

Consultation Report

Market Outages



OICU-IOSCO

**The Board
OF THE
INTERNATIONAL ORGANIZATION OF SECURITIES COMMISSIONS**

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This paper is for public consultation purposes only. It has not been approved for any other purpose by the IOSCO Board or any of its members.

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Foreword

The Board of the International Organization of Securities Commissions (IOSCO) has published this Consultation Report with the aim of identifying lessons learnt from recent market outages and developing good practices for trading venues to improve market-wide resilience in the event of an outage. The Consultation Report focuses on equities listing trading venues, however it may also have relevance to non-listing trading venues and venues where other financial instruments, such as derivatives, are traded.

Feedback to the Consultation Process

IOSCO welcomes input from all stakeholders as part of this consultation process.

Please submit consultation responses to marketoutages-consultation@iosco.org on or before 1 March 2024.

Your comment letter should indicate prominently that it is a *Public Comment on IOSCO's Consultation Report on Market Outages*.

All comments received will be made available publicly unless anonymity is specifically requested. Comments will be converted to PDF format and posted on the IOSCO website. Personal identifying information will not be edited from submissions.

Contents

Chapter		Page
	Executive Summary	5
1	Introduction	7
	(a) Background (b) Project mandate (c) Survey (d) Previous IOSCO work	
2	Legislative and Regulatory Framework	10
	(a) Overview of legislative and regulatory requirements (b) Industry protocols	
3	Key Findings from Recent Market Outages	13
	(a) Market structure (b) Incidents of recent market outages on listing trading venues (c) Causes of market outages (d) Resumption of trading (e) Parts of the trading process affected (f) Closing auctions / closing prices (g) Business continuity plans (h) Communication with the regulator (i) Post-outage response (j) Market outage policies and procedures (k) Impact on market participants (l) Migration of order flow (m) Third-party providers (n) Cross-border / cross-trading venue implications	
4	Good Practices	22
	(a) Outage plans (b) Communication plans (c) Reopening of trading (d) Closing auctions / closing prices (e) Post-outage plans	
5	Conclusion	27
	Annexes	28
	A. Questions for consultation B. List of IOSCO members that completed the survey C. Market outage causes not reported in the survey	

Executive Summary

Market outages occur when a technical problem or an operational issue causes the disruption of trading outright or the orderly trading of a trading venue, leading to the suspension of trading. Market outages can be highly disruptive, particularly if they occur on a listing trading venue, potentially impacting price discovery, market resilience and the integrity of financial markets more broadly. Whilst market outages are rare, their impact on trading venues and other market participants can be significant. Hence, market outages require an appropriate response by trading venues and their regulators.

In June 2022, the Board of the International Organization of Securities Commissions (IOSCO) issued a mandate for the Committee on Regulation of Secondary Markets (Committee 2) to identify lessons learnt from recent outages and whether other regulatory considerations or guidance could be developed to enhance market resilience and to help ensure, to the extent possible, that orderly trading in a market can be maintained throughout an outage. The focus of the market outages mandate is on equities listing trading venues, but the findings of the report may also be of relevance to other trading venues, including non-listing trading venues and derivatives trading venues.

In 2022, Committee 2 developed a survey to gather information regarding recent market outages from its members. The scope of this survey covered market outages in member jurisdictions on equities listing trading venues between 2018 and 2022.

This Consultation Report is based on the information relating to recent market outages collected as part of this survey and it:

- examines lessons learnt from recent market outages on listing trading venues in IOSCO jurisdictions;
- builds on past IOSCO work on operational resilience and business continuity planning to identify good practices for listing trading venues that may enhance market-wide resilience in the event of a market outage; and
- seeks feedback on the lessons learnt and the good practices identified.

To improve market-wide resilience in the event of outages, this Consultation Report proposes that listing trading venues consider adopting the following good practices:

- Establish and publish an **outage plan** with clearly defined roles and responsibilities. The outage plan may include, for example, the trading venue's communication plan, reopening strategy, the arrangements for operating a closing auction and the methodology for providing the market with alternative closing prices;
- Implement a **communication plan**, which provides, through an appropriate communication channel, initial notice (as soon as possible) of the outage to market participants and the general public and, thereafter, with regular updates on the status of the outage and the recovery pathway;
- Communicate information relevant to the **reopening of trading** in a timely and simultaneous manner to all market participants, providing clarity on the status of their

orders and ensuring they receive an adequate period of notice before the resumption of trading. The outage plan may outline the processes and steps involved in the reopening strategy and, where relevant, the pre-opening phase. Such arrangements may interact with existing operational resilience measures, such as trading venues' business continuity and disaster recovery plans;

- Ensure the processes and procedures that trading venues will follow to operate a **closing auction** and/or to establish **alternative closing prices** are published in the outage plan and communicated to all market participants during an outage. Where a closing auction cannot be run at the scheduled time, trading venues may consider various options, including postponing the auction. Trading venues may consider including in the outage plan a cut-off time by which trading venues would inform market participants whether a closing auction will be run. Market participants may likely need an adequate period of notice before the revised commencement of the closing auction. If it is not possible to operate a closing auction, trading venues may consider the use of a pre-defined methodology (as set out in their outage plan) to establish alternative closing prices for the day; and
- Conduct and share with the relevant regulators a lessons-learnt exercise of the market outage and adopt a **post-outage plan**, with clearly defined timelines and allocation of responsibilities for remediation, designed to reduce the likelihood of future incidents and to improve the ability of the trading venue to effectively respond to outages. The lessons learnt exercise could include both a root cause analysis, with remediation actions for those root causes, and the evaluation of the handling of the outage.

Chapter 1 - Introduction

(a) Background

A market outage¹ occurs when the provision of essential services offered by a trading venue – such as order processing, trade execution or the publication of confirmed trades – is disrupted as a result of technical problems or operational issues, leading to a temporary suspension of trading. Often the market outage is caused by a technical problem, but there may be other causes as well. Market outages can be disruptive on any trading venue. However, when they occur on a listing trading venue², they can be more problematic. This is because listing trading venues are usually the most liquid market for the securities they list, and they are often used by a larger and more diverse set of market participants. In addition, a market outage occurring on a listing trading venue that is the sole trading venue available in a jurisdiction can be particularly disruptive.

When a market outage occurs in a jurisdiction that has multiple trading venues, trading could potentially shift to alternative trading venues³. However, the extent to which this may occur is dependent on a number of factors, which are discussed below, especially if the outage happens on a listing trading venue.

Market outages that occur during, or otherwise impact, the opening or closing auctions of a listing trading venue bring additional risk. Without an opening auction to establish an initial price, it is difficult for trading in a security to commence. Closing auctions are widely used for benchmarking purposes, index calculation and pricing derivatives and funds, such as exchange traded funds. Thus, if an outage affects the closing auction, and closing prices cannot be produced, some securities may not be valued correctly, and the pricing of derivatives may also be disrupted. It could also have an impact on clearing and settlement processes.

