Morgan Lewis | White Paper

ALGORITHMIC TRADING: HONG KONG MONETARY AUTHORITY DISCUSSES SUPERVISORY EXPECTATIONS, EVOLVING MARKET MANIPULATION RISK

March 2020

www.morganlewis.com

ALGORITHMIC TRADING: HONG KONG MONETARY AUTHORITY DISCUSSES SUPERVISORY EXPECTATIONS, EVOLVING MARKET MANIPULATION RISK

The Hong Kong Monetary Authority (HKMA) published a circular on March 6, 2020, Sound Risk Management Practices for Algorithmic Trading (the Circular), setting out its supervisory expectations and sound risk management practices on algorithmic trading activities. We recommend that authorized institutions (AIs) that carry out algorithmic trading activities undertake a thorough review of their existing policies against the HKMA's supervisory expectations and sound practices, and assess the extent to which they need to update their existing policies in order to align with the HKMA's supervisory expectations.

We have identified specific action points for AIs and included a compliance checklist in the Appendix to this White Paper. While the HKMA has not specifically addressed this in the Circular, manipulative algorithmic trading activities have received significant attention from regulators, in particular, the United Kingdom Financial Conduct Authority (FCA), for several years. Accordingly, AI senior management should also review their existing algorithms to ensure they will always behave in a legitimate way; this White Paper includes recommendations to senior management for mitigating personal accountability against market manipulation risk.

BACKGROUND

The use of algorithms for routing, executing trades, and making investment decisions has been in the spotlight for some time, even more so since the infamous May 2010 flash crash in the United States. Regulators around the world are concerned about the potential impact of malfunctioning algorithms on the orderly functioning of markets and related knock-on consequences for financial stability. They are also concerned that algorithms can be used to manipulate markets and prices.

Against this backdrop, the HKMA carried out a survey in 2018 to understand the extent and nature of AIs' algorithmic trading activities. The results indicated that around 40% of the surveyed AIs already undertook algorithmic trading, most commonly in executing trade orders and carrying out market-making activities for foreign exchange–related transactions. In light of this, the HKMA conducted a round of thematic onsite examinations on seven AIs in 2019, mainly international banks using algorithms for making investment decisions.

In the course of these examinations, the HKMA observed a number of sound practices adopted by more advanced AIs. As the survey suggested that algorithmic trading may become more prevalent in the banking industry, the HKMA considers it useful to set out its supervisory expectations around algorithmic trading and share the sound practices observed during the thematic examinations with all AIs.

AIs engaged in algorithmic trading activities **are expected to give due consideration to those supervisory expectations and sound practices** when developing their risk management framework, having regard to the nature, scale, and complexity of their algorithmic trading activities.

AIs that are registered with the Securities and Futures Commission (SFC) to carry out regulated activities and algorithmic trading activities are already required to comply with the requirements relating to algorithmic trading under the SFC Code of Conduct for Persons Licensed by or Registered with the Securities and Futures Commission (the SFC Code of Conduct).

This White Paper (1) sets out the HKMA's supervisory expectations and sound practices; (2) identifies areas of the HKMA's supervisory expectations that go beyond SFC's existing requirements relating to algorithmic trading under the SFC Code of Conduct; and (3) sets out a compliance checklist that AIs can

use to implement the requirements in the Circular (see Appendix). This White Paper does not address existing requirements relating to algorithmic trading under the SFC Code of Conduct.

In addition, while not specifically addressed in the Circular, AI senior management should be aware of the risk that algorithmic trading activities can commit market manipulation that, as senior management, they can be directly held accountable for. Accordingly, this White Paper also discusses the more prominent methods of new forms of market manipulation such as pinging, spoofing, and electronic front running, and steps that senior management can take to mitigate personal accountability and liability.

EXECUTIVE SUMMARY

The HKMA's supervisory expectations are broadly in line with the requirements under the SFC Code of Conduct relating to algorithmic trading, except in three key areas:

- **Governance and oversight:** The HKMA expects AIs to establish **first, second, and third lines of defense** related to their algorithmic trading activities. Depending on the existing governance structure of the AIs, this may require AIs to change their current management and governance processes, perhaps quite significantly.

- **Robust post-trade controls:** The HKMA expects AIs' front office and independent control functions to conduct real-time monitoring of algorithmic trading activities and to use automated surveillance tools to detect suspicious activities and possible conduct issues, such as market manipulation. For reasons set out in the section **HKMA Supervisory Expectation 8 – Robust Post-Trade Controls**, this supervisory expectation may be particularly difficult for smaller AIs or AIs that have just launched algorithmic trading systems or trading algorithms to comply with.

- **Comprehensive inventory of algorithms:** This is a new requirement and we provide guidance herein on ways that AIs can comply with this supervisory expectation, drawing on the UK Prudential Regulation Authority Supervisory Statement SS5/18, Algorithmic Trading, dated June 2018 (the PRA Supervisory Statement).

Definitions of Algorithmic Trading and Algorithmic Trading System

The HKMA did not define algorithmic trading in the Circular. However, AIs should take into account the SFC Code of Conduct's definitions of algorithmic trading, defined as "computer generated trading activities created by a predetermined set of rules aimed at delivering specific execution outcomes," and algorithmic trading system, defined as a "system through which algorithmic trading is conducted. It includes a system designed and developed in-house or by a third party service provider."

HKMA SUPERVISORY EXPECTATIONS AND SOUND PRACTICES

The HKMA has set out its supervisory expectations and sound practices in four areas:

1. Governance and oversight
2. Development, testing and approval
3. Risk monitoring and controls
4. Documentation

We will consider each of these supervisory expectations in turn.

GOVERNANCE AND OVERSIGHT

HKMA Supervisory Expectation 1 – Proper Governance and Risk Management Frameworks

AIs should put in place proper governance and risk management frameworks for overseeing and managing the risks associated with algorithmic trading activities and ensuring that these risks are within their risk appetite.

The requirement to have in place a proper governance and risk management framework for senior management to oversee algorithmic trading activities is not something new. Chapter 18.4 of the SFC Code of Conduct provides that "a licensed or registered person should effectively manage and adequately supervise the design, development, deployment and operation of the electronic trading system (which cover[s] algorithmic trading system)[1] it uses or provides to clients for use, as may be appropriate in the circumstances." The SFC has further elaborated on the governance framework in Schedule 7 of the SFC Code of Conduct.

In light of this supervisory expectation, AIs should evaluate their existing governance and risk management framework and consider what enhancements are needed for their algorithmic trading activities. In carrying out this exercise, it will be useful to refer to Chapter 2.3 of the PRA Supervisory Statement, which is set out in the Appendix. It will also be necessary for AIs to consider the factors they will take into account in determining their risk appetites and set their risk appetite accordingly.

