rather, the report highlights issues of concern across jurisdictions, meaning identified gaps or shortcomings affecting the overall consistency of implementation, relative to the outcomes sought by the TCEMS Report. No serious issues of concern (i.e. issues of concern requiring urgent remediation) were identified in the course of the Review.

The findings in this Review are based on the IOSCO Assessment Committee's ("AC") analysis of the self-assessments submitted by the participating jurisdictions. Where necessary, the AC, through its Review Team ("RT") contacted respondents to clarify and/or verify the information submitted through the questionnaire. However, the RT did not seek to independently verify all information provided by participating jurisdictions.

3.2 Review Team

The Review was conducted by the AC, which set up a RT consisting of experts. The RT was led by Mr. Liam Mason (Financial Markets Authority, New Zealand) and included the following members: Mr. Leonardo Alcantara Moreira (Comissão de Valores Mobiliários Brazil), Mr. Nitesh Bhati (Securities and Exchange Board of India), Ms. Simona Serio (Commissione Nazionale per le Società e la Borsa Italy), Mr. José Vicente (Comisión Nacional del Mercado De Valores Spain), Mr. Jürg Tschirren and Mr. Rico von Allmen (Swiss Financial Market Supervisory Authority), with the IOSCO Secretariat's support (Ms. Raluca Tircoci Craciun, Mr. Josafat De Luna Martinez, Ms. Hemla Deenanath, and Ms. Jantakarn Pangutha).

3.3 Review Process

The Review was a desk-based exercise, which included the review of 35 responses from IOSCO members to the questionnaire developed by the RT. The questionnaire was circulated in July 2023 with responses due in September 2023.

The Assessment Methodology and Questionnaire used by the RT and circulated to the participating jurisdictions for self-assessment purposes are attached at Annexure 1.

Respondents were also asked to provide background information about their securities and derivatives markets, their regulatory structure for market surveillance, as well as a description of practices relevant to each recommendation. Relevant market statistics are set out in Annexure 3 of this report.

Chapter 4 – Participating Jurisdictions

All IOSCO members were invited to participate in the Review. Following a call for expressions of interest to participate in the review, 35 responses were received from 34 jurisdictions. A detailed list of respondents can be found at Annexure 2.

The geographical spread of the participants is distributed as follows for each of the IOSCO Regional Committees:

Region	Number of jurisdictions
Africa and Middle East Regional Committee (AMERC) ⁶	7
Asia- Pacific Regional Committee (APRC) ⁷	5
European Regional Committee (ERC) ⁸	13
Inter-American Regional Committee (IARC) ⁹	9
Total number of jurisdictions	34

Market Complexity

As previously mentioned, the assessment was focused on the consistency of outcomes pertaining to the eight recommendations specified in the Market Surveillance Report. The Market Surveillance Report noted several technological advances and regulatory developments that had produced fundamental changes in the structure of securities markets, the types of market participants, the trading strategies employed, the speed of trading, and the array of products traded. These changes posed challenges to effective market surveillance.

⁶ AMERC jurisdictions: Angola, Egypt, Jordan, Kenya, Malawi, Saudi Arabia, South Africa.

⁷ APRC jurisdictions: Hong Kong, India, New Zealand, Singapore, Thailand.

⁸ ERC jurisdictions: Bulgaria, Croatia, France, Germany, Israel, Italy, Liechtenstein, Montenegro, The Netherlands, Spain, Switzerland, Türkiye, United Kingdom (UK).

⁹ IARC jurisdictions: Argentina, Bahamas, Brazil, Canada, Chile, Ecuador, Mexico, Peru, United States of America (USA).

Relevance of Market Complexity to Issues of Concern

In assessing the consistency of outcomes of implementation of the Recommendations, the RT recognized that some markets have, to date, been less affected by these advances and changes than others. In other words, “more complex markets” (i.e., very large markets, markets with multiple trading venues and a broad range of traded instruments, and markets with complex cross-border surveillance needs) have been more affected by these technological advances and changes than less-complex markets.

For these less-complex markets it may not be an issue of concern at this stage in their development if they have not adopted measures consistent with those in more complex markets. This is consistent with the observation in the Market Surveillance report that the ability to supervise and conduct effective surveillance also depends on the structure of a market.

In the opinion of the RT the technological challenges associated with market surveillance correlated more closely with characteristics of market complexity than with whether a jurisdiction is designated as a Growth and Emerging market, or a “developed” jurisdiction. As such, some observations and findings in this report (specifically, those relating to Recommendation 1) note issues that are relevant to more complex markets.

In this context, jurisdictions with large capital market size or those in the European Union (EU) or European Economic Area (EEA) were categorized as “more-complex” markets. Jurisdictions with smaller capital market size and simpler market arrangements were categorized as less-complex markets.

- “More-Complex” markets included 24 jurisdictions¹⁰;
- “Less-Complex” markets included 10 jurisdictions¹¹.

Market information and statistics on the 34 jurisdictions can be found at Annexure 3.

¹⁰ Argentina, Brazil, Bulgaria, Canada, Chile, Croatia, France, Germany, Hong Kong, India, Israel, Italy, Liechtenstein, Mexico, Saudi Arabia, Singapore, South Africa, Spain, Switzerland, Thailand, The Netherlands, Türkiye, UK, USA.

¹¹ Angola, Bahamas, Ecuador, Egypt, Jordan, Kenya, Malawi, Montenegro, New Zealand, and Peru.

Chapter 5 – Key Findings

Recommendation 1: Regulatory Capabilities

Recommendation 1: MAs should have the organizational and technical capabilities to monitor effectively the Trading Venues they supervise, including the ability to identify market abuse and activities that may impact the fairness and orderliness of trading on such venues.

The Market Surveillance Report notes that the starting point for effective surveillance is a strong legal mandate and regulatory structure to support the surveillance of the market and its participants.

The Market Surveillance Report identifies two principal goals of market surveillance:

1. to seek to ensure that trading in a market is fair and orderly; and
2. to have the ability to detect market abuse.

Recognizing that the surveillance needs of each jurisdiction will depend in part on the structure and complexity of the market, the Report mentions that MAs, and in particular Statutory Regulators, need to assess whether they have the regulatory, organizational and technical capabilities to perform an effective surveillance function in view of their market structure. However, the ability of any MA to develop the capabilities to conduct effective surveillance is partially dependent on the resources available to the MA.

Each jurisdiction needs to have the ability to supervise its markets effectively depending on its legal framework as well as the structure of the market. Further, for market surveillance purposes, it is important that the MA has access to all the relevant data from all market participants, trading venues as well as from other MAs and that the data should be standardized as much as possible. Effective surveillance also requires the ability to reconstruct and analyze order books.

Key observation regarding practices

Automated surveillance systems

Given the challenges to market surveillance set out in the TCMS Report, the RT asked participating jurisdictions whether they operated an automated surveillance system capable of generating automated alerts. This is regarded as an essential tool to allow MAs to ensure that trading is fair and orderly, and to intervene where this appears not to be the case. The Market Surveillance Report suggested that

MAAs should utilize various tools to conduct market surveillance, including the use of automated systems¹².

The great majority of jurisdictions responded that they have an automated surveillance system in place that is capable either of real-time surveillance, surveillance on a T+1 basis, or surveillance on a longer historical basis. 24¹³ of the 34 participating jurisdictions reported that they have systems capable of real-time (or fractional delay) market surveillance.

The 4 jurisdictions¹⁴ that have no automated surveillance system at all are among the less-complex financial markets. These markets have low trading activities (low trading volumes, few transactions, products, issuers, and market participants) and market surveillance may be able to be conducted manually at this stage. Jurisdictions that do not have capability for automated trading surveillance should periodically review whether developments in their market structure require this to be adopted.

For the purpose of market surveillance in a broader sense and to ensure that trading is fair and orderly, real-time surveillance is expected to provide an MA with sufficient information upon which it can act to halt an identified problem in a timely fashion, and to provide the information necessary for an MA to understand within a reasonable time the underlying causes of a material market disruption¹⁵. Jurisdictions that lack this capability should consider adopting it.

Systems used by MAs (for real-time and post-trade) surveillance

The RT observed that well-established off-the-shelf surveillance solutions are employed by many MAs for both real-time and post-trade surveillance. However, there is a trend for these systems to be supplemented, or in some cases replaced, by self-developed systems, developed either in-house or externally (on behalf of the MA). Less-complex jurisdictions are more likely to use in-house developed systems or to rely on the systems employed by the trading venues.

Testing and recalibration of automated systems

¹² Page 10 of the report: <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD412.pdf>.

¹³ Argentina, Brazil, Canada, Chile, Egypt, France, Germany, Hong Kong, India, Israel, Italy, Jordan, Kenya, Malawi, Mexico, New Zealand, Saudi Arabia, Singapore, South Africa, Spain, Thailand, The Netherlands, Türkiye, USA.

¹⁴ Angola, Bulgaria, Malawi, Montenegro.

¹⁵ Page 2f, 8, and 27 of the report: <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD412.pdf>.

To ensure an adequate and effective automated surveillance system¹⁶, testing and recalibration is necessary, for example to reduce false positives¹⁷. The RT asked participating jurisdictions to provide information on their testing and recalibration of surveillance systems. Most jurisdictions with an automated surveillance system confirmed that they perform tests and recalibrations on a regular basis with different levels of automation and with a certain degree of manual interaction depending on their system(s).

This testing and recalibration are, for the most part, carried out on a regular basis, sometimes in coordination with third party service providers and/or trading venues, depending on the supervisory structure and on the implemented system.

Issue of concern:

Periodic testing and recalibration of automated systems is essential in order to ensure that market surveillance systems remain effective in the face of changing market conditions and trading behavior. Argentina, Bahamas, Chile, Croatia, Ecuador, and Jordan reported that they do not have regular testing or recalibration of their automated systems.

An absence of regular testing and recalibration of automated systems is an issue of concern that should be addressed by these jurisdictions.

Automated Market Surveillance challenges for multiple venues or across asset classes

The automated surveillance of products listed or traded on multiple venues still poses a challenge to 12 participating jurisdictions¹⁸. In these jurisdictions, although with multiple trading venues, automated surveillance of products traded on multiple venues is not yet possible. This is considered an issue of concern because trading has become more dispersed across multiple trading venues, making it more difficult to monitor¹⁹. Therefore, having an automated market surveillance system for products traded on multiple venues would allow more efficiency in monitoring.

While some of the jurisdictions concerned have markets that are less complex, the issue persists in many more-complex jurisdictions. In some cases, there is surveillance across venues, but not in an automated manner. Furthermore, it can

¹⁶ Either implementation of the system including alerts etc., or for adjustments, e.g. caused by changed market conditions.

¹⁷ Page 10 of the report: <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD412.pdf>.

¹⁸ Jurisdictions with multiple trading venues but no automated cross trading venue surveillance: Bahamas, Bulgaria, Croatia, Ecuador, Italy, Jordan, Liechtenstein, Peru, Singapore, South Africa, Switzerland, Thailand.

¹⁹ Page 2 and 32 of the report: <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD412.pdf>.

be noted that some of these markets have one dominant trading venue, and the issue is therefore less significant²⁰Cross-asset surveillance seems to be less of a challenge. Only a small number of participating jurisdictions²¹, mainly less-complex markets, have multiple asset classes but no automated cross asset surveillance (refer to Annexure 3).

Cross-asset surveillance is highlighted in the Market Surveillance report as necessary for any jurisdiction that has trading across asset classes, as some market abuse scenarios cannot be detected without cross-asset surveillance²².

Six participating jurisdictions reported that they are not able to analyze order and trade information on an integrated basis across their multiple venues. An ability to consider both order and trade information together for an accurate reconstruction of market behavior is essential to detect market abuse techniques that use orders, modifications and cancellations, as well as executions. It is an issue of concern that this capability is missing in 30% of participating jurisdictions.