Market outages occurred on listing trading venues in many of the surveyed IOSCO jurisdictions in recent years. These incidents disrupted the orderly, efficient and transparent functioning of the impacted market for the duration of the outage. Such market outages were accompanied by different approaches taken by the trading venues regarding the coordination and communication of recovery pathways for the impacted market participants.

The resilience of trading venues is vital to the smooth operation of global capital markets. Operational resilience remains one of the key priorities for regulatory authorities globally, and regulators around the world have been implementing legislative and regulatory changes to strengthen operational resilience in the financial services sector. In addition, some IOSCO

¹ In this Consultation Report, the term "market outage" is used to refer to the disruption of trading outright or the orderly trading of a trading venue caused by a technical problem or an operational issue, which leads to the suspension of trading.

² In this Consultation Report, the expression "listing trading venues" is used to refer to trading venues that facilitate secondary trading for the securities that they list. Listing trading venues are normally the most liquid markets in those securities and are often the sole operators of opening and closing auctions for those securities. They may also be referred to as primary exchanges or regulated markets.

³ In this Consultation Report, the expression "alternative trading venue" is used to refer to a trading venue where securities listed on another trading venue in a jurisdiction can be traded, including if or when trading is disrupted on the listing trading venue.

jurisdictions have established regulatory requirements in relation to market outages. These set out the arrangements that trading venues and, in some cases also market participants, are expected to put in place to ensure the resilience and integrity of financial markets during market outages.

(b) Project mandate

In June 2022, the IOSCO Board approved a mandate for Committee 2 to identify lessons learnt from recent market outages and whether other regulatory considerations or guidance could be developed that would be helpful for improving market-wide resilience and to help ensure, to the extent possible, that orderly trading in the market can be maintained throughout an outage. The project mandate noted that previous IOSCO reports have addressed market outages, but mainly from the perspective of managing risks to critical systems and business continuity planning.

This Consultation Report considers market outages from a market-wide resilience perspective. It builds on previous IOSCO reports, discussed below, which analysed the risks and circumstances that may lead to a market outage from an operational resilience perspective.

(c) Survey

The survey covered the period between 2018 and 2022 and included questions relating to: (i) recent market outages on listing trading venues, (ii) the rules and practices applicable to market outages in different jurisdictions, (iii) organisational requirements applying to trading venues and (iv) arrangements applying to market participants in an event of an outage.

Annex B to this report contains a list of the 24 IOSCO regulatory authorities that completed this survey.

(d) Previous IOSCO work

IOSCO has previously considered issues related to market outages and recommended mitigating actions⁴. For example, in July 2022, IOSCO published a report entitled *Operational resilience of trading venues and market intermediaries during the COVID-19 pandemic & lessons for future disruptions*⁵. This work focused on operational resilience during the COVID-19 pandemic and identified instances of trading venue closures that were not related to technological issues or business continuity planning failures.

The 2015 IOSCO Report on *Mechanisms for Trading Venues to Effectively Manage Electronic Trading Risks and Plans for Business Continuity*⁶ provided an overview of the steps trading venues might take to manage electronic trading risks to mitigate disruptions, including market outages.

⁴ At the February 2021 IOSCO Board meeting, operational resilience was identified as a Board priority.

⁵ [IOSCO Final Report \(FR06/22\): Operational resilience of trading venues and market intermediaries during the COVID-19 pandemic & lessons for future disruptions \(July 2022\)](#)

⁶ [IOSCO Final Report \(FR31/2015\) Mechanisms for Trading Venues to Effectively Manage Electronic Trading Risks and Plans for Business Continuity \(December 2015\)](#)

Finally, the *Thematic Review on Business Continuity Plans with respect to Trading Venues and Intermediaries*, published in 2021⁷, highlighted that in some jurisdictions, trading venues are required to perform stress tests to verify the performance of their systems. Further, these trading venues are required to identify the scenarios under which their trading system or component parts can continue to perform during systems failures and outages.

⁷ IOSCO Final Report (FR03/21): Thematic Review on Business Continuity Plans with respect to Trading Venues and Intermediaries. (May 2021)

Chapter 2 – Legislative and Regulatory Framework

(a) Overview of legislative and regulatory requirements

All surveyed jurisdictions reported to have frameworks, including regulations, rules and guidance, which relate to business continuity, disaster recovery, operational resilience, notification requirements, and operational systems and controls. These requirements usually apply to all trading venues (including listing trading venues) and across multiple financial instruments (including equities).

Generally, operational resilience refers to the ability of trading venues and other market participants to prevent, respond to, recover and learn from operational disruptions. Operational resilience remains one of the key priorities for regulators around the world, as well as international organisations and global standard setting bodies, including IOSCO. As such, most jurisdictions have published regulatory requirements, including rules, principles and/or guidance applying to listing trading venues in relation to business continuity and operational resilience.

For example, in 2019 the Securities Commission of Malaysia (SC) published its Guiding Principles of Business Continuity to ensure the continuation of critical services and to mitigate any possible wider systemic risk in the event of disruption. In 2022, the Australian Securities and Investments Commission (ASIC) issued new market integrity rules intended to promote technological and operational resilience of market operators and participants. In the United Kingdom (UK), new regulatory rules and guidance came into force in 2022, which aim to ensure that the important business services offered by listing trading venues operate with sufficient resilience to enable them to be delivered despite operational disruptions.⁸ Going forward, third parties designated as critical third parties will become subject to joint oversight by the relevant UK regulatory authorities in order to strengthen the resilience of services and to mitigate potential systemic risk.⁹ In the European Union (EU), the Regulation on Digital Operational Resilience (DORA) entered into force in 2023, with the aim to achieve a high common level of digital operational resilience by creating a harmonised regulatory framework to strengthen the information and communication technology security of financial entities, including trading venues.¹⁰

Some regulatory authorities have also implemented regulatory guidance specifically in relation to market outages. Collectively, these set out regulatory expectations for trading venues (and, in some cases, for market participants) in the event of a market outage. This guidance covers, for example, how trading venues should communicate with market participants if an outage occurs, and the steps they should take to reopen trading. For example, in 2021 ASIC published its expectations for industry in responding to market outages, with the aim of supporting the resilience and robustness of the Australian equity market.¹¹ In 2023, the European Securities

⁸ UK FCA Policy Statement on Building Operational Resilience (PS21/3)

⁹ Financial Services and Markets Act 2023

¹⁰ DORA entered into force on 16 January 2023 and will apply from 17 January 2025.