First, Second, and Third Lines of Defense: This supervisory expectation, together with supervisory expectations 2 and 4, requires AIs to establish first, second, and third lines of defense related to their algorithmic trading activities. AIs must clearly define the roles and responsibilities of each of these lines of defenses.

These lines of defenses are:

- First line: Front office function
- Second line: Independent control function
- Third line: Internal audit function

These supervisory expectations go beyond the existing SFC Code of Conduct and may require AIs to change their current management and governance processes, perhaps significantly.

Sound Practice – Training: Per the SFC Code of Conduct, training should be provided to persons who are approved to use AIs' algorithmic trading systems. The HKMA has observed that some AI senior management, risk, and compliance functions are provided with adequate training on a regular basis to get acquainted with algorithmic trading and the risks involved, so they are able to raise sensible challenges throughout the development, testing, and implementation of the algorithms.

Sound Practice – Adoption of Algorithms or Systems from AIs' Headquarters: Before implementing algorithmic trading systems, the SFC Code of Conduct currently requires suitably qualified persons who are involved in the design and development of and approved to use algorithmic trading systems and trading algorithms to participate in the approval of the use of such systems or algorithms.

For global financial institutions, the SFC has stated that irrespective of the arrangements within the group regarding the management of its electronic trading system and the allocation of duties or functions, the

---

[1] The term "electronic trading system" includes algorithmic trading system. See Paragraph 11 of the SFC's Consultation Paper on the regulation of electronic trading dated July 24, 2012.

responsibility to ensure compliance with the regulations in Hong Kong rests with the responsible officers/executive officers and the management of the intermediary in Hong Kong.[2]

In line with the SFC's statement, the HKMA has observed that in cases where the underlying algorithms or systems are adopted from AIs' headquarters, some AIs' local management do not place undue reliance on their headquarters' oversight. Instead, they are actively involved in managing the risks associated with their algorithmic trading activities through, for instance, local governance bodies, which mirror the setup at the group level. Some AIs also have sufficient representation in the algorithmic trading governance bodies at the group level to directly participate in the discussion and deliberation on relevant risk management and implementation issues and provide inputs from a local perspective. This approach is also in line with the HKMA's longstanding policy.[3]

HKMA Supervisory Expectation 2 – Effective and Independent Control Functions

AIs should establish or assign a control function, which acts as the second line of defense independent of the front office, to manage the risks associated with algorithmic trading activities.

The SFC Code of Conduct has already set out its expectation regarding senior management responsibilities and the need to have a formalized governance process with input from dealing, risk, and compliance functions. However, this supervisory expectation is more specific: It expects AIs to establish a second line of defense—the independent control function—which will play a proactive role in managing the risks associated with algorithmic trading activities.

Sound Practice: The HKMA has observed that some AI control functions play a proactive role in key processes throughout the lifecycle of the algorithms, including development, testing, and approval of algorithms; design and implementation of pre-trade and post-trade controls and kill functionality; handling of incidents; and regular reviews of algorithms and relevant controls. The HKMA has also observed that these control functions are staffed with algorithms trading experts who are given sufficient authority to challenge the front office and are equipped with the tools to properly discharge their duties (e.g., system access for activating the kill switch to suspend algorithmic trading if warranted).

HKMA Supervisory Expectation 3 – Regular Reviews of Algorithms and Relevant Governance and Controls

AIs' first and second lines of defense should conduct regular reviews (at least once a year) to evaluate the performance of the algorithms implemented and determine whether the relevant governance, systems and controls, and business continuity planning remain adequate and effective.

This supervisory expectation is broadly in line with the SFC Code of Conduct, which requires AIs to test their algorithmic trading systems and trading algorithms regularly and in any case no less than annually. The SFC Code of Conduct also has requirements relating to the review of system reliability, contingency plans, audit logs, and reports, but the SFC Code of Conduct does not prescribe the frequency of such review.

The HKMA's supervisory expectation is broader as it requires AIs' first and second lines of defense to conduct regular reviews (at least once a year) to evaluate the performance of the algorithms

---

[2] Please see paragraph 27 of the SFC's Consultation Conclusion on the Regulation of Electronic Trading dated March 22, 2013.
[3] See, for example, the HKMA's Supervisory Policy Manual CG-1 – Corporate Governance of Locally Incorporated Authorized Institutions, where the HKMA explicitly stated that "the board [of locally incorporated authorized institutions] should provide appropriate input to the formulation of group policy or conduct timely evaluation of any group-level policies. If the board is not satisfied that the group-level policies and practices are appropriate in the circumstances of the AI, the board should notify the holding company and discuss appropriate modification."

implemented, and determine whether the relevant governance, systems and controls, and business continuity planning remain adequate and effective. This review is therefore much more holistic than what is mandated under the SFC Code of Conduct.

Sound Practice: The HKMA has observed that for some AIs, these reviews cover all the key processes throughout the lifecycle of the algorithms and the first and second lines of defense are guided by the governance bodies overseeing algorithmic trading activities. The results of the reviews are then extensively discussed by the governance bodies. Where relevant, the review results are reported to the AIs' headquarters, not only for attention but also for necessary actions to be taken at the group level.

HKMA Supervisory Expectation 4 – Regular Internal Audit Reviews

AIs' internal audit function, being the third line of defense, should perform regular reviews of activities to ensure that these activities are subject to proper governance and that the risks arising from these activities are adequately and effectively managed.

As noted above, the SFC Code of Conduct requires algorithmic trading systems and trading algorithms to be tested regularly. However, this supervisory expectation is again more specific: It requires AIs' internal audit functions—being the third line of defense—to perform regular reviews of algorithmic trading activities and ensure the risks are adequately and effectively managed.

Sound Practice: The HKMA has observed that some AIs treat algorithmic trading as a separate business area from general treasury activities in their regular audit programs and develop a tailor-made scope of review to cater for the specific risks associated with algorithmic trading activities. Further, the internal audit staff of these AIs have sufficient knowledge on algorithmic trading activities and are capable of performing their reviews efficiently.

DEVELOPMENT, TESTING, AND APPROVAL

HKMA Supervisory Expectation 5 – Effective Framework Governing Development and Testing of Algorithms

AIs should establish an effective framework governing the development and testing of algorithms to ensure they behave as intended, and comply with the relevant regulatory requirements and the institutions' internal policies. AI staff responsible for developing and testing algorithms should possess the requisite expertise and experience.

This supervisory expectation is in line with the SFC Code of Conduct requirements. For example, the SFC Code of Conduct requires AIs to test the algorithmic trading systems and trading algorithms that they use or provide to clients to use, and adequately test any subsequent developments and modifications before deployment in such a way so as to be satisfied that (1) the algorithmic trading system and trading algorithms will operate as designed; (2) the design and development of the algorithmic trading system and trading algorithms have taken into account foreseeable extreme market circumstances and the characteristics of different trading sessions; and (3) the deployment of the algorithmic trading system and trading algorithms would not interfere with the operation of a fair and orderly market.