Issues of concern:

Trading has become more dispersed across multiple trading venues. Having automated market surveillance for products traded on multiple venues allows more effective monitoring. Not having this capability is an issue of concern.

The Bahamas, Bulgaria, Croatia, Ecuador, Israel, Italy, Jordan, Liechtenstein, Peru, Singapore, South Africa, Switzerland, and Thailand do not have automated surveillance of products traded on multiple venues, thus making it more challenging to monitor. Out of these 13 jurisdictions, 9 are more-complex markets.

An inability to analyze order and trade information on an integrated basis across multiple venues is an issue of concern. This is crucial for identifying market abuse, which involves manipulating orders, modifications, cancellations, and transactions to deceitfully portray market activity.

Argentina, Bulgaria, Croatia, Ecuador, Jordan, and Peru do not have the ability to analyze order as well as trade information across their multiple trading venues.

²⁰ For example, Italy, where one of the three trading venues is dominant. Also, for Chile, the cross-border and derivative exposures in Chile represent less than 0.1% of the overall secondary market

²¹ Angola, Bahamas, Bulgaria, Chile, Croatia, Ecuador, Egypt, Jordan, Kenya, Montenegro, Peru

²² E.g. market manipulation combining products of different asset classes respectively underlying and derivatives.

Additional supervisory or surveillance activities used to monitor market activity

Technologies that have arisen, or been widely adopted, since the publication of the TCEMS Report pose additional challenges to today's market surveillance. These more recent developments include the use of social media (by firms and individuals) to disseminate information and the advent of "social trading" – online trading where (usually retail) traders connect and share information, strategies, and insights. This has the potential to benefit markets by increasing retail participation but can also pose risks of market abuse.

Participating jurisdictions were asked to provide details of supervisory and surveillance actions that are taken, in addition to automated market surveillance, and were asked specifically about their monitoring of social media. The Review found that most jurisdictions²³ have established either manual or a partially automated monitoring of social media and digital platforms.

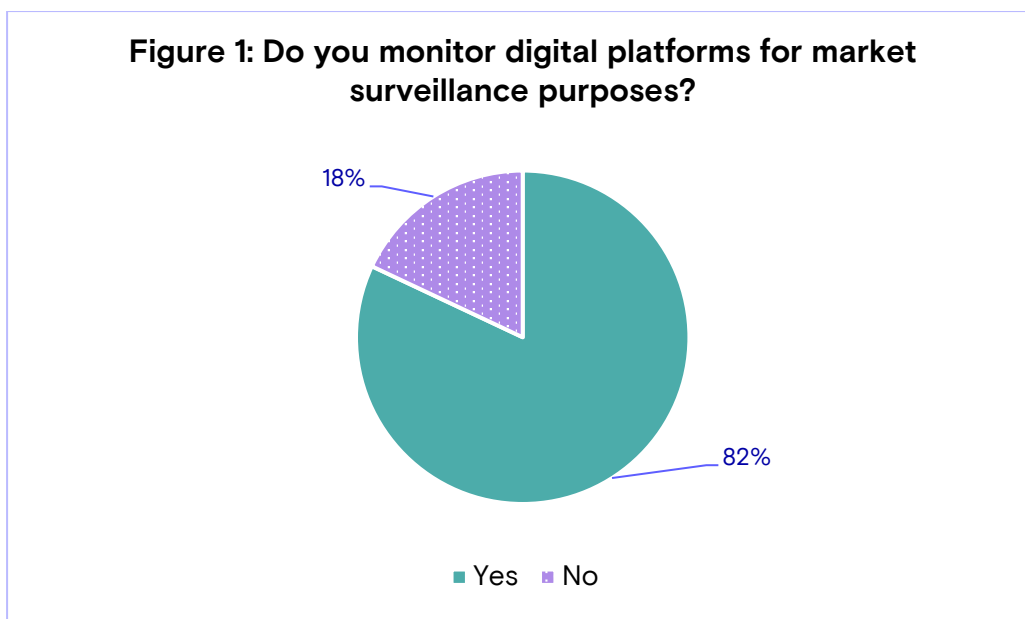
A few jurisdictions reported that their monitoring of social media is already fully²⁴ or partially automated²⁵. Other jurisdictions are using additional tools and/or are obtaining analytical data from internet sources such as social media. Some jurisdictions also highlight legal obstacles faced by regulators to have adequate supervisory powers with regard to social media (e.g. usage of web scraping techniques).

It is encouraging to see that the majority of MAs are actively monitoring social media for the purpose of market surveillance, though most also reported that investigations are still more likely to be initiated from suspicious market activity or reports from market participants. It is likely that the jurisdictions' efforts in this area may need to increase further.

²³ Angola, Argentina, Brazil, Canada, Chile, Croatia, Egypt, France, Germany, Hong Kong, India, Israel, Italy, Jordan, Kenya, Liechtenstein, Malawi, New Zealand, Peru, Saudi Arabia, Singapore, South Africa, Spain, Switzerland, Thailand, The Netherlands, Türkiye, UK, USA.

²⁴ India and Israel.

²⁵ Egypt, Malawi, France, Liechtenstein, South Africa, Switzerland, Thailand, Türkiye, UK, USA.



Supervision Gaps

Nearly one-third of participating jurisdictions²⁶ identified regulatory impediments to carrying out market surveillance.

Most jurisdictions identified missing data²⁷ as an impediment to effective market surveillance. This includes missing information regarding the ultimate customer²⁸, directors and senior managers²⁹, lack of data from participants³⁰, and a lack of data from foreign jurisdictions³¹.

Additionally, 5 participating jurisdictions³² stated that there are trading venues or marketplaces within their jurisdictions such as OTC, bonds, or structured products markets, which should be but are currently not monitored or supervised. Other jurisdictions mentioned that crypto markets are partially or not yet supervised, and crypto assets and cryptocurrencies are not subject to reporting requirements. In light of the increasing prevalence of cross-venue, cross-asset trading, and cross-jurisdictional trading, potentially including cryptocurrency markets, the RT considers this shortcoming an issue of concern that should be addressed.³³

²⁶ France, Germany, Israel, Jordan, Malawi, New Zealand, Spain, Switzerland, Thailand, The Netherlands, Türkiye, UK, US CFTC.

²⁷ E.g. for cross-product and cross-market surveillance.

²⁸ Partially Germany and Jordan.

²⁹ New Zealand.

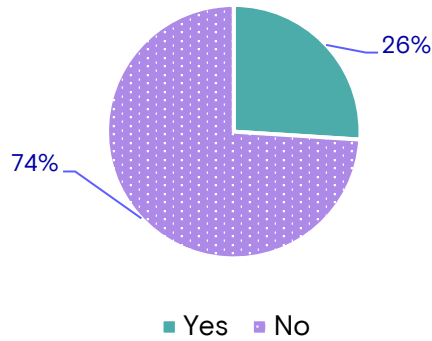
³⁰ Malawi.

³¹ France, The Netherlands.

³² Argentina, Ecuador, Kenya, Malawi, South Africa.

³³ Page 29 and 32 of the report: <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD412.pdf>

Figure 2: Are there relevant Trading Venues or market places (trading OTC, DLT, bonds, or structured products markets, etc.) currently not monitored or supervised, but should be?



Issue of concern:

Being able to monitor or supervise all marketplaces or trading venues is critical, given the growth of trading across various platforms and assets, including cryptocurrency markets. Not being able to do so is an issue of concern.

Argentina, Ecuador, Kenya, Malawi, and South Africa have reported not monitoring or supervising some marketplaces or trading venues, with 4 of these jurisdictions being more-complex markets.

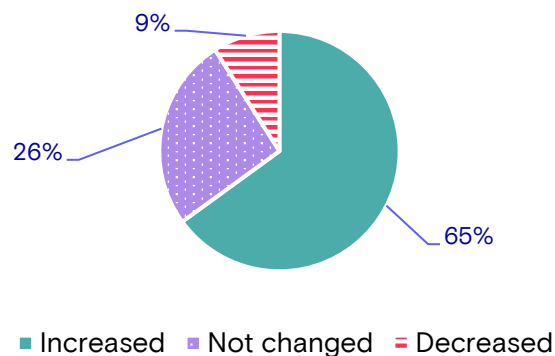
Resources

23 jurisdictions³⁴ responded that funding for market surveillance activities has mostly increased within the past 5 years. 3 jurisdictions³⁵ reported that funding has decreased over the past 5 years, while for the remainder funding has not changed.

³⁴ Bahamas, Brazil, Canada, Egypt, Germany, Hong Kong, India, Israel, Italy, Jordan, Liechtenstein, Malawi, Mexico, New Zealand, Saudi Arabia, South Africa, Spain, Switzerland, Thailand, The Netherlands, Türkiye, UK, USA.

³⁵ Chile, Ecuador, France.

Figure 3: Has funding for market surveillance activities by MAs increased, decreased, or remained static over the past 5 years?



Beyond trends in funding, the RT asked jurisdictions to assess whether they have sufficient resources dedicated to market surveillance. 8 jurisdictions³⁶ (about half of which are less-complex markets) responded that they do not have sufficient resources to enable them to conduct effective market surveillance. Some MAs reported difficulty in obtaining resources for market surveillance as it is not a revenue generating function.

Even jurisdictions that consider they have sufficient resourcing at present have noted the challenges to recruiting and retaining the professional resources needed for market surveillance, especially in the face of demand from private sector firms³⁷.

Sufficient funding and resources are highlighted in the Market Surveillance report as an explicit requirement for effective market surveillance³⁸. It is therefore an issue of concern that around 25% of participating jurisdictions report having insufficient resources for market surveillance.

Issue of concern:

Having appropriate funding and sufficient resources dedicated to market surveillance is essential for MAs.

³⁶ Angola, Argentina, Bulgaria (From June 2024, FSC acquired positive development in the required financial and human resources, which to enable FSC to conduct effective market surveillance), Chile, Ecuador, Jordan, Kenya, Malawi.

³⁷ Spain.

³⁸ Page 29 and 32 of the report: <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD412.pdf>

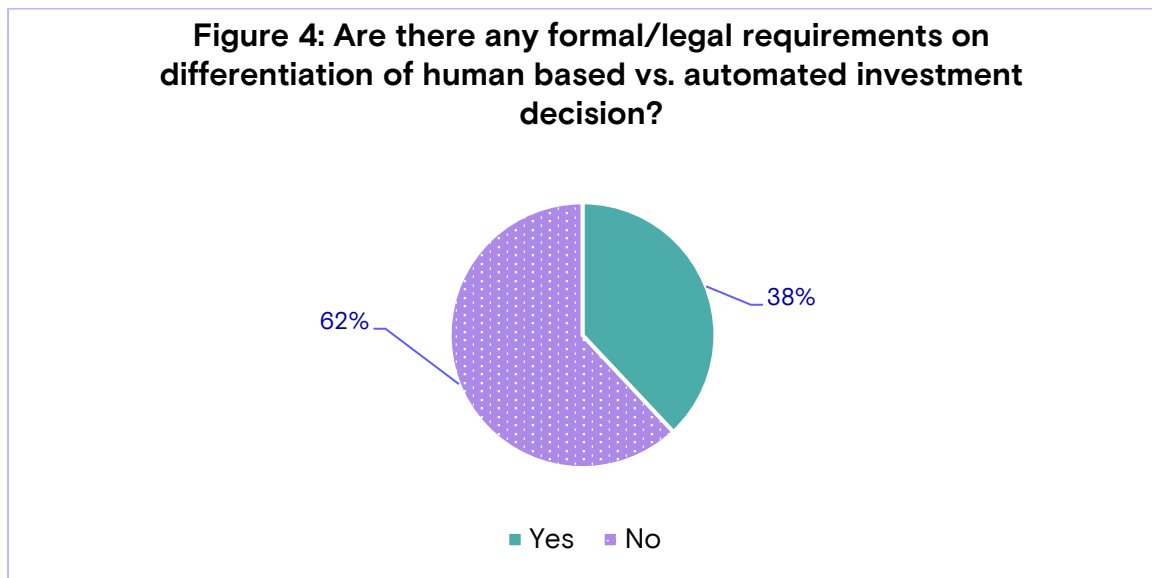
It was noted that Chile and Ecuador do not have adequate funding and resources³⁹. This is an issue of concern.