¹¹ [REP 708 ASIC's expectations for industry in responding to a market outage](#)

and Markets Authority (ESMA) published its Opinion on market outages.¹² This Opinion provides guidance on the requirements that EU national competent authorities should require trading venues to have in place to deal with market outages events. In 2023, the UK's FCA established an industry-led committee to develop good practices for trading venues and other market participants to improve market-wide resilience during outages.¹³ In 2023, the Securities and Exchange Board of India (SEBI) issued standard operating procedures which outline regulatory requirements in relation to extending trading hours in the event of outages.¹⁴

(b) Industry protocols

In 2022, the trade association for European exchanges – the Federation of European Securities Exchanges (FESE) – published industry-wide standard protocols with the aim of harmonising communication and outage procedures. As part of this industry-led initiative, FESE established 10 Principles for an Industry-wide Standard Protocol in Equity Markets (FESE Principles).¹⁵ The FESE Principles cover playbooks, market notices, market status, reopening, closing prices and post-outage analysis. FESE has also published outages protocols for fixed income and exchange-traded derivatives markets.

The FESE Principles have been adopted by 35 European exchanges. Whilst widely accepted, the FESE Principles have not been endorsed by national regulators. Since the publication of these Principles, FESE members have been developing and publishing individual playbooks on outage protocols. The FESE website includes a centralised database for all available playbooks.¹⁶

Table 1 summarises the existing legislative and regulatory frameworks that apply to market outages in relevant IOSCO jurisdictions.

¹² [ESMA Final Report on market outages](#)

¹³ [FCA Policy Statement 23/4: Improving Equity Secondary Markets](#) (Chapter 4 – Our response to feedback on improving market-wide resilience during outages). In due course, the FCA will consider whether to confirm this guidance. If confirmed, the FCA will take this industry guidance into account when exercising its regulatory functions.

¹⁴ [SEBI Standard Operating Procedure for handling of Stock Exchange Outage and extension of trading hours thereof](#)

¹⁵ FESE, [Trading Venue Outages: A framework for industry-wide standard protocols in equity markets](#) (January 2022)

¹⁶ FESE, [Exchange playbooks on outage protocols](#)

Table 1: Overview of the legislative and regulatory framework governing market outages in the surveyed IOSCO jurisdictions

Legislative framework				
<i>Not specifically focused on listing venues – applies to all trading venues and across multiple instruments</i>				
Business continuity / disaster recovery	Systems resilience / adequate capacity	Monitoring for system disruptions	Obligation to notify regulator	Recovery time objectives
Regulatory requirements				
<i>Specific to market outages</i>				<i>On business continuity and operational resilience</i>
<p>ASIC expectations for industry in responding to market outages (REP 708)</p> <ul style="list-style-type: none"> Sets out expectations for market operators, market participants and large institutional investors. 	<p>ESMA Opinion on market outages</p> <ul style="list-style-type: none"> Sets out the steps trading venues should take to reopen trading in an orderly manner. The guidance covers outage plans, communication during an outage, reopening of trading, closing auctions and reference price. 	<p>FCA Policy Statement on Improving Equity Secondary Markets (PS23/4)</p> <ul style="list-style-type: none"> Confirms the establishment of an industry-led committee with the aim of developing good practices for trading venues and other market participants during an outage. 	<p>SEBI Standard Operating Procedure for handling of Stock Exchange Outage and extension of trading hours thereof</p> <ul style="list-style-type: none"> Sets out expectations for reporting requirements, trading on unaffected segments / exchanges, resumption of trading and extension of trading hours. 	<p>ASIC – Market integrity rules for technological and operational resilience</p> <p>FCA – Operational resilience requirements applying to UK Recognised Investment Exchanges</p> <p>MAS – Guidelines on Business Continuity Management</p> <p>SC – Guiding principles on business continuity</p> <p>SEBI – Guidelines for BCP/DR of Market Infrastructure Institutions</p>
Industry protocols				
<i>Regulator-endorsed industry guidance</i>		<i>Federation of European Securities Exchanges (FESE) framework for industry-wide standard protocols for trading venue outages in equity markets</i>		
No specific industry guidance appears to have been endorsed by regulators.		<ul style="list-style-type: none"> 10 Principles adopted by 35 European exchanges Covers, for example, playbooks, market notices, market status, reopening, closing prices, post-mortem analysis. 		
Trading venue playbooks				
Produced by trading venues and governs how incidents will be managed. Often part of the broader BCP/DRP procedures and not specific to market outages. May not be publicly available.				

Chapter 3 – Key Findings from Recent Market Outages

The IOSCO survey sought information relating to market outages on listing trading venues that occurred between 2018 and 2022.¹⁷ Whilst the survey focused on the causes, impact and responses to recent market outages, it also asked questions about the organisational requirements and arrangements of trading venues and market participants. To complete the survey, IOSCO members sought input from trading venues within their jurisdiction, or alternatively, provided responses based on recently gathered information and perspectives from these trading venues.

(a) Market structure

The majority of the jurisdictions surveyed have between two and seven listing trading venues.¹⁸

Less than half of jurisdictions have alternative trading venues operating within their borders. In some cases, alternative trading venues may be available in foreign jurisdictions, meaning in jurisdictions other than where the listing trading venue is located. In some jurisdictions, where there is more than one listing trading venue, alternative trading venues may not be available for each of the listing trading venues or for each security listed.

(b) Incidents of recent market outages on listing trading venues

Respondents to the survey reported 42 market outages on listing trading venues between 2018 and 2022. The highest number of outages was reported in 2018, with 16 outages. Since then, the yearly number of outages decreased. In 2022, only three outages were reported. The jurisdiction with the greatest number of outages reported six events, and the jurisdiction with the second highest number of outages reported five events, including four on the same trading venue. Around a third of jurisdictions surveyed did not experience a market outage on their listing trading venue(s) between 2018 and 2022.