Sound Practice: The HKMA has observed that for some AIs, if they make changes to an algorithm currently in use, they would not merely test the changes in isolation. Instead, they would perform comprehensive tests on the updated algorithm as if it were a new algorithm. Some AIs also appoint an individual as a project leader to oversee the entire development and testing processes to ensure that the processes are well coordinated and performed in a consistent manner across different algorithms.

HKMA Supervisory Expectation 6 – Robust Algorithm Approval Policy and Procedures

AIs should put in place a robust approval policy and procedures to ensure that new algorithms or changes to the algorithms currently in use are subject to proper testing, reviews, and challenges before they are implemented. Some institutions' trading systems have algorithmic trading functionalities that are not activated at the inception of those systems. For these cases, AIs should ensure that the algorithmic trading functionalities are subject to a proper approval process before activation.

This supervisory expectation is broadly in line with the requirements under the SFC Code of Conduct as summarized above. However, the HKMA's supervisory expectation extends to algorithmic trading functionalities that are not activated at the inception of those systems and requires them to be subject to a proper approval process before activation.

Sound Practice: The HKMA has observed that some AIs use standardized approval templates to ensure that sufficient information is consistently provided to staff who are assigned approval authority to facilitate effective evaluation of new algorithms or changes to the algorithms currently in use. Where appropriate, these AIs would involve additional expert reviews to assess the appropriateness of complex algorithms.

RISK MONITORING AND CONTROLS

HKMA Supervisory Expectation 7 – Comprehensive and Prudent Pre-Trade Controls

AIs should have in place a comprehensive set of pre-trade controls for algorithmic trading activities to ensure risks are managed prudently. Examples of pre-trade controls include risk limits based on the institution's capital, trading strategy and risk tolerance, price collars that block orders that do not satisfy predefined price parameters, checking of repeated and rejected orders, and limits on maximum order value or volume to prevent uncommonly large orders from entering the order book.

This supervisory expectation is broadly in line with the SFC Code of Conduct requirements on automated pre-trade controls. Under the SFC Code of Conduct, among other things, AIs are expected to put in place automated pre-trade controls that are reasonably designed to (1) prevent the entry of any orders that would result in exceeding appropriate trading and credit thresholds prescribed for each client or proprietary account; (2) limit the financial exposure of the intermediaries; (3) alert the user to the entry of potential erroneous orders and prevent the entry of erroneous orders; and (4) prevent the entry of orders that are not in compliance with the regulatory requirements. In addition, AIs are expected to carry out post-trade monitoring to reasonably identify any order instructions and transactions that may be manipulative or abusive in nature.

Sound Practice: Some AIs' pre-trade controls are more granular (e.g., control limits vary by client and by trading strategy) and are reviewed regularly to take account of the latest market conditions. In establishing and reviewing the pre-trade controls, these AIs perform detailed analyses to ensure that the controls are prudent and in line with their risk appetite.

HKMA Supervisory Expectation 8 – Robust Post-Trade Controls

AIs' front office and independent control functions should conduct real-time monitoring of algorithmic trading activities. The relevant systems should be capable of providing real-time alerts to assist staff in identifying limit excesses, activation of kill functionality, and other abnormal trading activities (e.g., trading continues after the kill functionality is activated).

Automated surveillance tools should be in place to detect suspicious activities and possible conduct issues (e.g., signs of potential market manipulation).

While the SFC Code of Conduct has extensive requirements on automated pre-trade controls (as summarized above) and post-trade monitoring, it does not explicitly require AIs' first and second lines of defense to be involved in real-time monitoring of algorithmic trading activities.

The SFC Code of Conduct also does not mandate that AIs use automated surveillance tools to detect suspicious activities and possible conduct issues in post-trade reviews, although AIs are required to regularly conduct post-trade reviews of trading activities conducted through their algorithmic trading systems to identify any suspicious market manipulative or abusive activities and market events or system deficiencies, such as unintended impact on the market, which call for further risk control measures. In addition to the "traditional" market manipulation activities, the SFC now also focuses on whether the post-trade review will also pick up, among other things, layering, spoofing, and electronic front-running activities.[4]

This is perhaps one of the most difficult aspects of the HKMA's supervisory expectations to comply with, as first of all it requires AIs to devote human resources from both the front office and the independent control function to monitor algorithmic trading activities on a real-time basis. This may require AIs to change their governance structures relating to algorithmic trading activities, bearing in mind that the SFC Code of Conduct does not require the delineation of responsibilities among three lines of defense.

Moreover, although in the introductory section of the Circular the HKMA states that AIs can take into account the nature, scale, and complexity of their algorithmic trading activities in considering the HKMA supervisory expectations, this supervisory expectation mandates that AIs use automated surveillance tools for post-trade monitoring. This may be problematic for some AIs, as based on the nature of their businesses they may consider automated surveillance tools to be unnecessary. For example, if an AI's trading volumes are low, or if such AI's risk analyses consistently show very low risk of manipulating the markets, it may consider a manual approach to be fit for purpose. In this scenario, we recommend that the AI's senior management consider this supervisory expectation carefully, and if they decide to depart from this expectation, they should document fully their rationale for doing so. If necessary, the relevant AI should notify and consult with the HKMA prior to implementing any changes to its post-trade surveillance procedures.

That being said, AIs should take into account relevant international developments. In particular, the FCA's Algorithmic Trading Compliance in Wholesale Markets, dated February 2018, states that firms must establish and maintain "an automated surveillance system monitoring orders and transactions [and] generating real-time alerts and reports," and firms "must employ an automated surveillance system to detect market manipulation."[5] Therefore, we expect that if an AI wants to depart from this supervisory expectation, it will need a very strong justification to do so.

For kill functionality, please refer to the HKMA Supervisory Expectation 9, set out below.

Sound Practice: The HKMA has observed that some AIs have established alerts that are more stringent than the control limits (e.g., 80% of the respective control limits) to provide early warning signals. These AIs have a dedicated team for monitoring algorithmic trading activities, and produce structured management information reports on these activities for review by the relevant governance bodies and senior management.

---

[4] See Section B12 – Algorithmic Trading and Alternative Liquidity Pools, Question 5(b), Business and Risk Management Questionnaire.
[5] The United Kingdom's requirement is driven by the EU Markets in Financial Instruments Directive II and Regulatory Technical Standard 6.