Algorithmic, artificial intelligence (“AI”) and High Frequency Trading (“HFT”)

The automation of trading, driven by algorithmic trading strategies, and the adoption of HFT could potentially increase the risks posed to markets by illegal or otherwise inappropriate conduct, because market participants have the ability to trade numerous products and enormous volume in fractions of a second⁴⁰.

Knowing whether trading conduct (orders or trades) is driven by algorithm is considered important for the investigation and analysis of improper market conduct.

Nonetheless, 19 of responding jurisdictions⁴¹ have no formal or legal requirements for the identification of transactions (or orders) based on algorithmic execution⁴². However, 10 of these are jurisdictions with less-complex markets.



An inability to differentiate between human and computer-driven trading, whether through formal requirement or through surveillance systems, potentially impedes the oversight of algorithm operations and is an issue of concern.

³⁹ France has specified that it is a challenge for market regulators to maintain up-to-date surveillance systems in light of market developments.

⁴⁰ Page 2 of the report: <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD412.pdf>.

⁴¹ Angola, Argentina, Bahamas, Brazil, Bulgaria, Chile, Ecuador, Egypt, Hong Kong, Jordan, Kenya, Malawi, Mexico, Montenegro, New Zealand, Peru, Singapore, South Africa, Türkiye.

⁴² Angola, Argentina, Bahamas, Brazil, Bulgaria, Chile, Ecuador, Egypt, Hong Kong, Jordan, Kenya, Malawi, Mexico, Montenegro, New Zealand, Peru, Singapore, South Africa, Türkiye.

Some jurisdictions have introduced formal requirements for identification of algorithmic-driven activity, and small number have developed detection mechanisms in their surveillance systems to identify trading patterns associated with algorithm-driven trading. Some jurisdictions require algorithms to be registered, and in a few cases to be certified or approved prior to use, while other jurisdictions (notably, EU jurisdictions) require a notification where algorithmic trading is used.

Issue of concern:

Being able to identify whether trading conduct (orders or trades) is driven by algorithms is important for the investigation and analysis of improper market conduct.

Nonetheless, 19 of the responding jurisdictions have no formal or legal requirements for the identification of transactions (or orders) based on algorithmic execution. However, 10 of these are jurisdictions with less-complex markets.

Extended set of alerts for HFT

Participating jurisdictions generally reported that alerts are designed in a technology-agnostic way, capturing specific behavior or results from order placements and events regardless of their origin (algorithmic or human direction).

Most jurisdictions' surveillance systems have therefore not designed specific alerts for HFT. MAs should ensure that their surveillance systems are capable of detecting market abuse in all environments, including HFT. This can be done through specific alerts (e.g. targeting HFT) or other mechanisms that address potential abuses emerging from HFT. A few jurisdictions are already doing this. For example, FINRA and AMF France have surveillance patterns in place that are designed to detect various types of conduct, some of which is inherently automated, high-frequency, and low-latency.

Access to information about algorithms

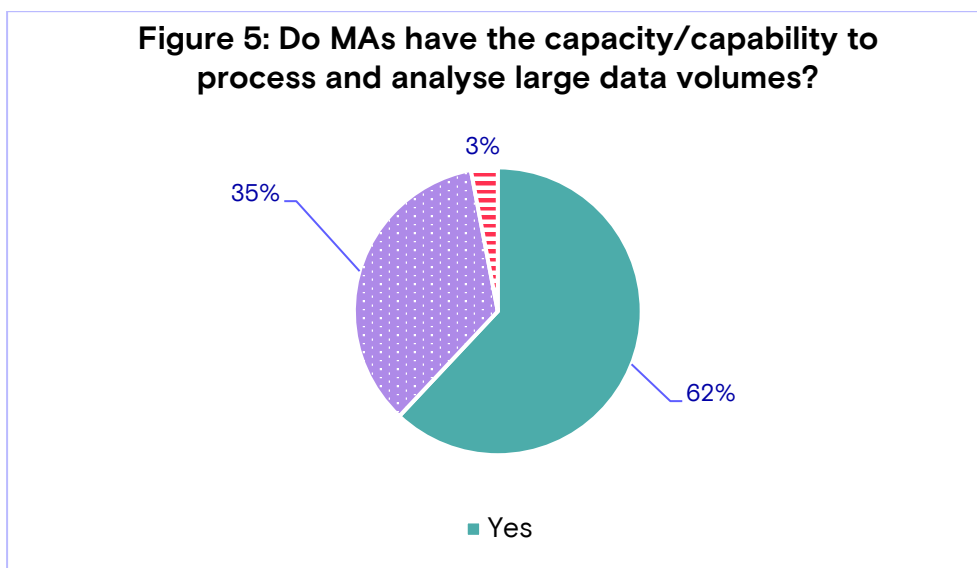
About a third of participating jurisdictions require firms to provide information about the functioning of algorithms on a routine basis. The remaining two-thirds obtain this information on a case-by-case basis.

Around 25% of participating jurisdictions have requirements for the oversight of algorithm performance, either by direct supervision by MAs or through audit and validation requirements on firms. For example, EU investment firms using algo-trading must perform an annual self-assessment and produce a validation report.

Capabilities regarding HFT (data volumes)

As the volume of HFT increases, MAs' capacity to handle the data produced by market surveillance poses a further challenge to effectiveness. Therefore, the RT asked jurisdictions to report on their capacity to consume and process the data produced by HFT. It is an issue of concern that 10 jurisdictions⁴³ responded that they do not currently have the capacity to process and/or analyze large data volumes produced by HFT, with a further 33% of the participating jurisdictions reporting that there are current limits to their capacity. Observations from participants demonstrate that whether capacity issues are immediate, or near-term, limits are often linked to whether MAs have adopted cloud storage solutions for surveillance data.

This current deficiency in data capacity is an issue of concern for these jurisdictions. 7 of 10 jurisdictions are less-complex markets, which may not have HFT in some of these markets. However, initiatives including having infrastructure to store and manage data, as well as having necessary tools and expertise, could also be considered.



Issue of concern:

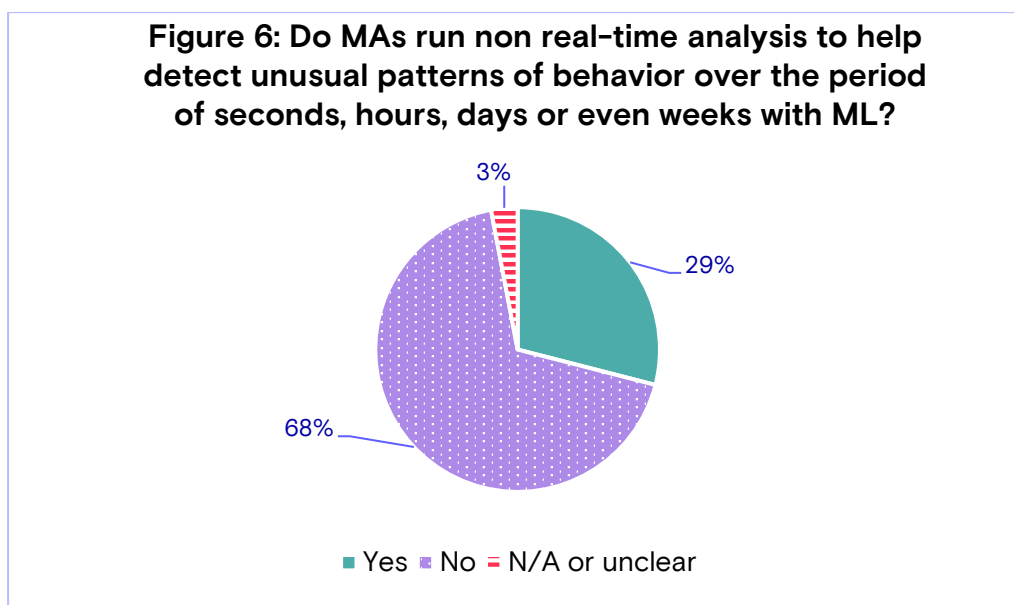
The MAs' capacity to handle the data produced by market surveillance should be sufficient for the data volume of HFT.

Therefore, having limits or inability to handle and/or analyze large data volume generated by HFT, and having inadequate data storage are issues of concern for Angola, Argentina, Bulgaria, Ecuador, Egypt, Jordan, Kenya, Malawi, Mexico, Montenegro.

⁴³ Angola, Argentina, Bulgaria, Ecuador, Egypt, Jordan, Kenya, Malawi, Mexico, Montenegro.

Use of Machine-learning (“ML”) tools by MAs

At present, 29% of participating jurisdictions have themselves adopted or developed ML-enhanced tools for trading and order pattern analysis. A small number of jurisdictions have developed ML tools for the analysis of specific trading strategies. For example, the UK FCA is currently developing AI tools to help detect market abuse. We expect these trends to continue to increase over time.



Recommendation 2: Review of Surveillance Capabilities

MAs should regularly review and update as appropriate their surveillance capabilities, including systems, tools, and surveillance staff skills, particularly with respect to technological advances.

The Market Surveillance Report was occasioned by concerns about the challenges to market analysis and surveillance posed by rapid technological and market developments. Against this backdrop, it was considered important to include a recommendation that MAs take specific steps to ensure that their market surveillance capabilities keep pace with market developments by regularly reviewing and updating these.

The Report noted that surveillance programs are developed by MAs considering the structure of the market and the legal system that underpins it. Both markets and legal frameworks change over time and regular review was seen as key in markets that are more-complex and continuously evolving.

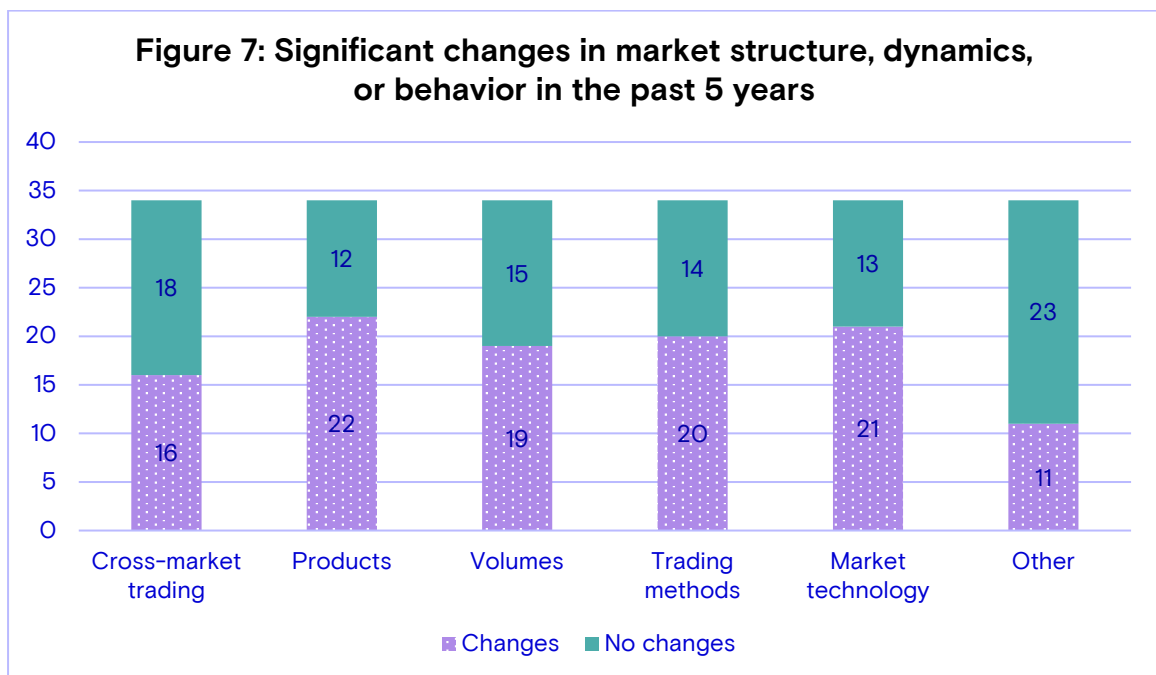
Key observation regarding practices

Significant Market Developments

The RT asked participating jurisdictions to provide information about significant developments in their markets' structures, dynamics, or behaviors in the past 5 years, including about cross-market trading, volume and range of products traded, trading methods, market technology, and other changes.