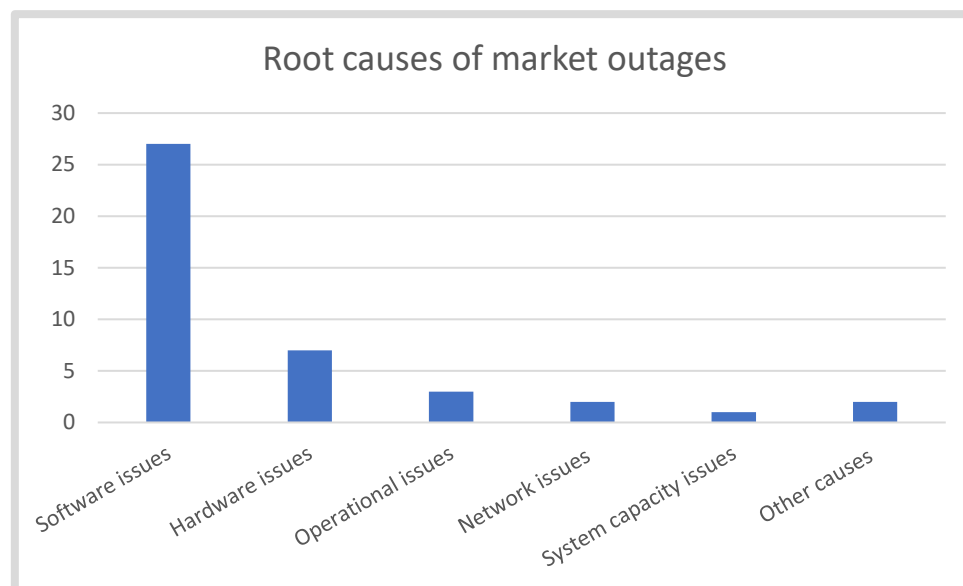
(c) Causes of market outages

Table 2 below demonstrates the different root causes of market outages on listing trading venues reported in the surveyed IOSCO jurisdictions between 2018 and 2022. The main causes of market outages were software and hardware issues, with some jurisdictions reporting more than one root cause for the same event. For example, several incidents were caused by a combination of hardware and software issues.

¹⁷ The findings in Chapter 3 are based on the survey responses from 24 regulatory authorities.

¹⁸ Some jurisdictions have only one listing trading venue, and one jurisdiction does not have any listing trading venues.

Table 2: Root causes of market outages on listing trading venues reported in the surveyed IOSCO jurisdictions between 2018 and 2022



Software issues

The majority of market outages were caused by software issues. Examples of software issues include a failed software release rollout, an unexpected and invalid instruction submitted by an exchange member, and a delayed restart of the system following scheduled maintenance.

Hardware issues

Examples of hardware issues include a failure in a central storage appliance of the trading system, a memory module failure leading to the failure of an automated switch to a back-up device, and a faulty hardware causing a power outage. Whilst hardware issues were identified as the root cause in several instances, there are other examples where a combination of software and hardware issues were involved.

Operational issues

Examples of operational issues include an incident where a data center service vendor mistakenly allowed access to third parties, which resulted in the disconnection of servers and telecommunications equipment by those third parties. In one case, a securities pricing error was introduced late in the development cycle, which was not identified in testing.

System capacity issues

Whilst not frequent, system capacity issues were another root cause. In one case, a large increase in messages congested the trading system, leading to connectivity issues and the system being unable to process the increased number of messages in real-time.

Network issues

Network issues were identified as another root cause by some survey respondents. In one case, an outage occurred during preparations for the launch of a new trading venue.

Other causes

This category includes market outages caused by issues other than those identified above. These included, for example, market outages caused by a false fire alarm and a real fire incident.

(d) Resumption of trading

The timing of outages was generally spread throughout the day, with a slight concentration in the morning. Outages were not more prevalent in the opening or closing of a trading session than any other time. Most trading venues resumed trading activities within the same trading session using the primary site. When this did not occur, the reasons identified included:

- backup facilities exhibiting similar issues;
- more time required for problem investigation and resolution; and
- concerns over market readiness for the resumption of trading.

In some instances, trading was resumed on the next business day. Regardless of the extent of the interruption, opening (or re-opening) call auctions were usually used to resume trading in accordance with trading venues' outage protocols and guidelines.

(e) Parts of the trading process affected

Market outages affect different parts of the trading cycle, including order entry and matching, participant connectivity, pre- and post-trade transparency, and post-trade processes (e.g., clearing and settlement). In most cases, all parts of the trading process were affected. However, in some instances the impact of the outage was limited to the directly affected trading segments due to segregated platform modules.

(f) Closing auctions / closing prices

Survey responses suggest that where trading was affected by a market outage, the production and update of associated indices, benchmarks, and reference prices in the relevant asset classes were also interrupted for the duration of the outage.

Where a closing auction could not be held because of an outage, several trading venues used the last traded price (established during continuous trading prior to the outage) as the closing price. Some jurisdictions noted that third-party index providers have published procedures for determining reference prices during market outages, often using the last traded price instead of closing auction data. There have also been instances of trading venues using the mid-point of the best bid/offer price immediately before the outage as the closing price.

In some jurisdictions with multiple trading venues, more complex procedures and methodologies have been developed to determine a closing price in the event of a market outage. For example, in the United States of America, which has consolidated tapes for listed equity markets data, some exchanges have additional contingency procedures, whereby an alternate exchange may be designated to determine the official closing price.

In certain cases, trading venues in the United States of America and Canada have developed protocols to establish an alternative closing price, which may include the use of volume-weighted average prices within a specified time window, the consolidated last-sale, or the closing price for a security on the last day in which it traded on the applicable exchange.

Several other jurisdictions indicated that they determine the closing price on a case-by-case basis, depending on their assessment of each incident.

(g) Business continuity plans

Business continuity plans (BCP) are crucial to help ensure the effective management of any disruption. All jurisdictions reported having requirements for trading venues to have a BCP in place with defined policies and procedures to follow. Many jurisdictions also require trading venues to have a disaster recovery site in a separate geographical location in the event of an operational failure of the primary trading system.

Some jurisdictions reported that their listing trading venues conduct regular rehearsals with market participants on contingency scenarios (including market outages), and that these exercises have proven to be useful in preparing the market for trading disruptions and enhancing market resilience.

(h) Communication with the regulator

It is common practice for market outages to be broadly communicated to market participants. Survey responses indicate that real-time market notices are frequently used for this purpose. In addition, trading venues typically have an obligation to notify their regulator of market outages. In all instances, the relevant regulator was notified immediately via email or telephone calls, in accordance with the listing trading venue's notification obligations. In some instances, where the outage had a cross-border impact, relevant foreign regulators were notified as well.

(i) Post-outage response

Most jurisdictions conduct a post-mortem or lessons learnt analysis following market outages. Depending on the jurisdiction, these were conducted by trading venues, the regulator or independent third parties. The reports containing the underlying analysis and any identified

remedial action or recommendations put forward by the national regulator were published in only a few jurisdictions.

(j) Market outage policies and procedures

Trading venues have various monitoring tools and methodologies designed to detect system disruptions on an ongoing basis. These include dedicated teams, systems and tools for monitoring possible issues related to hardware, software, network connectivity and trading activities. Where an incident was identified, trading venues generally conducted an initial assessment of the incident to determine its scope and impact.

Trading venues typically have policies and procedures they must follow in the event of a market outage. These procedures may include incident response playbooks, procedure handbooks, BCPs, disaster recovery plans and incident management plans. The application of these policies and procedures depends on the nature and severity of the incident. Several trading venues have established a disaster recovery site in a separate geographical location to the primary site as part of their disaster recovery plans. This is designed to allow them to continue trading operations in the event of an operational failure affecting the primary trading facility or site.