HKMA Supervisory Expectation 9 – Proper Kill Functionality to Suspend Trading

AIs should put in place a proper kill functionality as an emergency measure to suspend the use of an algorithm and cancel part or all of the unexecuted orders immediately in case of need. There should be a robust framework governing the activation of the kill functionality and the subsequent re-enablement of algorithmic trading.

This supervisory expectation is in line with the SFC Code of Conduct's requirement, which provides that AIs should ensure that the electronic trading system (including the algorithmic trading system) they use or provide to clients for use have effective controls to enable the AIs, where necessary, to (1) immediately prevent the system from generating and sending orders to the market; and (2) cancel any unexecuted orders that are in the market. Where this supervisory expectation goes beyond the SFC Code of Conduct's requirement is in the need to have a robust framework governing the subsequent re-enablement of algorithmic trading, after activating the kill functionality.

Sound Practice: The HKMA has observed that some AIs can activate the kill functionality at various levels (e.g., at the system, algorithm, trader, and client levels). This can minimize disruptions to other algorithmic trading activities that are not related to the underlying reasons for activating the kill functionality. For a kill functionality that requires manual activation (commonly referred to as a "kill switch"), these AIs provide detailed guidance to the relevant staff on the circumstances under which the switches should be activated. For a kill functionality that is activated automatically based on predefined triggers (commonly referred to as a "circuit breaker"), these AIs review these triggers regularly to ensure they remain appropriate.

HKMA Supervisory Expectation 10 – Effective Business Continuity Arrangements

AIs should establish a robust business continuity plan to set out contingency measures for dealing with possible adverse scenarios where algorithmic trading systems cannot function normally due to, for instance, a breakup in the data feed to these systems or other forms of system malfunctioning. These contingency measures should include fallback solutions (e.g., alternative arrangements to execute orders) and should be subject to regular testing to ensure they are effective and that staff is familiar with the business continuity plan.

This supervisory expectation is in line with the SFC Code of Conduct requirements. Among other things, the SFC requires AIs that provide electronic trading systems for use by their clients to establish a written contingency plan to cope with emergencies and disruptions related to the electronic trading system. The contingency plan should at least include a suitable backup facility that will enable AIs to provide electronic trading services or alternative arrangements for order execution in the event of an emergency. In addition, AIs need to ensure the contingency plan is periodically tested and the plan is viable and adequate. While it is not expressly stated in the SFC Code of Conduct, the SFC expects the contingency plan to also apply to AIs' proprietary algorithmic trading systems.

Sound Practice: The HKMA has observed that some AIs tailor their business continuity plans to cover a wide range of scenarios, and the plans cover each major type of algorithm with regard to the purpose of the algorithm (e.g., making investment decisions, executing trade orders, and market-making), and the markets and products to which the algorithms are applied.

HKMA Supervisory Expectation 11 – Adequate Controls on Access Rights

AIs should put in place proper security controls on physical and electronic access to algorithmic trading systems to ensure that only authorized staff is given access to these systems. These security controls should include the use of reliable techniques to authenticate the identity of staff and application of differentiated access controls according to the staff's responsibility and

authority. Staff departures or transfers resulting in changes in responsibility and authority should be timely reflected in these security controls. Staff's access records and activity logs should be subject to regular reviews to identify any unauthorized access to or improper use of the systems.

This supervisory expectation is partly in line with the SFC Code of Conduct requirements, which provide that AIs should employ adequate and appropriate security controls to protect the electronic trading systems they use, or provide to clients for use, from being abused. The security controls should at least include, among other things, reliable techniques to authenticate or validate the identity and authority of the system users to ensure that access to or use of the system is restricted to persons approved to use the system on a need-to-have basis.

Where this supervisory expectation goes beyond the SFC Code of Conduct requirement is that the controls on access rights will also need to cover staff departures or transfers. That being said, we expect AIs would already have in place procedures to deal with this. This supervisory expectation also requires regular review of staff's access records and activity logs to identify any unauthorized access to or improper use of the systems.

Sound Practice: The HKMA has observed that some AIs have a dedicated policy governing access controls for algorithmic trading systems that specifies the rights of access that should be given to relevant staff at different stages of the algorithm lifecycle, including development, testing, migration from testing to the production environment, and implementation.

HKMA Supervisory Expectation 12 – Robust Incident-Handling Policy and Procedures

AIs should establish a robust policy and procedures for handling incidents related to algorithmic trading. Any such incidents and associated remedial actions should be properly escalated. Sufficient information should be provided to the governance bodies and other responsible staff to facilitate their review of the incidents and the adequacy and effectiveness of the remedial actions. Remedial actions should be implemented timely with proper audit trails.

This supervisory expectation introduces "new" requirements for AIs to establish incident-handling policies and escalation procedures. The SFC Code of Conduct touches on incidents (e.g., where an AI's electronic trading system experiences a material delay or failure that renders it unusable by clients) and focuses on the content of the incident reports that are required to be kept. However, in practice, we expect that after the occurrence of a material incident, AI employees will promptly escalate such incident to senior management and provide senior management with all necessary information. Senior management will in turn seek input from different functions (e.g., front office, risk, compliance, and information technology) for the purposes of evaluating the most appropriate remedial actions and ensure that remedial actions are taken promptly. After the incident, senior management and different functions will consider ways to prevent similar incidents from occurring again. Depending on the nature of the incident, they may also decide to carry out a detailed review in order to identify any weaknesses and vulnerabilities of the algorithmic trading system and/or the trading algorithm. If the AI has not already done so, it will need to document the incident-handling procedures.

Sound Practice: The HKMA has observed that some AIs investigate incidents related to algorithmic trading thoroughly and the results of the investigation are extensively discussed by the governance bodies. In light of the nature and root causes of the incidents, these AIs may initiate a holistic review of all relevant algorithms and the associated controls to avoid recurrence of similar incidents in other algorithms.

DOCUMENTATION

HKMA Supervisory Expectation 13 – Proper Documentation for Audit Trials

AIs should maintain proper documentation to provide sufficient audit trails on the key processes throughout the lifecycle of algorithms.

This is in line with the SFC Code of Conduct requirements, which require AIs to keep, or cause to be kept, proper records on the design, development, deployment and operation of their electronic trading system.

Specifically, AIs are required to retain the following:

1. Comprehensive documentation of the design and development, including any testing, reviews, modifications, upgrades, or rectifications, of their system
2. Comprehensive documentation of the risk management controls of their system
3. Audit logs on the activities of their system
4. Incident reports for all material system delays or failures of their system

For (1) and (2), AIs need to retain the record for a period of not less than two years after the electronic trading system has ceased to be used. For (3) and (4), AIs need to retain the record for a period of not less than two years.