30 of the 34 participating jurisdictions said that their market had undergone significant developments in one or more of these areas, with 21 jurisdictions reporting developments in 3 or more areas.

Common areas of change included the introduction of new markets or trading venues⁴⁴, increases in volume and range of algorithmic trading⁴⁵, increases in the range of products traded, including derivatives referencing cryptocurrencies⁴⁶. Several European jurisdictions reported an increase in cross-border trading and the relocation of some trading activity following the withdrawal of the United Kingdom from the European Union.



Formal review of Surveillance Capabilities and Governance of Reviews

24 of the 34 participating jurisdictions⁴⁷ reported that they do have a formal requirement to undertake a regular review of their market surveillance capabilities.

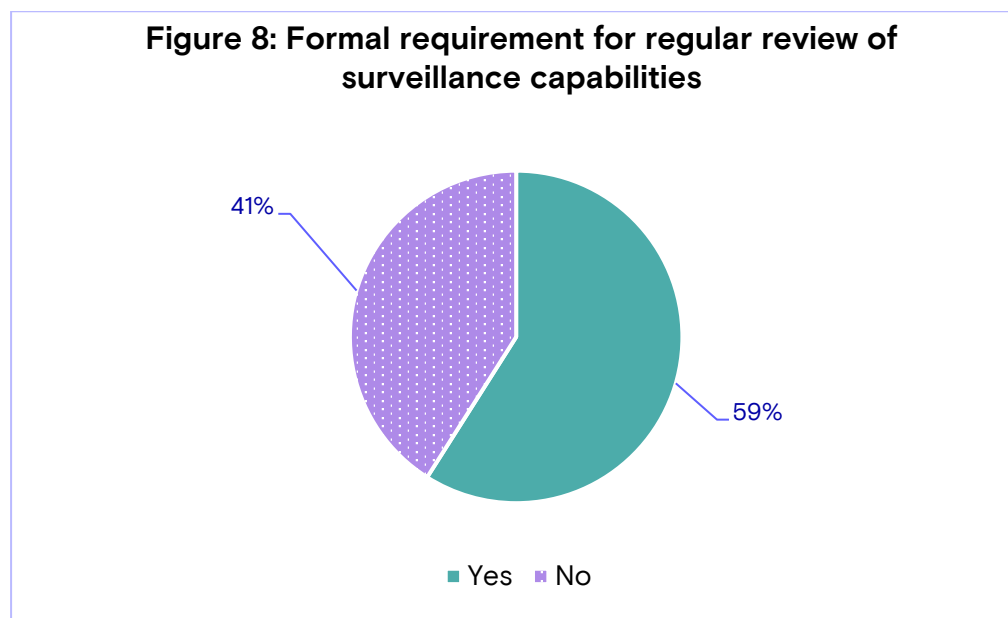
⁴⁴ For example, Croatia, Mexico, South Africa, Spain, USA.

⁴⁵ For example, Canada, New Zealand, Thailand.

⁴⁶ For example, Thailand, UK, USA.

⁴⁷ Except Argentina, Chile, Ecuador, Egypt, France, Malawi, Montenegro, the Netherlands, Türkiye.

In a few cases, these reviews are mandated in legislation, but the majority are linked to formal policies of MAs. Several jurisdictions reported that reviews undertaken by SROs with responsibility for frontline market surveillance are reported to and reviewed by the statutory regulator.



14 jurisdictions⁴⁸ reported that a formal review requirement advised that this review is carried out on an annual basis.

Some jurisdictions that do not have formal requirements for periodic review nonetheless demonstrated that there are, at least annual, reviews of technology, surveillance tools, staff capacity, and staff training⁴⁹. Other jurisdictions responded that surveillance capabilities are reviewed, when necessary, in light of market developments such as amendments to regulations⁵⁰.

Board oversight of reviews, and especially of changes required in the light of reviews, was commonly reported⁵¹. Others reported that an Audit and Risk, or Risk Committee, of the MA has responsibility for oversight of the process⁵². In some cases, responsibility for oversight of any reviews lies with senior executives of the market surveillance department of the Regulator.

⁴⁸ Brazil, Canada, Croatia, Germany, India, Jordan, Kenya, Liechtenstein, New Zealand, Peru, Saudi Arabia, Singapore, South Africa, Spain.

⁴⁹ For example, The Netherlands.

⁵⁰ For example, Angola, Egypt, Hong Kong.

⁵¹ For example, Angola, Canada, Croatia, India, Saudi Arabia, Singapore.

⁵² For example, Kenya, Jordan, South Africa, Thailand, USA.

While the responses show strong review practices from the majority of jurisdictions, in light of the ongoing changes experienced by the most markets it is an issue of concern that many participating jurisdictions do not have any formal review requirement in place and could not demonstrate that effective or periodic reviews were being undertaken in practice.

Issue of concern:

MAAs should regularly review their surveillance capability. This is vital to keep pace with market developments and technological advances.

MAAs not having either any formal requirement to review surveillance capabilities or an ability to demonstrate that reviews have in fact been conducted effectively is an issue of concern. Jurisdictions, for example, Egypt, France, Malawi, the Netherlands, and the UK, should consider initiating a program of regular reviews.

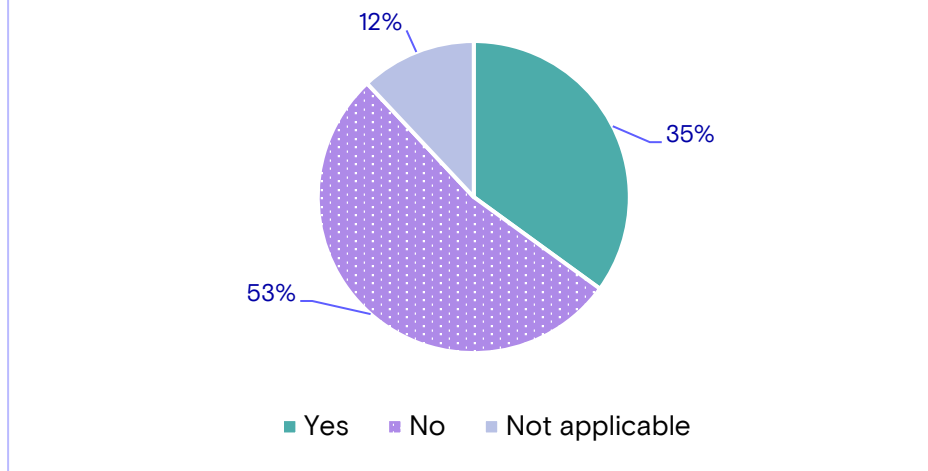
SRO Oversight

Many Participating Jurisdictions reported that they rely wholly or in part on market operators to perform market surveillance functions. Some of these jurisdictions consider market operators to be self-regulatory organizations. Most, however, view the market operators as licensed market participants, with obligations to perform market surveillance activities as part of their conditions of license. As such, most participants indicated that oversight of SROs was not relevant within their jurisdiction. Out of the 14 jurisdictions that formally recognize market operators as SROs, 12⁵³ reported that reviews carried out by the SRO must be reported to the regulator, while 2 jurisdictions⁵⁴ reported that they do not have any oversight of this process.

⁵³ Angola, Bahamas, Brazil, Canada, New Zealand, Peru, Singapore, South Africa, Switzerland, Thailand, Türkiye, USA.

⁵⁴ Egypt, Malawi.

Figure 9: Are reviews conducted by SROs reported to the Regulator?



Outcomes of Reviews

The RT sought information from participating jurisdictions about the key changes that have been made to surveillance capabilities in the past 5 years, as a result of reviews undertaken.

22 participating jurisdictions⁵⁵ reported that they had either introduced new IT systems or upgraded and improved existing systems in the past 5 years to meet changes in technology, market structure, market volume, or other needs. Examples included steps to greatly increase data-handling capacity, improve data collection, improve analysis of unstructured data, and automate processes. MAs also reported the adoption of new technology to assist with market surveillance. For example, France reported that the AMF's surveillance team now regularly utilizes AI in its work, such as clustering (an ML process designed to categorize data based on common or close attributes) to help find similarities in trading patterns, and use of natural language processing to assist with extraction of text from documents.

⁵⁵ Argentina, Bahamas, Brazil, Bulgaria, Canada, Egypt, France, Hong Kong, India, Israel, Italy, Jordan, Kenya, Liechtenstein, Malawi, The Netherlands, New Zealand, Saudi Arabia, Singapore, South Africa, Spain, Switzerland, UK.

Keeping up-to-date with technological advances

All but one respondent⁵⁶ reported that their staff receive in-house training to keep up-to-date with technological developments. Participating jurisdictions also reported that they receive specialist external and academic training from a variety of sources, including online providers, universities, and technology suppliers⁵⁷. Participants also reported receiving training from regional regulatory networks, and international organizations including IOSCO and ESMA.

An identified recent trend in training for market surveillance staff was an increase in training in data science, data analysis, and related topics including coding and visualization tools.

A number of jurisdictions also reported increases in surveillance staff. More than half of jurisdictions agreed that the recruitment profile for new staff in their surveillance teams had changed over the past 5 years. Matching the trend in staff training, the trend in recruitment was a shift to staff with IT and/or data analysis backgrounds rather than (or to supplement) staff with specific trading experience⁵⁸.

Sharing knowledge and best practices is an essential element of maintaining currency in the face of rapid technological changes. 28 jurisdictions⁵⁹ reported that they maintain regular contact with peer regulators and other relevant bodies to keep abreast of technological developments. Participating jurisdictions again referred to international organizations including the FSB, IOSCO, Bank for International Settlement (BIS), European Securities and Markets Authority (ESMA), and International Conference on Technology Applied to Securities Markets Enforcement (TASMEC).

One result of technological developments has been an increased focus on cyber resilience for regulators as well as market participants. 27 jurisdictions⁶⁰ reported that they have implemented additional measures to address potential cyber security issues or cyber resilience weaknesses. These include additional staff training, strengthening IT infrastructure, separating key systems, secure

⁵⁶ Montenegro.

⁵⁷ For example, Argentina, Bulgaria, Chile, Germany, Mexico, New Zealand, Spain, UK.

⁵⁸ For example, Canada, Chile, Germany, Hong Kong, India, Israel, Italy, Jordan, Kenya, Malawi, Mexico, Spain.