In addition, trading venues disseminate information concerning market outages through their standard communication protocols, which may be required by regulation or by industry convention. The information typically disseminated includes the nature and impact of the incident, proposed mitigation actions and the anticipated duration of the incident before the resumption of trading.

In the event of a market outage, trading venues will generally try to restart trading as soon as it is practicable to do so. Survey respondents noted the importance of trading venues communicating promptly to market participants on the status of their orders, and how they propose to resume operations in an orderly and controlled manner. The timing of the resumption of trading (e.g., intraday or next day) depends on when the cause of the trading suspension is resolved and how confident the trading venue is to safely reopen the market. For market pre-opening phases, trading venues generally follow specific procedures to ensure a fair and orderly market re-opening, which, among other things, considers mitigating risks associated with members' access to, and management of, open orders.

Most jurisdictions with multiple trading venues support efforts to facilitate the continuity of trading in the event of one trading venue experiencing a market outage. This is sometimes achieved by developing industry protocols that foster the routing of orders to operational trading venues while minimising the issues arising from market fragmentation.¹⁹

(k) Impact on market participants

Listing trading venues generally account for the largest market share in terms of number and volume of executed transactions and are often used by a larger and more diverse set of market participants. Some survey responses suggest that listing trading venues are generally perceived to be leading the price discovery process, which means that the absence of a price formed on

¹⁹ See for example ASIC's expectations for industry in responding to a market outage (Chapter entitled Expectations of large institutional investors).

the listing venue negatively affects liquidity in other markets as there is greater uncertainty about the fair price of affected instruments. This may have adverse consequences for market participants, such as wider bid-offer spreads or smaller trade execution volumes.

Survey responses suggest that the impact of an outage on market participants depends on the specific circumstances of each case and the root cause of the event. A market outage may have a range of potential consequences for market participants. These include:

- Uncertainty around whether orders had been filled, partially or fully, on the trading venue affected by the outage, sometimes preventing market participants' ability to use an alternative trading venue;
- Lack of liquidity, concerns about price formation and reliability of market data, and the consequent difficulty to fulfil best execution obligations;
- Difficulties in commencing the trading in an instrument in the absence of an opening auction to establish an initial price;
- Lack of a closing auction, which deprives market participants of a reference price which plays an important role in pricing benchmark trades and valuing funds;
- Adverse consequences for derivatives trading and benchmarking activities due to the inability to obtain reliable pricing for the underlying securities;
- Higher volatility upon the resumption of trading;
- The impact on clearing due to processing delays and potential margin calls caused by higher volatility; and
- Reputational issues for the impacted trading venue and the financial market more broadly.

(1) Migration of order flow

To maintain market resilience and integrity, facilitating the continuity of trading is a key issue for jurisdictions with alternative trading venues. Strategies, such as the creation of links between trading venues or market participant connectivity to multiple trading venues, may help ensure trading can continue in the event of an outage, thus allowing for continuous trading and accurate pricing of securities throughout the trading day. On the other hand, switching from one trading venue to another may require enhanced technical capabilities, which could result in increased costs for market participants. This may create a disincentive to connect to multiple trading venues for some market participants.

Most jurisdictions do not impose specific obligations on market participants to connect to alternative trading venues in the event of a market outage on a listing trading venue, even where those trading venues form part of the market structure. However, where alternative trading venues are available, market participants – particularly larger ones – are often already connected to those trading venues. This may occur in several ways, including:

- Alternative connectivity arrangements, such as direct membership in two or more trading venues;

- Direct market access or straight through processing via another market participant; or
- Using the intermediation of another market participant with trading access to / membership in the alternative trading venue.

IOSCO members identified four scenarios regarding migration of order flow during a market outage:

- There were no alternative trading venues to which orders could migrate;
- Alternative trading venues were available, but there was only limited or no order flow migration;
- Material order flow migrated to alternative trading venues; or
- It was not possible to quantify how much trading migrated to alternative trading venues (for some jurisdictions operating within a cross-border environment, for example the EU), since trading that migrated to alternative trading venues was under the oversight of another regulatory authority.

Some of the jurisdictions surveyed have alternative trading venues operating within their borders. These are trading venues where securities listed on another trading venue can be traded, including if or when trading is disrupted on the listing trading venue.

In a few jurisdictions, regulators expect market participants to have arrangements in place to continue submitting orders to alternative trading venues during a market outage on the listing trading venue. There is also an alternative approach whereby market participants are not required to connect to alternative trading venues, but they are subject to a more general obligation to have in place policies and procedures setting out the steps to take in case of a market outage, including how to achieve the best execution of client orders. Continuity of trading during a market outage is also generally part of a market participant's operational resilience arrangements. In jurisdictions where a consolidated tape in equities is available, there appeared to be more significant migration to alternative trading venues. This appears to suggest that a consolidated tape might assist with the resiliency of markets by providing a trusted source of pricing which enables continuity of trading when there is an outage on a listing trading venue. In addition, material migration of order flow is generally supported when alternative trading venues are interconnected.

However, in the majority of jurisdictions that provided feedback, even where alternative trading venues were available, they contributed only to a limited extent in mitigating the effects of market outages. There may be a number of reasons for this, including:

- In the absence of a price formation on the listing trading venue, liquidity in the entire market – including on alternative trading venues – may be affected;
- Differences in, or limitations on, the capabilities of market participants to connect, or divert order flows, to alternative trading venues;
- Market participants lacking adequate information from the listing trading venue about the status of their orders;

- Uncertainty about the fair price of the affected instruments, and market participants being cautious about relying on “stale” prices;
- Differences in or limitations on order types on alternative trading venues;
- Coordination problems affecting the ability of alternative trading venues to gather liquidity. For example, trading on an alternative trading venue is not a viable alternative if only a fraction of market participants does the same; and
- Market participants not submitting client orders to alternative trading venues due to uncertainty around the application and interpretation of best execution policies and arrangements during market outages.

(m) Third-party providers

Trading venues often rely on third-party service providers’ data and software to carry out critical functions on their behalf, such as members’ connectivity to trading venues, the operation of the matching engine and the determination of closing and settlement prices. If a system disruption affects any critical function operated by a third-party provider, this may result in a market outage.

The majority of survey respondents noted that they evaluate the risks related to operational processes and the provision of third-party services, as well as those related to the protection of data. One respondent conducted, together with an external independent technology consultant, a comprehensive review of the listing trading venue’s IT infrastructure and systems to strengthen its in-house technology capabilities and risk management framework. As a result, the trading venue improved its testing capabilities and alert monitoring.

Other respondents noted that following market outages in their jurisdictions, trading venues put in place mitigating actions to improve the monitoring of technical issues.