The SFC Code of Conduct further provides recordkeeping requirements for algorithmic trading activities. AIs should ensure that the design and development, including any modifications, of their algorithmic trading systems and trading algorithms are documented and recorded in writing. The documentation should show the rationale for any design, development, and modification, as well as the intended outcome. These records should be retained for a period of no less than two years after the system and algorithms are no longer used.

AIs should also ensure that (1) records of all the parameters that their algorithmic trading systems and trading algorithms take into account for each order are retained for a period of no less than two years; and (2) records of the reviews and tests conducted on an algorithmic trading system's ability to handle sizable trading volume and a trading algorithm's ability to execute orders without interfering with the operations of a fair and orderly market and their scope of findings are retained for a period of no less than two years.

Sound Practice: The HKMA has observed that some AIs have developed clear documentation standards and templates for the development, testing, and approval processes; design and implementation of pre-trade and post-trade controls; handling of incidents; and regular reviews of the performance of algorithms and effectiveness of the relevant risk controls. These AIs store the documentation in a centralized database accessible only to authorized personnel.

HKMA Supervisory Expectation 14 – Comprehensive Inventory of Algorithms

AIs should establish and maintain a comprehensive inventory to document all the algorithms implemented and the relevant key information, such as a brief description of the algorithms and the trading strategies involved, owner, approver and approval date, implementation date, names of systems where the algorithms are implemented, scope of application (e.g., market and product type), review records, and applicable risk controls.

This is a new supervisory expectation that goes beyond the SFC's current requirements. AIs will therefore need to put in place procedures to ensure compliance as soon as reasonably practicable.

In addition to the categories of inventory of algorithms that need to be kept in accordance with the supervisory expectations, it will be helpful to refer to Chapter 5.3 of the PRA Supervisory Policy

Statement, which sets out the types of inventory of algorithms that need to be kept. AIs should follow these steps:

1. Provide a brief overview
2. Detail the status of the algorithm (e.g., implemented for use, under development, and/or recently retired)
3. State the date(s) the algorithm was approved and, if appropriate, retired
4. Detail the scope of approval of the algorithm in terms of region, asset class, instrument, desk, and portfolio
5. Detail any restrictions placed on the algorithm when approved
6. Identify the algorithm owner(s)
7. Provide a link to the algorithm's documentation
8. Provide a unique identifier

Sound Practice: Some AIs maintain two inventories, one for the algorithms implemented and another for the applicable risk controls. This allows all the key information on the risk controls to be included in the dedicated inventory and facilitates the identification of any inconsistencies in the risk controls across the implemented algorithms.

MARKET MANIPULATION RISK

This section provides a high-level overview of new types of market manipulation risk associated with algorithms and ways that senior management can mitigate personal liability. The three most common methods of market manipulation associated with algorithms are pinging, spoofing, and electronic front running.[6]

Pinging

With pinging, a larger number of small orders for a particular financial instrument are submitted and cancelled in fractions of a second by computerized platforms to induce others in the marketplace to react to their "pings" and disclose their trading intentions to the pinging party. Pinging allows the initiating party to discern valuable information at little to no risk since most of the pinging orders are cancelled prior to execution. For instance, investor A wants to buy 100,000 shares of HSBC at any price up to $50 per share. Dishonest investor B, using the pinging strategy, sends out numerous small orders to sell HSBC shares at various prices with no intention of honoring them. Investor A reacts to dishonest investor B's orders and reveals its preferred volume and price points. Rather than being able to fulfill its large order at various price points, investor A will likely end up paying $50 or more per share for her entire order since she has unwittingly revealed her preferences to the devious pinging counterparty. When pinging is done on a large scale, over a sustained period, it can cost investors and the marketplace significant sums of capital.

Spoofing

With spoofing, orders are placed by computerized platforms for a financial instrument at prices outside the current bona fide limits to spook other market participants to react in a manner favorable to the spoofing party. Spoofing allows the initiating party to distort the ordinary price discovery in the marketplace by placing orders with no intention of ever executing them and merely for the purpose of manipulating honest participants in the marketplace. For instance, if shares of a bank are trading between $59.98 and $60.05 per share, a spoofing party will submit and cancel multiple limit orders to sell 100,000 shares at $59.90 to trick others in the market into offloading their positions before the stock

---

[6] We have referred to an article titled "The New Market Manipulation," published by Tom Lin on August 3, 2017, in the *Emory Law Journal*, Vol. 66, p. 1253, for descriptions of pinging, spoofing, and electronic front running.

drops. In 2010, the US Financial Industry Regulatory Authority sanctioned Trillium Brokerage Services with US$1 million in fines for engaging in illicit spoofing via it high-frequency trading programs.

The rise of autonomous, high-speed trading systems running on smart algorithms made spoofing possible and profitable, since spoofing requires the rapid submission and cancellation of voluminous orders measured in seconds, which is too fast for human traders and brokers to keep up with.

Electronic Front Running

Front running seeks to manipulate the marketplace by executing trades ahead of a known future price change, thereby profiting once the price moving order is executed. Unlike the "traditional" front running where human traders and brokers do so in small batches, electronic front running frequently leverages new, high-tech mechanisms that allow brokers to gain an unfair glimpse into order flows at one trading venue and to jump ahead of those flows to their advantage at another trading venue.

Regulators' Focus

The FCA is particularly focused on manipulative algorithmic trading activities. As Julia Hoggett, the director of market oversight at the FCA, remarked in a speech: "I can see a world where seemingly 'rational' [artificial intelligence], unconstrained and exposed to certain markets and data, would deem it entirely rationale to commit market manipulation. Now, the UK Financial Conduct Authority cannot prosecute a computer, but we can seek to prosecute the people who provided the governance over that computer." [7]

In light of the global regulators' heightened focus against market manipulation and on personal accountability, we expect the HKMA and the SFC will follow the FCA's regulatory focus on market manipulation using algorithims. Specifically, the HKMA and the SFC will prosecute chief executives, alternative chief executives, members of senior management, and the relevant "Section 72B managers" who are responsible for an algorithmic trading system or the trading algorithms that conduct market manipulation activities, should the circumstances warrant it.

To illustrate the FCA's determination in prosecuting "the person who provided the governance over the computer," see three recent cases in the United Kingdom:

- The August 2015 High Court decision in *FCA v. Da Vinci Invest and Others* [2015] EWHC 2401 (Ch) in which the FCA successfully obtained injunction and penalties in the High Court against the defendants for spoofing using an algorithm.

- The 2016 High Court decision in extradition proceedings against Navinder Sarao (the Hound of Hounslow) who subsequently pleaded guilty to spoofing of the market for "E-minis"—a stock market index futures contract based on the Standard & Poors 500 Index—on the CME, operating from his residence in the United Kingdom, using an algorithm.