⁵⁹ Angola, Argentina, Bahamas, Brazil, Bulgaria, Canada, Chile, Croatia, Egypt, France, Germany, Hong Kong, India, Israel, Italy, Jordan, Kenya, Liechtenstein, New Zealand, Saudi Arabia, Singapore, South Africa, Spain, Switzerland, Thailand, The Netherlands, UK, USA.

⁶⁰ Angola, Bahamas, Brazil, Bulgaria, Canada, Chile, Ecuador, Egypt, France, Germany, Hong Kong, India, Israel, Italy, Kenya, Liechtenstein, Malawi, New Zealand, Saudi Arabia, Singapore, South Africa, Spain, Switzerland, Thailand, The Netherlands, UK, USA.

communication portals, enhancing testing of systems, crisis management exercises, and strengthening business continuity and backup protocols.

Recommendation 3: Access to Data

Within their jurisdiction, the relevant MAs should individually or collectively have the capability to access data in a way that enables them to conduct effectively their surveillance obligations.

The Market Surveillance Report notes that the ability to access the data that is necessary to oversee a market is integral to an effective surveillance system. The report notes that an effective surveillance system should have, at a minimum, the ability to:

1. detect the use of manipulative or deceptive devices in the purchase and sale of securities (equities), futures on commodities and securities markets and other financial products; and
2. perform market reconstructions.

The report concluded that MAs that do not have access to necessary surveillance data would not be able to oversee their markets effectively.

Key observation regarding practices

The RT asked participating jurisdictions to provide information both about their legal authority to obtain data and also their ability, in practice, to access all data needed to allow them to perform effective surveillance, such as orders, trades, cancellations, etc. Jurisdictions were also asked whether they had encountered any obstacles to the effective collection of data over the past 5 years.

Ability to access data

All 34 participating jurisdictions confirmed that they have the legal authority to access data in a way that enables them to conduct their surveillance operations effectively. However, 2 jurisdictions do not have access to all relevant data⁶¹, notably data on orders and cancellations.

In practice, 8 of the 34 participating jurisdictions⁶², 5 of which are more-complex markets, have encountered some obstacles to obtaining market data in the past 5 years. These obstacles included difficulties in accessing order books and

⁶¹ Liechtenstein, The Netherlands.

⁶² Chile, Ecuador, France, Italy, Kenya, Malawi, Switzerland, and The Netherlands

associated data for cross-border transactions⁶³, in obtaining consistent and standardized data or data meeting the required standard from market participants⁶⁴, and information concerning the ultimate customer / beneficial ownership⁶⁵.

Access to data on OTC derivatives

The Market Surveillance Report noted that as the use of related OTC derivatives could increase the risk of abuse or manipulation of venue-traded products, regulators may wish to consider ensuring they have access to data relating to OTC derivatives. 8 participating jurisdictions are not able to obtain this data (though one noted that derivatives trading was not permitted in the jurisdiction). A jurisdiction⁶⁶ reported that authority over OTC derivatives transactions was outside the remit of the securities regulator.

Adoption of Central Reporting Point (“CRP”)

The Market Surveillance Report discussed the usefulness of adoption of CRP as a tool that can enable MAs to access the data they need to conduct effective surveillance, especially for cross-asset and cross-market activity. The report acknowledged that there are also costs and other issues associated with the development of a CRP, and in light of specific market structures, alternative tools for organizing effective surveillance may also be appropriate, and so did not make a specific recommendation that jurisdictions adopt a CRP.

The RT sought information on use of CRPs, and on whether jurisdictions that have not adopted a CRP have taken other measures to facilitate aggregation or comparison of cross-market trade data. 9 jurisdictions⁶⁷ have adopted a CRP. Out of the remaining 25 jurisdictions that have not adopted a CRP, it is however an issue of concern that 15⁶⁸ have not adopted any other measures to facilitate aggregation or comparison of cross-market trade data (noting that some jurisdictions at present have only one trading venue).

⁶³ France, Italy, Spain, Switzerland.

⁶⁴ Argentina, Chile, Ecuador, Kenya.

⁶⁵ Malawi.

⁶⁶ Kenya.

⁶⁷ Canada, Egypt, France, New Zealand, Saudi Arabia, Thailand, Türkiye, UK, USA.

⁶⁸ Bahamas, Brazil, Bulgaria, Croatia, Ecuador, Jordan, Kenya, Malawi, Mexico, Montenegro, The Netherlands, Peru, Singapore, South Africa.

Issue of concern:

Jurisdictions with multiple trading venues should have a Central Reporting Point (CRP) or should adopt some alternative measures to allow MAs to surveil cross-asset and cross-market activity.

Of the 25 jurisdictions that have not adopted a CRP, 15 have not adopted other measures to ease the collection or comparison of trade data across multiple trading venues. This is an issue of concern for those jurisdictions with multiple trading venues, i.e., Bulgaria, Chile, Ecuador, and South Africa.

Recommendation 4: Customer Identification

MAs (individually or collectively) should have the capability to associate the customer and market participant with each order and transaction.

MAs should have the capability to know if a particular customer is sending orders across multiple markets and assets, as this can be essential in the detection of market abuse.

Key observation regarding practices

The RT sought information from participating jurisdictions to understand whether MAs have both the legal authority and the technical ability to obtain customer identification information.

Unique Identifiers

The RT asked whether participating jurisdictions had a requirement for unique identifiers, and whether these enabled identification of ultimate clients of participants of trading venues (or traders accessing markets via direct market access).

31 participating jurisdictions⁶⁹ responded that they have a participant identifier in place. In 27 jurisdictions the identification of the customer or beneficial owner, in some or all cases, is also available.

⁶⁹ Except Mexico, Ecuador, and Switzerland.

Many participating jurisdictions have linked their customer identifiers for market purposes to some form of national ID, for individuals, and to Legal Entity Identifiers (LEI), for entities.

The identification process implemented by most jurisdictions associates the identity of the customer and market participant with each order and transaction.

11 jurisdictions⁷⁰ identify the ultimate beneficiary owner (UBO) of non-individual clients (for example, identification of the natural persons behind a legal entity or legal structure which control it) through their transaction identifiers. 1 MA⁷¹ has developed an automated Ownership or Controller reporting regime that uniquely identifies over 80% of all trades down to the beneficial owner or controller.

The majority of MAs that do not identify ultimate beneficial owners or controllers through trading identifiers are able to obtain this information, usually through the statutory regulator⁷², from market participants as a result of information to be obtained when on-boarding clients⁷³, or through additional reporting requirements, such as for off-exchange transactions⁷⁴. Few jurisdictions reported no difficulties in obtaining required customer information arising from confidentiality or privacy laws.

However, 4 participating jurisdictions⁷⁵ do not have the ability to associate customers or beneficial owners with each order and transaction, which is an issue of concern that should be addressed. Ultimately, an audit trail/surveillance system is less useful if the customer cannot be identified, particularly when they are coordinating orders across multiple markets. The responsible Market Authority should have the capability to know if a particular customer is sending orders across multiple markets and assets to facilitate unlawful manipulation.

The Market Surveillance Report noted strong support for adoption of customer identifiers and LEI, as recommended by the FSB in 2012. Out of the 34 participating jurisdictions, 19 jurisdictions⁷⁶ reported that they have mandated the use of LEI.

⁷⁰ Argentina, Bahamas, Brazil, Bulgaria, Croatia, Egypt, France, Hong Kong, Israel, Italy, Kenya.

⁷¹ US CFTC.

⁷² For example, New Zealand, UK.

⁷³ For example, USA

⁷⁴ For example, Hong Kong.

⁷⁵ Angola, Ecuador, Mexico, and Switzerland.

⁷⁶ Except Angola, Argentina, Bahamas, Brazil, Chile, Ecuador, Hong Kong, Israel, Jordan, Malawi, Mexico, Montenegro, Peru, South Africa, Thailand.

Issue of concern:

MAs should have the ability to identify the customer and market participant with each order and transaction across multiple markets for effective market surveillance.

Having difficulties in linking customers/beneficial owners or market participants with individual orders and transactions is an issue of concern for Mexico, and Switzerland, for more-complex markets, and Angola and Ecuador for less-complex markets.

Recommendation 5: Format

MAs should require that data required for market surveillance be reported to the requisite MA for use and storage in a usable format.

The Market Surveillance Report recognized that receipt of data in a myriad of formats can complicate and delay surveillance efforts. The Report mentions that “solutions must be found so that the data from all markets within a jurisdiction can be used and compared by MAs in an efficient and effective manner.”⁷⁷

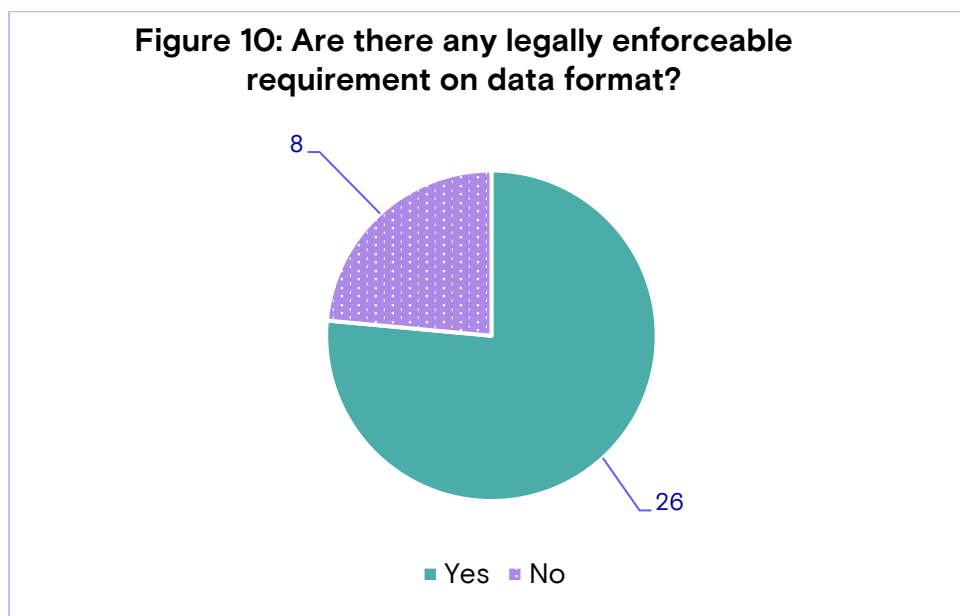
The requirements for effective implementation of this recommendation may differ across jurisdictions, in particular depending on whether one or more venues operate in the individual jurisdiction.

Key observation regarding practices

In order to assess the consistency of implementation outcomes of this Recommendation the RT sought information from participating jurisdictions on: (i) the presence of legally enforceable requirements relating to the format of data required for market surveillance; (ii) the steps taken in the various jurisdictions to standardize data obtained from different Trading Venues, intermediaries, and markets; and (iii) whether the data provided to MAs enable efficient reconstruction and analysis of order books, including for cross-market, cross-asset, and algorithmic trading.

⁷⁷ Page 35 of the report: <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD412.pdf>.

The RT found varying levels of implementation of this Recommendation among participating jurisdictions. 26 out of 34 jurisdictions⁷⁸ confirmed that legally enforceable requirements are in place in relation to the format of data. Standardization of data formats tended to have received less attention, understandably, in jurisdictions with only one trading venue.



In 17 jurisdictions⁷⁹, these requirements are established directly in law⁸⁰ or in the form of supervisory guidelines for market participants⁸¹. In the remainder, the requirements are managed through specific transmission protocols between the regulators and the market participants under the regulator's powers to request data. In some cases, common use data formats are mandated.