(n) Cross-border / cross-trading venue implications

Survey responses indicate that market outages did not appear to have cross-border causes and that they had limited cross-border impact.

In one instance, the outage had some cross-border impact due to the underlying securities being traded in a different jurisdiction through the use of depositary receipts. Given the use of arbitrage strategies, in such instances an outage in one jurisdiction might affect price formation in both markets. In this instance, the relevant foreign exchange was notified about the trading interruption in the relevant instruments.

There may be cross-trading venue implications where trading venues share the same internal trading infrastructure. There were also instances, however, where an outage on a trading venue impacted another trading venue using a different trading infrastructure. This may occur if a link exists between the two trading venues. For example, when the equity market experiences an outage, the related derivatives market could also be affected.

Survey responses suggest that listing trading venues publicly communicated market outages – via their website, status updates and market notices – to all market participants, regardless of

their geographical location. There was also evidence that regulatory authorities from different jurisdictions were engaged when there was a link between the listing trading venue experiencing the outage and trading venues operating in another jurisdiction. This may occur, for example, where entities in the same exchange group operate in different jurisdictions.

Chapter 3 – Questions for consultation

Question 1: Do you agree with the key findings and/or do you think there are additional aspects of recent market outages that have not been captured?

Chapter 4 - Good Practices

Building on previous IOSCO work on operational resilience and business continuity²⁰, and the key findings from recent market outages, IOSCO has identified five good practices for trading venues to consider adopting that may improve market-wide resilience during outages.

IOSCO seeks feedback on these good practices. These are intended to allow for sufficient flexibility in their application across different jurisdictions and trading venues. Subject to domestic legal and regulatory requirements, it is within individual trading venues' discretion whether, and if so, how to implement these good practices.

IOSCO recognises that market outages could occur as a result of different causes, some of which may not have been evidenced by the survey responses. Annex C to this Consultation Report identifies three such additional causes, namely cyber-attacks, natural events and technical disruptions caused by reliance on a small number of third-party providers delivering key functions and services. Given these causes did not lead to market outages in the surveyed jurisdictions between 2018 and 2022, the Consultation Report does not capture any key findings relating to them. However, IOSCO recognises that the good practices may also be relevant to these causes as well as those identified in the survey responses. Therefore, IOSCO also seeks feedback on the applicability of these good practices to other causes of market outages not covered in this Consultation Report.

(a) Outage plans

Where trading venues have effective playbooks and outage plans in place, this provides market participants with certainty about the steps that trading venues will take in the event of an outage. This, in turn, could improve confidence and resilience in the market. IOSCO has identified the following good practices that trading venues could consider adopting:

- **Establishing an outage plan**, including the key steps and actions trading venues will take during an outage to ensure resumption of trading. The content of the plan may include, for example, communication protocols and procedures, the strategy for reopening, the arrangements for operating a closing auction and the methodology used for establishing alternative closing prices (where closing auctions do not take place), and the treatment of submitted orders.
- **Publishing the outage plan** on the trading venues' website to ensure it is available to all market participants and the public at large. Where this is not possible, trading venues could consider other ways to make the outage plan available to their members and market participants.
- **Outlining the governance arrangements** for the outage plan. This could include, for example, assigning roles and responsibilities, escalation procedures and training requirements.

²⁰ In FR31/2015, IOSCO identified a number of sound practices related to BCPs. As part of this, IOSCO asked trading venues to consider including in their BCP "clear and comprehensive communication protocols and procedures for both external and internal communications" and "testing the operation of the BCP on a periodic basis".

- **Regular review and testing of the outage plan** to help ensure that it remains effective. This may include regular scenario planning and stress testing of potential outages and the trading venue’s response, as well as regular testing of the communication protocols used in the event of an outage.

(b) Communication plans

The survey results highlighted the importance of clear, informative, and frequent market communications by trading venues in the event of an outage. This is considered key to help maintain, to the extent possible, orderly trading conditions and to allow market participants to take appropriate steps to manage related risks for their activity, for example by re-directing their order routing systems to alternative trading venues. In particular, trading venues may consider:

- **Formally setting out their communication plan** to be implemented in the event of an outage, including how and to whom information will be communicated, and the content of that communication.
- **Publishing an initial notice about the outage** as soon as possible and using a communication channel – such as the trading venues’ website – that is most likely to reach the widest audience, including all market participants and the public at large. This initial notice may include, for example, information about the nature of the outage (e.g., details around the market participants, trading processes and financial instruments affected), a link to trading venues’ playbook and/or outage plan, the system status, the estimated time and method of re-opening, the orderbook status, and the expected key milestones and deadlines (e.g., the cut-off time for announcing whether a closing auction will be held). Given the initial notice may need to be provided immediately, it is unlikely that all relevant information will be available for dissemination in the initial notice. Where elements are not immediately known, these may follow in the update notices as soon as they become available.
- **Providing regular updates** to all market participants and the public at large, using the same communication channel, at pre-defined time intervals or when new relevant information becomes available. The updates may include, for example, information about the status of submitted orders, the estimated time and method of re-opening and the cut-off times by which information will be communicated, and the methodology used for establishing alternative closing prices.
- **Maintaining specific communication channels** throughout the duration of the outage, where deemed appropriate. For example, this could include communication channels with affected market participants and interconnected market infrastructures – including other market operators within the same group – to mitigate the impact of the incident.

(c) Reopening of trading

Ultimately, the objective of the outage plan is to set out the trading venue’s strategy for reopening, once the issue causing the outage has been identified and resolved. Trading venues

may also need to consider their wider operational resilience arrangements, such as their BCP and disaster recovery plans, to determine their approach to the resumption of trading.

Reopening of trading may start as soon as it is safe to do so, provided trading venues can operate their markets in a fair and orderly manner. There are a number of factors that trading venues may need to consider before trading resumes. The main elements that may be considered as part of reopening include: (i) reopening strategy, (ii) assessment, (iii) communication; and, where relevant, (iv) pre-opening phase.

- **Reopening strategy:** Trading venues' reopening strategy may be set out in their outage plan. This may include, for example, their approach to any pre-opening phase and how orders will be managed prior to reopening. Trading venues may also consider the amount of time market participants may need to ensure that they are ready for reopening, taking into consideration relevant factors, such as the nature and severity of the outage, the type of trading system used, and the asset classes traded.
- **Assessment:** Trading venues may wish to establish certain criteria or thresholds which must be met before reopening can occur. For example, the criteria may include the number of participants connected, or the percentage of historical trading reflected in connected participants.

Trading venues may also wish to consider whether there remains sufficient time during the trading day to allow for a certain, minimum period of time for full market trading to recommence. If, upon a positive assessment to reopen, there is insufficient time left to resume trading, trading venues may consider extending the trading hours or postponing the closing auction.