- The November 2017 FCA final notice against Paul Axel Walter, who was fined £60,090 for committing market abuse by placing orders that would advance the best bid or best offer, attracting algorithms to follow, before cancelling his own orders.

MITIGATING MARKET MANIPULATION RISK

To mitigate market manipulation risk and senior management accountability for market manipulation activities arising from algorithmic trading activities, we recommend that AIs maintain a robust governance

---

[7] Speech, "Market abuse requires a dynamic response to a changing risk profile," Julia Hoggett, Director of Market Oversight of the Financial Conduct Authority, delivered at the AFME Implementation of the Market Abuse Regulation, London, Feb. 13, 2019.

Morgan Lewis

and oversight framework that demonstrates effective challenge from senior management on algorithmic trading activities.

Specifically, senior management should do the following:

- Ensure the AI carries out algorithmic trading activities in accordance with the risk appetite set by the organization (see **HKMA Supervisory Expectation 1 – Proper Governance and Risk Management Framework**).

- Be well versed in the expected behaviors of the algorithmic trading strategies and trading algorithm employed by the AI and understand the risks involved, so they can effectively challenge the decisions made by the front office and control functions. In order to do so, senior management should receive regular management information and adequate training on a regular basis and keep abreast of the latest technology development trends and computer-based market manipulation strategies.

- Ensure the front office and independent control functions conduct a review of key processes throughout the lifecycle of the algorithms and receive copies of these reviews, which they should then review extensively as a basis for formulating appropriate risk management actions, and have procedures in place so they can ensure any actions they recommend are actually being taken.

- Ensure there are clear lines of responsibilities, and identify persons who are responsible for specific aspects of algorithmic trading and ensure they are qualified to do so.

- Ensure there are clear lines of accountability, including procedures to approve the development, deployment, and subsequent updates of algorithms.

- Ensure they receive regular risk management (e.g., where risk limits are being breached) and incident reports to facilitate their oversight of the AI's algorithmic trading activities on a day-to-day basis.

- Ensure there are effective communications within the AI so that any critical issues will be escalated, with instructions being sought and implemented in an efficient and timely manner.

- Ensure the AI's employees create and maintain comprehensive inventories of algorithms and risk controls, and documentation that sets out each algorithm's strategy and risk mitigants and kill-switch control procedures.

- Ensure employees proactively attend to pre-trade controls and post-trade monitoring, and if there are any suspected market manipulation activities, these are escalated to senior management promptly. These controls and monitoring procedures should be stress-tested regularly.

Morgan Lewis

APPENDIX
COMPLIANCE CHECKLIST OF THE CIRCULAR

This checklist sets out the HKMA's supervisory expectations and sound practices, and questions that AIs should consider in implementing the HKMA's supervisory expectations. The checklist also identifies those HKMA supervisory expectations that go beyond existing requirements in the SFC's Code of Conduct. It does not set out the requirements under the SFC Code of Conduct relating to algorithmic trading.

In developing the checklist, we have made reference to the PRA Supervisory Statement. This checklist is by no means exhaustive and is not tailored to the individual circumstances of each AI. Unless otherwise specified, capitalized terms used herein shall have the same meanings as those defined in the Circular.

	Governance and Oversight: 1 – Proper Governance and Risk Management Framework

✓	Has the AI established a governance and risk management framework for overseeing and managing the risks associated with algorithmic trading activities, involving the front office, an independent control function, and an independent audit function (i.e., the three lines of defense)?
	
	This supervisory expectation goes beyond existing SFC Code of Conduct requirements and may require the AI to change (perhaps substantially) its existing governance and management framework.
	
	It will be helpful to refer to Chapter 2.3 of the PRA Supervisory Statement in evaluating whether their existing framework is adequate. Chapter 2.3 of the PRA Supervisory Statement provides that the governance framework should define lines of responsibility, including for
	
	    1. overseeing the execution of the algorithmic trading policy and monitoring adherence to that policy,
	
	    2. reviewing and approving algorithms in line with the algorithm approval process,
	
	    3. assigning ownership for the inventory of algorithms and risk controls,
	
	    4. ensuring the inventories of algorithms and risk controls are accurate,
	
	    5. assigning ownership for the kill-switch controls, and
	
	    6. setting out and overseeing a process that reviews algorithmic trading incidents, where an incident occurs if an algorithm or a risk control does not operate as intended.
	
	It will also be helpful to refer to Chapter 2.7 of the PRA Supervisory Statement in evaluating their algorithmic trading policy. For example, whether such policy is able to
	
	    1. identify the AI's algorithmic trading activity, including where it is undertaken within the AI (e.g., trade execution and making investment decisions);
	
	    2. define the term "algorithm" as used by the AI in the context of algorithmic trading system; and
	
	    3. prescribe the process for the approval and decommissioning of an algorithm.

✓	What factors has the AI taken into account in setting its risk appetite (e.g., operational market, credit, liquidity, reputation, legal, compliance and exchange requirements, and cybersecurity)? Furthermore, does the AI book algorithmic trading positions remotely? If so, it is necessary to also take into account the remote booking platform's risk appetite and limits.

Morgan Lewis

✓	What are the policies and procedures to oversee and ensure the AI only takes risks that are within its appetite? Does the AI have policies in place to cater to circumstances where the AI needs to exceed or inadvertently exceeds its risk appetite (e.g., escalation and approval procedures relating to limit breaches)?
✓	Do all members of senior management, the front office, the independent control function, and the independent audit function regularly receive management function and other reports (e.g., incident reports) to facilitate their oversight over the AI's algorithmic trading systems and trading algorithms?
✓	Do all members of senior management, the front office, the independent control function, and the independent audit function receive adequate training on a regular basis to get acquainted with algorithmic trading systems and trading algorithms used by the AI and the risks involved, so that they are able to raise sensible challenges throughout the development, testing, and implementation of the algorithms?
✓	In cases where the AI relies on algorithm trading systems or trading algorithms from the headquarters, is the AI actively involved in reviewing the specific features and the risks associated with these algorithms or systems from a local perspective? Has the AI established effective communication channels to provide input to the headquarters?
✓	Does the AI have adequate procedures in place to evaluate algorithm trading systems or trading algorithms developed by the headquarters and ensure they are adequate to be used in the relevant local markets (or if necessary, to make appropriate adjustments)?

Governance and Oversight: 2 − Effective and Independent Control Function

✓	Has the AI established an independent control function to manage the risks associated with the algorithmic trading system and trading algorithms? This goes beyond the SFC's existing requirement.
✓	Who should be a member of this independent control function (e.g., compliance, risk management, information technology, personal data privacy officer)? The AI should clearly define the roles and responsibilities of each function within the independent control function.
✓	Does the independent control function play a proactive role in key processes throughout the lifecycle of the algorithm, including development, testing, and approval; design and implementation of pre-trade and post-trade controls; and kill functionality, handling of incidents, and regular reviews of algorithms and relevant controls?
✓	Is the independent control function staffed with algorithmic trading experts who are fully aware of the algorithmic trading being undertaken at the AI?
✓	Is the independent control function given sufficient authority to challenge the front office, and equipped with the tools needed to properly discharge its duties (e.g., system access for activating the kill switch to suspend algorithm trading if warranted due to market manipulation risk and country-specific requirements)?