⁷⁸ Angola, Argentina, Brazil, Bulgaria, Canada, Chile, Croatia, Ecuador, France, Germany, Hong Kong, Kenya, India, Israel, Italy, Jordan, Kenya, Liechtenstein, Malawi, Mexico, Peru, Spain, Switzerland, The Netherlands, UK, USA.

⁷⁹ Angola, Argentina, Bulgaria, Chile, France, Germany, Hong Kong, India, Israel, Italy, Malawi, Mexico, Peru, Spain, The Netherlands, UK, USA.

⁸⁰ Argentina, Bulgaria, Chile, France, Germany, Israel, Italy, Malawi, Mexico, Spain, The Netherlands, UK, USA.

⁸¹ Angola, Canada, Hong Kong, India, Mexico, Peru.



Participating jurisdictions also reported other steps taken to improve standardization of data, including:

- implementation of specific platforms and systems to receive and analyze data in accordance with a specific format⁸²
- use of supervisory tools to promote standardization⁸³
- publication of manuals⁸⁴
- requiring trading venues to include surveillance gateways in their trading systems that adhere to specific messaging standards⁸⁵
- issue of technical specifications by the trading venue.⁸⁶

One jurisdiction⁸⁷ that does not currently have such standards indicated that it is working on surveillance team and building processes and systems to enable this.

Despite these measures, 70% of participating jurisdictions⁸⁸ consider that the level of standardization of data allows MAs to efficiently reconstruct and analyze order books, including for cross-market, cross-asset, and algorithmic trading.

⁸² Angola, Argentina, Ecuador, India, Switzerland.

⁸³ Angola, Bahamas, Brazil, Mexico.

⁸⁴ Brazil.

⁸⁵ Kenya.

⁸⁶ Jordan.

⁸⁷ South Africa.

⁸⁸ Angola, Bahamas, Brazil, Canada, Egypt, France, Germany, Hong Kong, India, Israel, Italy, Jordan, Kenya, New Zealand, Peru, Saudi Arabia, Singapore, South Africa, Spain, Switzerland, Thailand, Türkiye, UK, USA.

Participating jurisdictions identified a number of challenges, including:

- a need for further quality checks on data provided⁸⁹
- collection of additional meaningful timestamp granularity for high speed/low latency trading analysis⁹⁰
- cross-border trading of financial instruments and the lack of consolidation across different trading venues in different jurisdictions⁹¹
- high volumes or orders⁹²
- the use of different formats by various trading venues despite the presence of requirements for standardization.⁹³

3 respondents⁹⁴ pointed out that additional/ad hoc data might be required in case of investigations. One jurisdiction⁹⁵ is currently working to improve standardization, putting in place specific systems and interfaces to better enable surveillance activities.

It is an issue of concern that a significant percentage of jurisdictions are, in practice, encountering difficulties in trade and order reconstruction arising from problems associated with data format or quality.

Issue of concern:

Despite having formal requirements regarding data format in place, 5 respondents⁹⁶ reported that they encounter practical difficulties in reconstructing and analyzing order books because of difficulties with data format or quality. MAs should consider steps to enforce or improve data standards to reduce this.

⁸⁹ Mexico and Switzerland.

⁹⁰ Canada.

⁹¹ Spain in relation to the EU fragmented landscape.

⁹² Spain.

⁹³ The Netherlands.

⁹⁴ Angola, New Zealand, Spain.

⁹⁵ Argentina.

⁹⁶ Canada, Mexico, Spain, Switzerland, the Netherlands.

Recommendation 6: Data protection

MAAs should establish and maintain appropriate confidential safeguards to protect surveillance data that is reported to them.

Surveillance data can include sensitive information, including personal information, and it is essential that MAs take appropriate steps to safeguard this data in order to protect and promote public confidence in the MAs. Unlike most of the Recommendations discussed in this Review, this Recommendation applies equally to all jurisdictions, regardless of market structure or complexity.

Key observation regarding practices

In order to assess the level of implementation of the Recommendation, the survey circulated to IOSCO members investigated: (i) where and how market supervision data is held in each jurisdiction (e.g., in a server, in the Cloud, etc.); (ii) the measures in place to protect the confidentiality and integrity of market surveillance data reported to MAs (e.g., related to IT infrastructure security and access rights, etc.); (iii) the presence of Memorandum of Understanding (“MoUs”) or information agreements in place to protect the confidentiality of information shared for market surveillance purposes.

In general, the RT found that jurisdictions usually use internal servers⁹⁷, cloud solutions⁹⁸ or hybrid solutions combining the two⁹⁹ to store data relating to market surveillance. Some jurisdictions using internal servers indicated that they are migrating¹⁰⁰ or evaluating migration¹⁰¹ to cloud solutions.

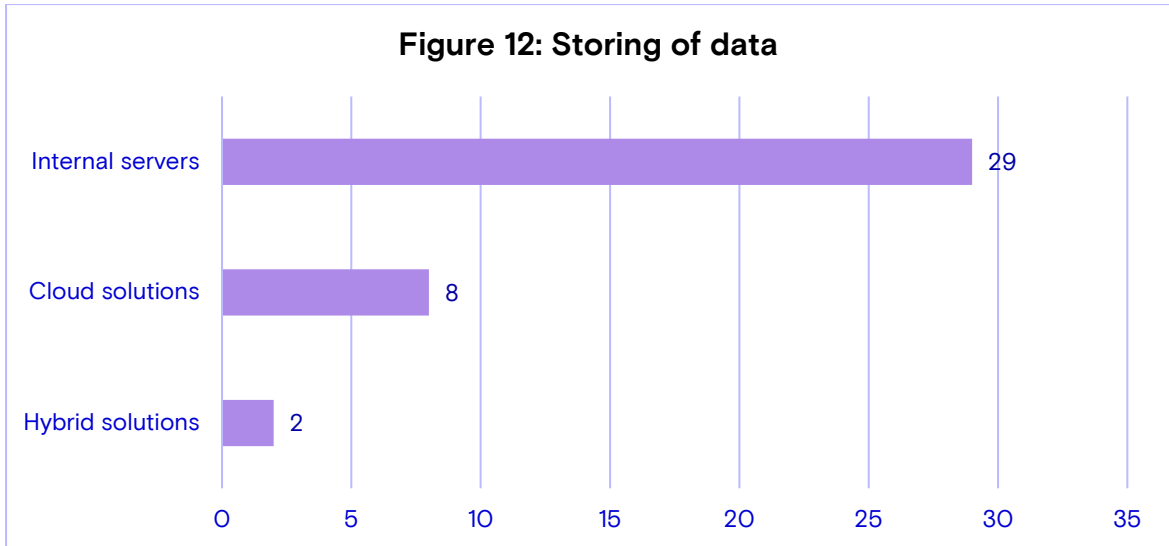
⁹⁷ Angola, Argentina, Bahamas, Brazil, Bulgaria, Croatia, Ecuador, Egypt, France, Germany, Hong Kong, India, Israel, Italy, Jordan, Kenya, Liechtenstein, Malawi, Mexico, Montenegro, New Zealand, Peru, Saudi Arabia, Singapore, South Africa, Spain, Switzerland, Thailand, Türkiye.

⁹⁸ Angola, Mexico, South Africa, The Netherlands, UK, USA.

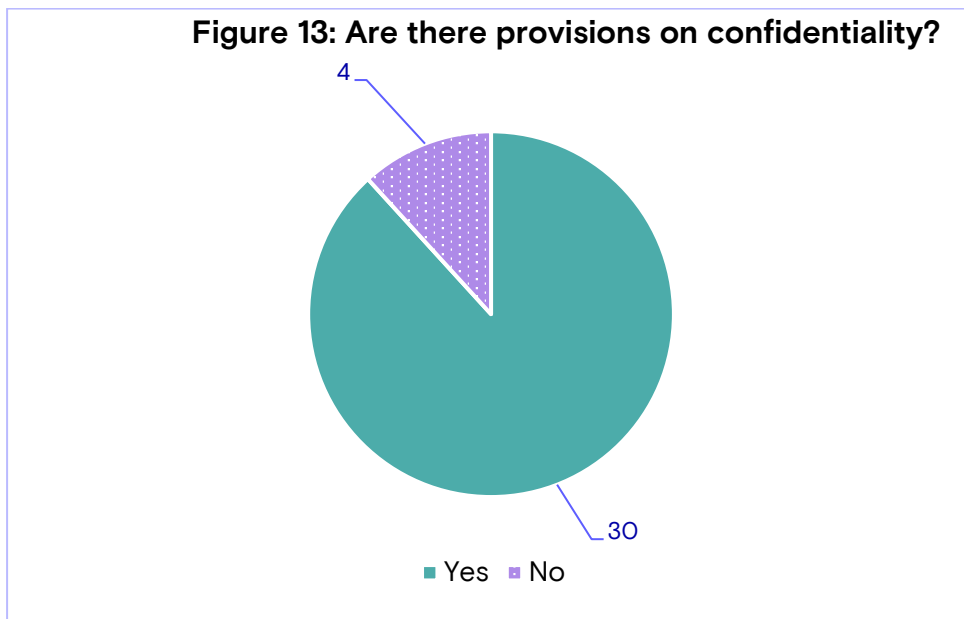
⁹⁹ Canada, Chile, Mexico.

¹⁰⁰ Israel, New Zealand, Singapore.

¹⁰¹ Brazil, Liechtenstein, Spain, Switzerland.



The RT's analysis of the information showed that all the respondents have taken significant measures to protect and keep confidential market surveillance data reported to MAs.

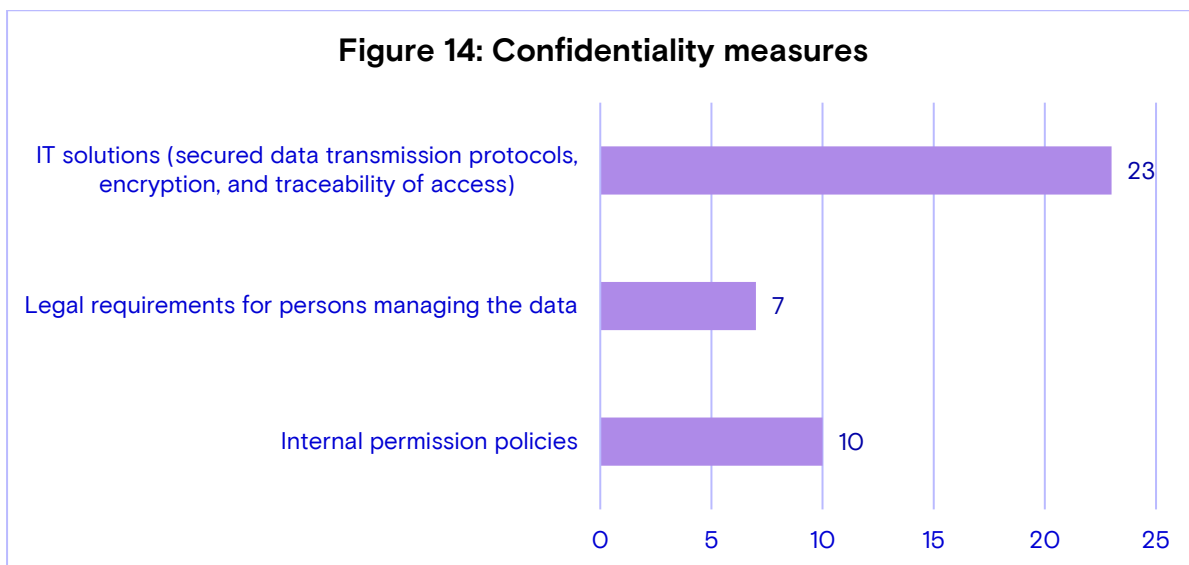


Specific measures taken vary across jurisdictions. Most commonly, MAs in 23 jurisdictions¹⁰² have implemented technology solutions such as secure data transmission protocols, encryption, and traceability of access. 8 jurisdictions¹⁰³ also referred to applicable legal requirements of confidentiality for persons

¹⁰² Brazil, Bulgaria, Canada, Chile, Ecuador, France, Germany, Hong Kong, India, Israel, Italy, Jordan, Kenya, Liechtenstein, Malawi, New Zealand, Peru, Singapore, South Africa, Spain, Thailand, The Netherlands, USA.