Prior to resumption of trading, market participants would also likely need clarity on the status of their orders.

- **Communication:** Clear communication about reopening is important to market participants and the public at large. Market participants would likely need to receive an appropriate period of notice prior to the resumption of trading. Trading venues may consider how to communicate information about reopening in a timely manner, and to all market participants simultaneously. This may include, for example, the time of reopening and, where relevant, information about the pre-opening phases, closing auction and the extension of trading hours.
- **Pre-opening phase:** Prior to the reopening of trading, trading venues may consider whether market participants are able to access the market and the status of their orders. One way of doing this, depending on the trading system used, is to include a pre-opening phase before the resumption of trading. Where trading venues decide to include a pre-opening phase, information about this phase could be published via an appropriate communications channel that is accessible to all market participants.

(d) Closing auctions / closing prices

The closing price established in the closing auction is crucial to the proper functioning of financial markets. It is an important benchmark that is used by market participants for a number of purposes, including fund accounting, index valuation, determining end of day net asset values, benchmark trading, and managing trading risk. For some, the closing price is of crucial

importance as it is employed as a reference for contractual obligations, including determining fair value for derivatives instruments, indices, and exchange traded funds.

In the event of a market outage occurring on a trading venue that establishes the closing price for a security, it is important to determine whether the trading venue's ability to provide a closing price would be impacted and, if so, how the market would be provided with alternative closing prices. This would help maintain investor confidence and market transparency. Trading venues that establish closing prices may consider adopting the following good practices:

- **Outage plan:** Trading venues' pre-determined arrangements for the operation of the closing auction (including, for example, the postponement of the closing auction and the latest time it may be run), as well as the methodology used for the provision of alternative closing prices may be considered as part of the outage plan. It may be useful to have this information available to market participants and the public at large before an outage happens.
- **Communication:** Trading venues may consider arrangements in relation to the closing auction and the methodology used for establishing alternative closing prices, and how to clearly communicate such arrangements to all market participants during the outage. Consideration of how market participants could receive an appropriate period of notice before the commencement of the closing auction may also be useful.
- **Closing auction:** Closing auctions and the establishment of closing prices may need to be prioritised. Where a closing auction cannot be run at the scheduled time, trading venues may need to consider postponing the closing auction before cancelling it. Certainty about the latest time that trading venues may run a closing auction or establish a closing price is crucial for market participants. Therefore, setting out the cut-off time in the outage plan, and communicating this to all market participants and the public at large during the outage may be an important consideration.
- **Alternative closing prices:** If the operation of a closing auction is not possible, trading venues may need to consider how to ensure the market is provided with alternative closing prices. This may include a designated alternative trading venue determining the closing prices should contingency procedures provide for this. Trading venues may also consider setting out a methodology for the establishment of alternative closing prices in the outage plan.

(e) **Post-outage plans**

After an outage, conducting a lessons learnt exercise – or post-mortem analysis – can help trading venues identify the root cause of the outage, evaluate the effectiveness of their response to the incident, and identify any potential areas for improvement.

Applying lessons learnt from outages is important to drive continuous improvements and to build trust and confidence with market participants and regulators. In this context, the lessons learnt exercise may need to cover several distinct areas including the root cause analysis, with remediation of those root causes, an evaluation of the effectiveness of the handling of the outage, and identification of any areas for improvement. The lessons learnt exercise and any subsequent remediation plan could reduce the likelihood of future outages and improve the ability of trading venues to effectively respond to and recover from future outages.

The lessons learnt exercise may include a detailed analysis of what went well and what could be done differently in the event of future outages. This could cover, for example, the evaluation of the effectiveness of the outage plan, communication protocols, reopening strategy, and the operation of the closing auction. It could also consider the effectiveness and the speed of decision making and the market impact, as well as feedback from market participants. Following this exercise, trading venues may consider sharing the post-mortem analysis with the relevant regulators, and putting in place a remediation plan with clearly defined timelines and allocation of responsibilities.

Market participants may also be invited to provide feedback to the trading venue in order to improve the trading venue's response to outages going forward.

Chapter 4 – Questions for consultation

Question 2: Do you agree with the good practices that IOSCO recommends for trading venues? If not, please explain why and provide further information.

Question 3: Are there any other good practices that could be considered?

Question 4: Do you agree that these good practices could also be useful for addressing other causes of market outages, such as those set out in Annex C? If not, please explain why and/or provide further information on what additional good practices may be relevant to these.

Chapter 5 - Conclusion

Market outages – particularly if they occur on a listing trading venue – can be highly disruptive, impacting price discovery and market resilience, and undermining the integrity of financial markets more generally. Previous IOSCO reports addressed disruptions, but mainly from the perspective of managing risks to critical systems and business continuity planning.

This Consultation Report identifies key findings from recent market outages and puts forward five good practices for trading venues to consider adopting to improve market-wide resilience during an outage. These good practices may assist regulators, trading venues and market participants in preparing for, and managing, future market outages and thereby help improve market-wide resilience.

Therefore, IOSCO invites comments on the consultation questions in this Consultation Report with the ultimate objective of encouraging trading venues to consider adopting these good practices.

Annexes

A. Questions for consultation

Question 1	Do you agree with the key findings and/or do you think there are additional aspects of recent market outages that have not been captured?
Question 2	Do you agree with the good practices that IOSCO recommends for trading venues? If not, please explain why and provide further information.
Question 3	Are there any other good practices that could be considered?
Question 4	Do you agree that these good practices could also be useful for addressing other causes of market outages, such as those set out in Annex C? If not, please explain why and/or provide further information on what additional good practices may be relevant to these.

B. List of IOSCO members that completed the survey

Regulatory authority		Jurisdiction
The Dutch Authority for Financial Markets	AFM	Netherlands
Autorité des marchés financiers	AMF	France
Australian Securities and Investments Commission	ASIC	Australia
Bundesanstalt für Finanzdienstleistungsaufsicht	BaFin	Germany
Capital Market Authority	CMA	Kuwait
Capital Markets Authority	CMA	Saudi Arabia
Capital Markets Board	CMB	Turkey
Comisión Nacional Bancaria y de Valores	CNBV	Mexico
Comisión Nacional del Mercado de Valores	CNMV	Spain
Commissione Nazionale per le Società e la Borsa	CONSOB	Italy
Comissão de Valores Mobiliários	CVM	Brazil
Dubai Financial Services Authority	DFSA	Dubai
Financial Conduct Authority	FCA	United Kingdom
Swiss Financial Market Supervisory Authority	FINMA	Switzerland
Financial Supervisory Authority	FSA	Romania
Finansinspektionen	FSA	Sweden
Financial Services Regulatory Authority	FSRA	Abu Dhabi
Japan Financial Service Agency	JFSA	Japan
Monetary Authority of Singapore	MAS	Singapore
Ontario Securities Commission	OSC	Canada
Securities Commission Malaysia	SC	Malaysia
Securities and Exchange Board of India	SEBI	India
Securities and Exchange Commission	SEC	United States of America
Securities and Futures Commission	SFC	Hong Kong

C. Market outage causes not reported in the survey

The survey identified several technical and operational causes, which led to market outages on equities listing trading venues in the surveyed jurisdictions between 2018 and 2022. The survey responses were used to identify key findings from recent market outages and to propose good practices that trading venues could consider adopting to improve market-wide resilience in the event of future outages.