Morgan Lewis

Governance and Oversight: 3 – Regular Reviews of Algorithms and Relevant Governance and Controls	
✓	Do the AI's first and second lines of defense conduct regular reviews (at least once a year) to evaluate 1. the performance of the algorithms implemented; 2. whether the algorithms operate as intended; 3. whether there are circumstances where the algorithms did not operate as intended, and if so, what are the procedures to resolve such incidents; and 4. whether the relevant governance, systems and controls, and business continuity planning remain adequate and effective? This requirement goes beyond the SFC's current requirement, which requires AIs to test their algorithmic trading systems and trading algorithms regularly and in any event no less than annually.
✓	Are the reviews conducted by the first and second lines of defense guided by the governance bodies overseeing algorithmic trading activities and do they cover all the key processes throughout the lifecycle of the algorithms?
✓	Are the results of the reviews extensively discussed by the governance bodies, including the first, second, and third lines of defense, for the purposes of formulating appropriate actions to strengthen the risk management, and other relevant aspects, of the algorithmic trading system and trading algorithms? Who will be responsible for overseeing the implementation of the results of the review? If relevant, does the AI need to report to the headquarters?
Governance and Oversight: 4 – Regular Internal Audit Reviews	
✓	Does the AI's internal audit function, being the third line of defense, perform regular reviews of algorithmic trading activities to ensure that these activities are subject to proper governance and that the risks arising from these activities are adequately and effectively managed? This supervisory expectation is more specific: It requires an AI's internal audit function—as the third line of defense—to perform regular reviews of algorithmic trading activities and ensure the risks are adequately and effectively managed.
✓	How many business lines of the AI currently rely on algorithm trading systems or trading algorithms (e.g., trade execution and algorithms that make investment decisions)? If applicable, should the AI treat algorithmic trading as a separate business area from the AI's general treasury activities in its regular audit program and develop a tailor-made scope of review to cater to the specific risks associated with algorithmic trading activities and trading algorithms?
✓	Is the internal audit staff fully aware of the algorithmic trading being undertaken at the AI?
Development, Testing, and Approval: 5 – Effective Framework Governing Development and Testing of Algorithms	
✓	Has the AI established a framework to oversee the development and testing of algorithms to ensure the algorithms

	1. behave as intended;
	2. comply with the relevant regulatory requirements and the relevant trading venues;
	3. comply with the AI's internal policies;
	4. work effectively in stressed conditions;
	5. will not contribute to disorderly trading or disrupt market functioning at any time; and
	6. take into account any other factors the AI considers as appropriate?
✓	Does the AI's staff responsible for developing and testing the algorithms possess the requisite expertise and experience?
✓	Does the AI need to put in place change management procedures for algorithmic trading system and trading algorithms? For example, if the AI needs to make changes to the algorithm trading system or trading algorithms, under what circumstances should the AI only test the changes, and under what circumstances should the AI test the updated algorithm as if it were a new algorithm trading system or trading algorithm?
✓	For complicated algorithm systems or trading algorithms, should the AI break down the development process into separate phases so the AI will then be able to establish independent checks and balances at each stage?
✓	Should the AI appoint an individual as a project leader to oversee the entire development and testing processes to ensure consistency?

Development, Testing, and Approval: 6 — Robust Algorithm Approval Policy and Procedures

✓	Does the AI have policies and procedures to ensure that new algorithms or changes to algorithms currently in use are subject to proper testing, reviews, and challenges before implementation? In evaluating whether policies and procedures are sufficiently robust and, at the same time, provide flexibility, it will be helpful to refer to Chapter 3.2 of the PRA Supervisory Statement. Chapter 3.2 of the PRA Supervisory Policy Statement provides that it is feasible for an AI to choose to have different approval requirements depending on an algorithm's use and, where relevant, the customization or amendment being made. Examples include the following: 1. The approval process to be commensurate with the risks the AI could be exposed to via the algorithm. 2. Compliance with the approval requirements set by the relevant AI, clearly indicating the conditions under which different approval requirements apply, if appropriate. 3. The AI must ensure that the approval process does not incentivize approvals to be made in a manner that could result in a lower rigour of review. For example, it would not be acceptable for a significant change to an algorithm to be broken into a number of smaller changes, each of which would be subject to testing less rigorous than would be applied to the significant change itself.
✓	If the AI's algorithm trading system has functionalities that are not activated at the inception of the system, does the AI have policies and procedures to ensure such functionalities are properly tested before activation? This supervisory expectation goes beyond existing SFC Code of Conduct requirements.

✓	Does the AI need to develop standardized templates to ensure all evaluations of algorithms and changes to algorithms currently in use are consistent?
✓	For complex algorithms, does the AI need to involve additional expert reviews?
✓	If the AI identifies deficiencies or errors during the testing process, what remedial actions will it take? The AI should have a process for managing identified issues that includes tracking and documenting outstanding issues to an auditable standard.
✓	Will each stakeholder sign off on its assigned task, and are there procedures to ensure all signoffs must be documented and retained? Before signing off, it will also be helpful to refer to the guidance in Chapter 3.3(c) of the PRA Supervisory Statement, which provides that all relevant functions that sign off on their respective assigned tasks should have considered the risks relevant to that function that the algorithm could expose the AI to. This should be assessed under both normal and severe but plausible conditions.
✓	Will the AI deploy the approved algorithm trading system or the trading algorithms in an appropriate and controlled manner?

Risk Monitoring and Controls: 7 – Comprehensive and Prudent Pre-Trade Control

✓	Does the AI have in place a comprehensive set of pre-trade controls for algorithmic trading activities to ensure risks are managed prudently? The SFC Code of Conduct has already prescribed certain automated pre-trade controls. Are there any other additional pre-trade controls the AI should consider implementing? In addition to the ones set out in the supervisory expectation, maintaining maximum message limits and repeated automation throttles (to pause application of the strategy until restarted by human intervention) is another example of pre-trade risk controls that can be included.
✓	Does the AI need to ensure controls are more granular (e.g., control limits vary by client and trading strategy) and are reviewed regularly to take account of the latest market conditions? In establishing and reviewing the pre-trade controls, the AI should perform detailed analyses to ensure that the controls are prudent and in line with its risk appetite.