¹⁰³ Brazil, Bahamas, Germany, Italy, Mexico, South Africa, Spain, Switzerland.

managing the data and internal policies maintained by MAs to restrict access to this data by staff of the MAs¹⁰⁴.



The RT found that the majority of jurisdictions¹⁰⁵ did not require specific MoUs or confidentiality agreements between MAs and trading venues to protect the confidentiality of information shared for market surveillance purposes because the jurisdictions have applicable legal provisions requiring confidentiality of such information. 10 jurisdictions¹⁰⁶ do have specific MoUs or confidentiality agreements between MAs and trading venues for this purpose. 9 jurisdictions¹⁰⁷ referred to MoUs to protect confidentiality in relation to exchange of information between regulators on a cross-border basis (for example, some referred to reliance on the IOSCO Multilateral Memorandum of Understanding (“MMoU”) for this purpose).

Recommendation 7: Synchronization of Business Clocks

MAs should consider requiring Trading Venues and their participants within their jurisdiction to synchronize, consistent with industry standards, the business clocks they use to record the date and time of any reportable event. Where they do so, business clocks should be synchronized to UTC.

¹⁰⁴ Angola, Argentina, Croatia, Chile, Hong Kong, India, Malawi, Montenegro, Spain, Saudi Arabia, Türkiye, UK.

¹⁰⁵ Angola, Brazil, Croatia, Germany, Israel, Italy, Jordan, Liechtenstein, Mexico, New Zealand, Peru, South Africa, Spain, Switzerland.

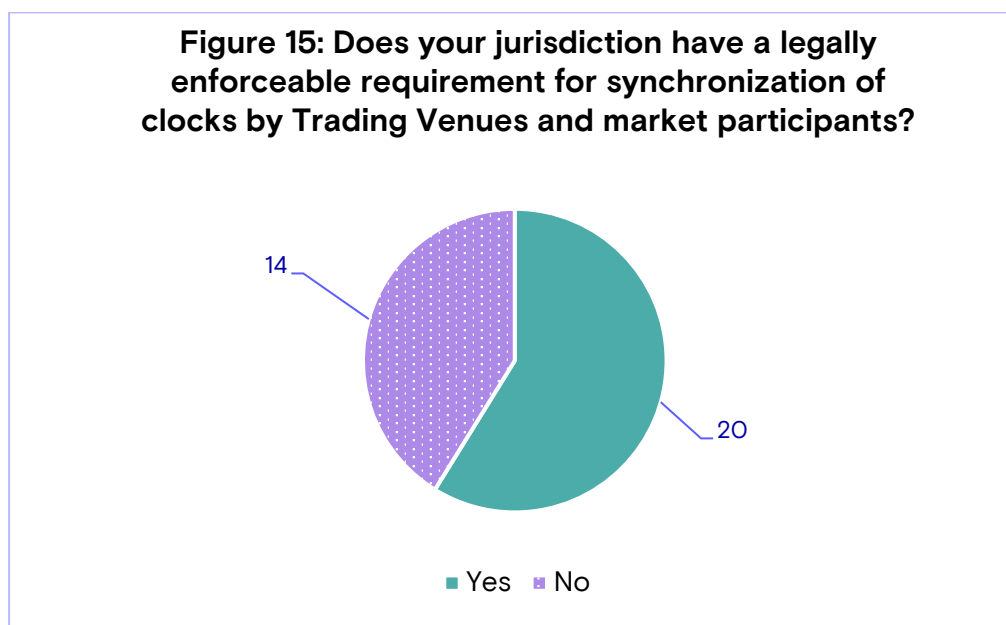
¹⁰⁶ Canada, France, Hong Kong, India, Saudi Arabia, Singapore, Spain, Thailand, The Netherlands, USA.

¹⁰⁷ Bahamas, Bulgaria, Chile, Germany, Liechtenstein, Mexico, Spain, Türkiye, UK.

The Market Surveillance Report recommends that MAs should consider requiring trading venues and participants to synchronize business clocks. Synchronization of clocks used to timestamp orders and trades is important to help establish a clear audit trail for surveillance purposes. The importance of this is growing as more trading takes place over multiple venues and at faster speeds. The case for synchronization requirements is likely to depend on local market conditions and needs, whether there are multiple trading venues, and the occurrence of HFT.

Key observation regarding practices

The RT found that implementation of this Recommendation varied among participating jurisdictions. The most common indicator in favor of clock synchronization among participating jurisdictions is the presence of multiple trading venues in the jurisdiction.



In more-complex markets with multiple trading venues, clock synchronization in 19 jurisdictions¹⁰⁸ is a key requirement for reconstructing an audit trail of the events. Almost all jurisdictions in this situation are compliant with the recommendation. In one jurisdiction, MAs have adopted measures to ensure clock synchronization between trading venues and dealers despite this not being a formal requirement.

¹⁰⁸ Except Argentina, Switzerland, South Africa.

Most jurisdictions where all (or the great majority of) transactions are concentrated in a sole venue, as is the case for many participating jurisdictions, have not yet required clock synchronization, but 5 of such jurisdictions¹⁰⁹ have done so. Jurisdictions that have not implemented this should consider whether to do so, bearing in mind that synchronization requirements apply among market participants as well as among trading venues.

In 2020 IOSCO published a Final Report on Clock Synchronization, referring to Recommendation 7 of the Market Surveillance report. The 2020 report amended Recommendation 7, which as published in 2013 had not settled on a specific standard that should be used for clock synchronization. As amended, the Recommendation now is that jurisdictions that decide to introduce clock synchronization requirements should use Coordinated Universal Time (UTC) as the standard for this. This aspect of the recommendation has been implemented by all but one of the jurisdictions that mandate clock synchronization.

Recommendation 8: Cross-border Surveillance capabilities

MAAs should at a minimum map and be aware of the extent of their cross-border surveillance capabilities. MAAs should also work collectively and take any steps that would be appropriate to strengthen their cross-border surveillance capabilities.

The Market Surveillance Report noted that it is important that MAAs are clear as to the cross-border surveillance capabilities they have, having regard to the inter-linkages between their domestic markets and those abroad, including instances of single products being traded in more than one country, or related products (such as derivatives and underlying assets) being traded in different jurisdictions. Cross-border surveillance is a great challenge that involves many key aspects and might pose significant risks.

The complexities introduced by the cross-border trade of securities and the difficulties in obtaining timely and complete information, necessary for effective surveillance, are challenges that not all regulators have the resources and expertise to address. However, where cross-border activity is a feature of a market, MAAs should understand the risks arising and their own capability to

¹⁰⁹ Jordan, Kenya, Egypt, Brazil, Hong Kong.

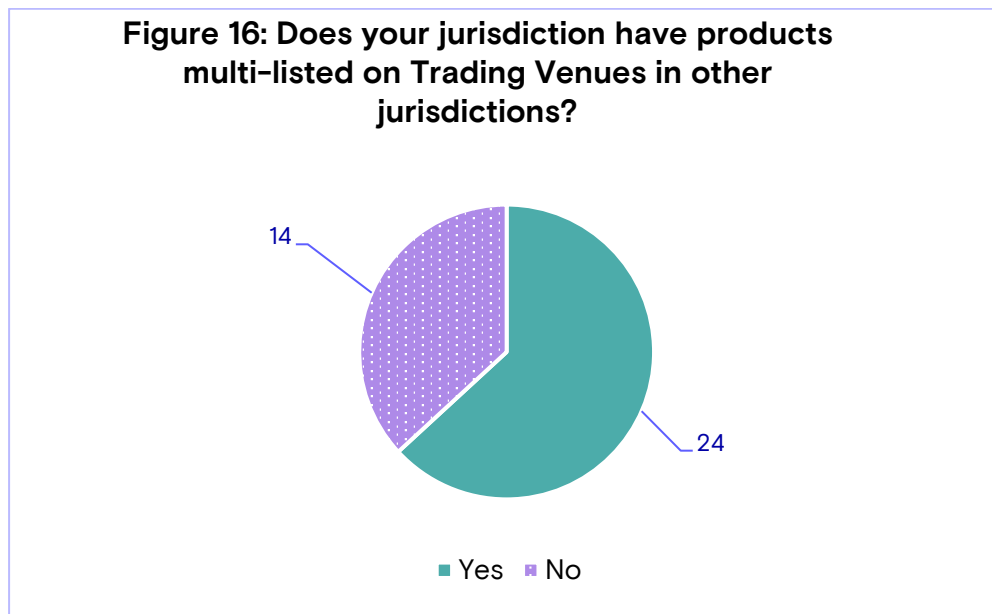
manage these and to conduct surveillance of activity on markets in different jurisdictions.

Key observation regarding practices

18 participating jurisdictions¹¹⁰ reported that they have not mapped their cross-border surveillance capabilities with regards to the interlinkage between domestic markets and those abroad.

In less-complex markets, the immediate need to consider cross-border capabilities may be less pressing, and this is reflected in the responses received from these jurisdictions. However, progress was not significantly better in more-complex markets, with greater trading volumes, a broader range of assets traded, and usually more inter-linkages with markets abroad. 12 of these 19 jurisdictions¹¹¹ are more-complex markets who have not mapped their capabilities.

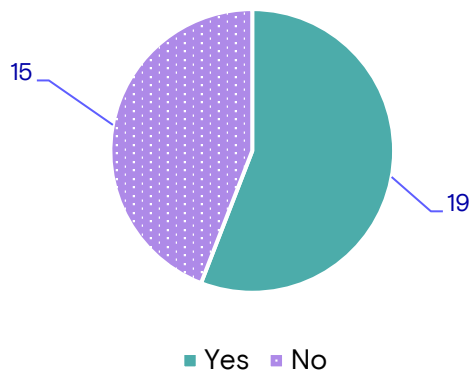
While 70% of participating jurisdictions reported that they have not identified any gaps or limitations in their cross-border surveillance capabilities, many of those who reported no gaps had not in fact carried out a mapping exercise. It is telling that of the jurisdictions that have mapped their capabilities, 55% have identified specific gaps and limitations relevant to their markets.



¹¹⁰ Angola, Argentina, Brazil, Canada, Croatia, Ecuador, Israel, Jordan, Kenya, Liechtenstein, Malawi, Montenegro, New Zealand, Saudi Arabia, Singapore, South Africa, Türkiye, UK.

¹¹¹ Argentina, Brazil, Canada, Croatia, Israel, Liechtenstein, Saudi Arabia, Singapore, South Africa, Türkiye, UK.

Figure 17: Do Trading Venues in your jurisdiction allow the trading of derivative products based on underlying assets traded on markets (or OTC) in other jurisdictions?



To provide context for the need for MAs to understand their cross-border surveillance limitations, the RT sought information on whether participating jurisdictions are exposed to cross-border trading activity. This exposure could arise from dual or multi-listing of securities on markets abroad¹¹² or the trading of derivatives based on underlying assets traded in other jurisdictions¹¹³. The majority of participating jurisdictions have exposure to one or both of these.

Despite this, 12 jurisdictions¹¹⁴ that have cross-listings, and 9 of those¹¹⁵ with derivatives trading on the basis of underlying assets traded abroad have not mapped their cross-border surveillance capabilities.