Nevertheless, IOSCO recognises that there may be other causes that were not identified by the responses because these had not led to an outage in the surveyed jurisdictions over the relevant period. Three such causes – some of which have been identified in previous IOSCO reports²¹ – include cyber-attacks, natural events, and technical disruptions caused by reliance on a small number of third-party providers delivering key functions and services. Whilst the Consultation Report does not capture any key findings relating to market outages resulting from these causes, IOSCO nevertheless recognises that the good practices identified may also be relevant to these.

(a) Cyber attacks

The speed and scale of the propagation of cyber incidents, as well as the potential intent of threat actors, differentiate cyber risk from other sources of operational risk that potentially cause market outages.

Cyber risk has become an increasingly significant concern for the global financial system as technology continues to advance and reshape the way financial markets operate. Due to digital developments and the current geopolitical situation, cyber threats are evolving at an unprecedented pace, posing new challenges for market operators and their participants.

The surveyed jurisdictions did not report market outages related to cyber events. However, trading venues should be aware of potential cyber-attacks given their critical role in maintaining market liquidity and price discovery. In fact, the integration of advanced technology in the trading, clearing and settlement processes of secondary markets – as well as the deep interconnectedness of market participants and cross-listed securities – can make them targets for cybercriminals. Disruptions from cyber incidents can have severe consequences on the orderly functioning of a market, potentially leading to market outages, liquidity shortages, and increased volatility.

Most recently, incidents such as distributed denial-of-service attacks and ransom demands caused by malware-related data breaches have impacted both trading venues and financial services companies.

Some key impacts of a prolonged market outage caused by a cyber-attack may include:

²¹ [FR21/2015](#) provides an overview of the steps trading venues can take to manage electronic trading risks to mitigate possible disruptions.

- A loss of confidence in the financial system due to the inaccessibility of the trading venue or confidential market data breaches;
- Systemic risks leading to a “contagion” effect generated by the interconnectedness of financial markets and trading venues; and
- Market integrity breaches due to unauthorised access to order book data and other inside information leakages.

Market outages caused by cyber-attacks may pose unique challenges for trading venues, which are different from those resulting from other market outage causes. While there has been significant progress in increasing global awareness and action to address cyber risks, cyber incidents continue to occur with greater frequency and sophistication. To address these issues, the IOSCO Board established the Cyber Task Force in October 2017. The Cyber Task Force published a report in 2019²² to raise awareness about existing international guidance on cyber resilience²³, and to encourage the adoption of good practices among the IOSCO regulatory community.

(b) Natural events

Natural events may lead directly or indirectly to market outages²⁴. These events can directly generate a market outage if, for instance, they impact the premises (either the primary or secondary sites) of a trading venue. Natural events may also affect the physical functioning of trading venues, for instance by affecting communication networks. Therefore, they can be linked to the operational resilience of the market. For example, one respondent to the survey indicated that a fire, although of a limited nature, caused a market outage on a listing trading venue.

Natural events can also be an indirect cause of a market outage if they have a significant impact on the broader economy, leading to an increase in volatility or extraordinary price movements, or low transactions volumes that do not allow efficient price formation. In such instances, trading venues (or the relevant regulator) may decide to suspend or halt trading. In addition, a pandemic may have global impact for significant periods of time. While a pandemic may not cause physical damage to property and assets like a natural disaster, it can threaten the health of key personnel and demand a special level of consideration.²⁵

²² [FR09/2019](#): Cyber Task Force Final Report (June 2019)

²³ In 2016, IOSCO and the Committee on Payments and Market Infrastructures published guidance for financial market infrastructures to enhance their cyber resilience. Please see [CPMI/IOSCO Guidance on cyber resilience for financial market infrastructures](#) (June 2016) and [CPMI/IOSCO Implementation monitoring of PFMI: Level 3 assessment on financial market infrastructures’ cyber resilience](#) (November 2022).

²⁴ Natural events may include such things as hurricanes, typhoons, floods, wildfires, droughts, earthquakes, volcanic eruptions, pandemics, and similar events but do not include instance of civil disruption, politically motivated actions or warfare.

²⁵ For further guidance on the operational resilience of trading venues and market participants during the COVID-19 pandemic, refer to IOSCO final report [FR06/22](#): Operational resilience of trading venues and market intermediaries during the COVID-19 pandemic & lessons for future disruptions (July 2022).

Furthermore, indirect effects could arise on trading venues located in different jurisdictions to the trading venue directly affected by the natural event. This is particularly true if they rely heavily on liquidity and investor activity located in the trading venue experiencing the outage.

Natural events can potentially have both short-term and long-term effects on market outages. The short-term effects depend on the severity, duration, and frequency of the event, as well as the resilience and recovery capacity of the affected market. The long-term effects may instead depend on the adaptation and mitigation strategies adopted by the market, as well as the policy responses implemented by the authorities. Understanding the causes and consequences of these events can help regulators and trading venues to deal with them more effectively.

(c) Material third parties

In an increasingly digital world, some trading venues are becoming more dependent on a small number of third-party providers that deliver their key functions or services. For example, technology services, such as cloud computing, are often delivered by third parties. Well managed outsourcing and other arrangements with third parties can bring benefits to trading venues, for example through efficiency gains, reduced costs, and improved operational resilience. However, the increasing reliance on a small number of third-party providers may also pose resilience and concentration risk if these third parties were to fail or experience disruption.

This may cause risks to individual trading venues and to the wider financial system. These risks stem from a combination of: (i) dependency on third parties for services whose failure or disruption could have a material impact on the continued operation of trading venues; (ii) concentration in the provision of these services; and (iii) the potential impact of the failure or disruption of these services on the resilience of trading venues, as well as the stability and market integrity of the financial system more generally. Therefore, factors such as the ability to recover or substitute a third party's services following disruption may influence the potential impact that their failure or disruption could have.

Disruption to any material services that third parties provide to trading venues could therefore lead to a single-point-of-failure that may simultaneously impact multiple trading venues and their members, market-wide resilience and, in extreme cases, financial stability. Trading venues are ultimately accountable for their operational resilience, regardless of whether they rely on third parties to support the delivery of their important business services.