The RT also asked whether jurisdictions have mapped their capabilities to obtain information from overseas regulators regarding derivatives of digital assets. At this time, only 4 jurisdictions¹¹⁶ have done so.

Given the high proportion of jurisdictions that have exposure to trading conduct risks through cross-border activity it is an issue of concern that 61% of

¹¹² Argentina, Brazil, Bulgaria, Canada, Chile, Croatia, Egypt, France, Germany, Hong Kong, Israel, Italy, Kenya, Mexico, New Zealand, Peru, Saudi Arabia, South Africa, Spain, Switzerland, The Netherlands, Türkiye, UK, USA.

¹¹³ Brazil, Canada, Chile, France, Germany, Hong Kong, Israel, Italy, Kenya, Singapore, South Africa, Spain, Switzerland, Thailand, The Netherlands, UK, USA.

¹¹⁴ Argentina, Brazil, Chile, Croatia, Canada, Israel, Kenya, New Zealand, Saudi Arabia, South Africa, Türkiye, UK.

¹¹⁵ Brazil, Canada, Chile, Israel, Kenya, Singapore, South Africa, UK.

¹¹⁶ Bahamas, Germany, Hong Kong, Switzerland.

jurisdictions have not mapped their cross-border surveillance capabilities. Those that have done so have frequently discovered limitations, which MAs can then seek to address.

More promisingly, the majority of participating jurisdictions¹¹⁷ make use of information-sharing agreements with other jurisdictions. The IOSCO MMoU or Enhanced Multilateral Memorandum of Understanding (“EMMoU”) were the most frequently mentioned agreements, but many participants also are signatories of bilateral, regional MoUs (e.g., Union of Arab Securities Authorities, ESMA). Platforms of the FSB, Organization for Economic Co-operation and Development (OECD), and Financial Action Task Force (FATF) were also mentioned as exchange of information fora.

Issue of concern:

It is important that MAs ascertain the cross-border surveillance capabilities they have, especially in respect to the inter-linkages between domestic markets and international markets.

The failure of most jurisdictions¹¹⁸ to map their the cross-border surveillance capabilities is an issue of concern, for both more-complex and less-complex markets, given the risk of trading misconduct from cross-border activities.

5.1 Relevant EU Practices

In Europe, there are already regulatory provisions covering the recommendations included in this report. There are several relevant EU regulations and guidelines with origin on MiFID I (2007) and MiFID II/ MiFIR (2018), implemented a few years ago and recently revised, worth to mention, and related to these report recommendations:

- Central reporting point for transactions through the Transaction Reporting European System (TREM), across all EU jurisdictions
- Regulation of reporting of orders, transactions, and reference data in a standardized format
- Obligations to uphold integrity or markets, to maintain records, and report transactions and order books requirements in a standardized format on Title IV of MiFIR articles 24-27

¹¹⁷ Argentina, Bahamas, Brazil, Bulgaria, Canada, Chile, Ecuador, Egypt, France, Germany, Hong Kong, India, Italy, Jordan, Kenya, Malawi, Mexico, New Zealand, Peru, Spain, Switzerland, Thailand, UK, USA.

¹¹⁸ Except Bahamas, Germany, Hong Kong, Switzerland, USA.

- Self-assessment, and detailed obligations and regulations regarding algorithmic trading oversight
- Requirements for reviews of surveillance capabilities, considering the impact of MAS to survey markets and technology developments
- Requirements for the Consolidated Tape Provider contemplated on the regulation
- Requirements on clock synchronization across the European Union
- MMoU on Cooperation Arrangements and Exchange of Information

In addition, ESMA has carried out an assessment study of the suitable data formats and transmission protocols for the purpose of the consolidated tape providers and other reporting regimes.

Chapter 6 – Conclusion and Recommendations

The review demonstrates that most jurisdictions have taken meaningful steps to address the challenges that technology poses to effective market surveillance, particularly in more-complex markets where these challenges are more significant. However, the pace of technological change is not slowing, and fast-evolving technologies such as AI mean that it will be a continual challenge for MAs to keep pace and maintain effective surveillance over, and understanding of, market activity. This highlights the importance of jurisdictions regularly reviewing their capability, to understand how to keep pace with technology.

The review shows that challenges remain for many regulators in collecting or analyzing the data needed to provide a complete picture of market activity across markets (within jurisdiction and cross-border), asset classes, and customers. The fact that most MAs have not assessed their cross-border surveillance capabilities, combined with the high number of gaps and issues associated with cross-border surveillance, points to likely further data gaps, or at least unassessed risks.

Many MAs have taken significant steps to strengthen their technological capability, in terms of recruitment and training of staff, IT capacity, and use of machine learning and AI to assist with market surveillance. These efforts will need to continue, and to be adequately resourced, in order for regulators to maintain sufficient oversight of securities trading and to ensure the integrity of their markets.

While market surveillance has improved in many aspects since 2013, it will remain a challenge for MAs to keep up with market abuse. As mentioned in the 2013 Market Surveillance Report, the goals of market surveillance are primarily twofold. One goal is to seek to ensure that trading in the given market is fair and orderly. The other goal of market surveillance is to have the ability to detect or uncover market abuse. Both goals help to protect the integrity of the markets and the participants within them. Therefore, IOSCO has long recognized the importance of these goals and will remain important in its role to achieve the following three objectives:

- Protecting investors;
- Ensuring that markets are fair, efficient and transparent; and
- Reducing systemic risk.

To this end, IOSCO's work program includes a focus on addressing new risks in sustainability and fintech. In April 2024 IOSCO launched a new AI workstream to be progressed through the IOSCO Fintech taskforce. This two-year policy initiative aims to ensure the development of a shared understanding among IOSCO members on the issues, risks, and challenges presented by emerging AI technology through the lens of market integrity, financial stability and investor protection. This work will assist IOSCO members in their policy responses to AI developments and will support the ongoing work of MAs to understand and adapt to technological challenges to effective market surveillance.

Jurisdictions should consider the issues of concern and review their own capability to conduct effective market surveillance in light of these, and in the context of their own markets and trading environment.

Jurisdictions with less-complex markets (for example, single venue, low trading volumes, absence of algorithmic trading and HFT) should periodically review developments in their markets to assess whether changes in market conditions or behavior require strengthening of market surveillance capability or capacity.

Annexure 1 – Assessment Methodology and Questionnaire

https://www.iosco.org/members_area/file.cfm?file=members-area\documents\pdf\2023-06-29-AC%20TCMs%20Assessment%20Methodology%20and%20Questionnaire.pdf

Annexure 2 – List of Respondents

1) Comissão do Mercado de Capitais	Angola
2) Comisión Nacional de Valores	Argentina
3) Securities Commission of The Bahamas	Bahamas
4) Comissão de Valores Mobiliários	Brazil
5) Financial Supervision Commission	Bulgaria
6) Alberta Securities Commission, Alberta Ontario Securities Commission, Ontario Autorité des Marchés Financiers, Quebec British Columbia Securities Commission, British Columbia Canadian Investment Regulatory Organization	Canada (joint response)
7) Comisión para el Mercado Financiero (Financial Market Commission)	Chile
8) Croatian Financial Services Supervisory Agency (HANFA)	Croatia
9) Superintendencia de Compañías, Valores y Seguros	Ecuador
10) Financial Regulatory Authority	Egypt
11) Autorité des marchés financiers	France
12) Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin)	Germany
13) Securities and Futures Commission	Hong Kong
14) Securities and Exchange Board of India	India
15) Israel Securities Authority	Israel
16) Commissione Nazionale per le Società e la Borsa (CONSOB)	Italy
17) Jordan Securities Commission	Jordan
18) Capital Markets Authority	Kenya
19) Financial Market Authority Liechtenstein	Liechtenstein
20) Capital Markets & Microfinance Regulation	Malawi
21) Comisión Nacional Bancaria y de Valores	Mexico
22) Capital Market Authority	Montenegro
23) The Dutch Authority for the Financial Markets	The Netherlands
24) Financial Markets Authority	New Zealand
25) Superintendencia del Mercado de Valores	Peru
26) Capital Market Authority	Saudi Arabia
27) Monetary Authority of Singapore	Singapore
28) Financial Sector Conduct Authority / Prudential Authority	South Africa
29) Comisión Nacional del Mercado de Valores	Spain
30) Swiss Financial Market Supervisory Authority (FINMA)	Switzerland
31) Securities and Exchange Commission	Thailand
32) Capital Markets Board	Türkiye

33)	Financial Conduct Authority	United Kingdom
34)	Securities and Exchange Commission	USA
35)	Commodity Futures Trading Commission	USA

Annexure 3 – Participating Jurisdictions’ Market Statistics

Participating Jurisdictions ¹¹⁹	Market capitalization ¹²⁰ (in million USD)	Data from participants’ responses	
		Number of trading venues	Range of products
Angola	1,138.79 ¹²¹	1	Stocks, bonds
Argentina	52,665.87	3	Stocks, bonds
Bahamas	6,490.81	1	Stocks, bonds, derivatives
Brazil	872,652.66	1	Stocks, derivatives
Bulgaria	7,651.59	3	Stocks, bonds, derivatives
Canada	2,862,850.00	3	Stocks, bonds, derivatives
Chile ¹²²	167,707.33	2	Stocks, bonds
Croatia, Republic of	46,860.31	2	Stocks, bonds, exchange traded products
Ecuador	8,124.86	6	Stocks, bonds, securitization, and treasury certificates
Egypt	66,553.23	1	Stocks, bonds, exchange traded products
France	3,374,530.00	4	Stocks, bonds, derivatives
Germany	2,426,500.00	6	Stocks, bonds, derivatives, exchange traded products
Hong Kong	3,858,618.00	2	Stocks, derivatives, exchange traded products
India	4,458,740.00	5	Stocks, bonds, derivatives

¹¹⁹ Highlighted jurisdictions are categorized as less-complex markets.

¹²⁰ Data from Bloomberg database as of 29 February 2024, for equities only.

¹²¹ Data provided by the CMC Angola.

¹²² The cross-border and derivative exposures in Chile represent less than 0.1% of the overall secondary market

Israel	245,537.08	1	Stocks, bonds, derivatives, exchange traded products
Italy	697,826.10	3	Stocks, bonds, derivatives, exchange traded products
Jordan	23,808.46	3	Stocks, bonds, sukuk
Kenya	9,381.11	1	Stocks, bonds, derivatives
Liechtenstein	-	1	Stocks
Malawi	3,363.53	1	Stocks, bonds
Mexico	475,304.19	1	Stocks, bonds, derivatives
Montenegro	-	1	Stocks, bonds
The Netherlands	1,067,990.00 ¹²³	1	Stocks, bonds, derivatives
New Zealand	87,930.26	1	Stocks, bonds, derivatives, exchange traded products
Peru	89,403.89	2	Stocks, bonds
Saudi Arabia	2,994,410.00	4	Stocks, bonds, derivatives, exchange traded products
Singapore	2,994,410.00	2	Stocks, bonds, derivatives
South Africa	281,811.28	4	Stocks, bonds, derivatives, exchange traded products
Spain	967,047.19 ¹²⁴	1	Stocks, bonds, derivatives
Switzerland	2,031,000.00	4	Securities, such as stocks, bonds, derivatives, exchange traded products, etc.
Thailand	472,855.51	2	Stocks, derivatives

¹²³ Data provided by the AFM Netherlands.

¹²⁴ This figure is for the SIBE, including the equity. Not including BME Growth companies listed in other platforms (MTFs).

Türkiye	391,197.89	1	Stocks, bonds, derivatives, exchange traded products, Sukuk
United Kingdom	2,980,690.00	1	Stocks, derivatives
United States of America	53,360,720.00	24 national securities exchanges and 103 alternative trading systems	Securities