Risk Monitoring and Controls: 8 – Robust Post-Trade Controls

✓	Do the AI's front office and independent control functions conduct real-time monitoring of algorithmic trading activities? The relevant systems should have the capability of providing real-time alerts to assist staff in identifying limit excesses, activation of kill functionality, and other abnormal trading activities (e.g., trading continues after the kill functionality is activated). Automated surveillance tools should be in place to detect suspicious activities and possible conduct issues (e.g., signs of potential market manipulation). Please note our observations in the section **HKMA Supervisory Expectation 8 – Robust Post-Trade Controls**, which explains that the requirements to have both front office and independent control staff involved in real-time monitoring of algorithmic trading activities and the

	need to have automated surveillance tools go beyond the current SFC Code of Conduct requirements.
✓	In reviewing the use and governance process of the kill functionality, it will be helpful to refer to Chapter 3.5 of the PRA Supervisory Guideline. AIs should consider whether at a minimum they should 1. have a governance process around the use of kill-switch controls; 2. detail the actions that need to be taken in respect of outstanding and placed orders when kill-switch controls are activated; and 3. periodically assess kill-switch controls to ensure that they operate as intended. This includes an assessment of the speed at which the procedure can be affected.
✓	Should the AI establish alerts that are more stringent than the control limits (e.g., 80% of the respective control limits) to provide early warning signals?
✓	Should the AI have a dedicated team for monitoring algorithmic trading activities and production of structured management information reports on these activities for review by the relevant governance bodies and senior management?

Risk Monitoring and Controls: 9 – Proper Kill Functionality to Suspend Trading

✓	Does the AI have in place a proper kill functionality as an emergency measure to suspend the use of an algorithm and cancel part or all of the unexecuted orders immediately in case of need?
✓	Is there a robust framework governing the activation of the kill functionality and the subsequent re-enablement of algorithmic trading? This part of the supervisory expectation goes beyond the SFC Code of Conduct's requirement as the current SFC requirement does not require AIs to put in place a robust framework governing the subsequent re-enablement of algorithmic trading after activation of the kill functionality.
✓	Should the AI implement kill functionality at various levels (e.g., at the system, algorithm, trader, and client levels)? This can minimize the disruptions to other algorithmic trading activities that are not related to the underlying reasons for activating the kill functionality. For a kill functionality that requires manual activation (commonly referred to as a "kill switch"), the AI should provide detailed guidance to the relevant staff on the circumstances under which the switches should be activated. For a kill functionality that is activated automatically based on predefined triggers (commonly referred to as a "circuit breaker"), the AI should review these triggers regularly to ensure they remain appropriate.

Risk Monitoring and Controls: 10 – Effective Business Continuity Arrangements

✓	Does the AI have a robust business continuity plan established to set out contingency measures for dealing with possible adverse scenarios where algorithmic trading systems cannot function normally due to, for instance, a breakup in data feed to these systems or other forms of system malfunctioning? These contingency measures should include fallback solutions (e.g., alternative arrangements to execute orders) and should be subject to regular testing to ensure they are effective and staff is familiar with the business continuity plan.

✓	Should the AI prepare a tailor-made business continuity plan covering a wide range of scenarios for each major type of algorithm with regard to the purpose of each algorithm (e.g., making investment decisions, executing trade orders, and market-making), and the markets and products to which the algorithms are applied?

Risk Monitoring and Controls: 11 – Adequate Controls on Access Rights

✓	Does the AI have in place proper security controls on the physical and electronic access to the algorithm trading system to ensure that only authorized staff is given access to the system? These security controls should include the use of reliable techniques to authenticate the identity of staff and application of differentiated access controls according to the staff's responsibility and authority. Staff departures or transfers resulting in changes in responsibility and authority should be timely reflected in these security controls. Staff's access records and activity logs should be subject to regular reviews to identify any unauthorized access to or improper use of the system. Where this supervisory expectation goes beyond the SFC Code of Conduct requirement is that the controls on access rights will also need to cover staff departures or transfers. It also requires regular review of staff's access records and activity logs to identify any unauthorized access to or improper use of the system.
✓	Should the AI establish a dedicated policy governing the access controls for the algorithmic trading system, specifying the rights of access that should be given to the relevant staff at different stages of the lifecycle of the algorithm, including development, testing, migration from testing to the production environment, and implementation?

Risk Monitoring and Controls: 12 – Robust Incident-Handling Policy and Procedures

✓	Does the AI have established a robust policy and procedures for handling incidents related to algorithmic trading? Any such incidents and the associated remedial actions should be properly escalated. Sufficient information should be provided to the governance bodies and other responsible staff to facilitate their review of the incidents and the adequacy and effectiveness of the remedial actions. Remedial actions should be implemented timely with proper audit trails. The SFC Code of Conduct does not specify incident-handling policies and procedures. However, in practice, we expect the AI will have such policies and procedures in place.
✓	Are incidents related to algorithmic trading investigated thoroughly and are the results of the investigation extensively discussed by the governance bodies? In light of the nature and root cause of the incident, the AI may initiate a holistic review of all relevant algorithms and the associated controls to avoid recurrence of similar incidents in other algorithms.

Documentation: 13 – Proper Documentation for Audit Trails

✓	Has the AI maintained proper documentation to provide sufficient audit trails on the key processes throughout the lifecycle of algorithms?
✓	Have clear documentation standards and templates been developed for the development, testing, and approval processes; design and implementation of pre-trade and post trade controls; handling

	of incidents; and regular reviews of the performance of algorithms and effectiveness of the relevant risk controls?
	The AI should store the documentation in a centralized database accessible only to authorized personnel.

Documentation: 14 – Comprehensive Inventory of Algorithms

✓	Has the AI established and maintained a comprehensive inventory to document all the algorithms implemented and the relevant key information, such as
	1. a brief description of the algorithms and the trading strategies involved; and
	2. the owner, approver and approval date, implementation date, names of systems where the algorithms are implemented, scope of application (e.g., market and product type), review records, and applicable risk controls?
	This is a new requirement that does not exist in the SFC Code of Conduct. Please refer to the section **HKMA Supervisory Expectation 14 – Comprehensive Inventory of Algorithms**, where we discuss the inventory of records to be kept.
✓	Does the AI have in place two inventories, one for the algorithms implemented and another for the applicable risk controls?
	This allows all the key information on the risk controls to be included in the dedicated inventory, and facilitates the identification of any inconsistencies in the risk controls across the implemented algorithms.

Morgan Lewis

Contact

If you have any questions or would like more information on the issues discussed in this White Paper, please contact the following Morgan Lewis lawyer:

Hong Kong

Helen Fok   +852.3551.8565   helen.fok@morganlewis.com

About Us

Morgan Lewis is recognized for exceptional client service, legal innovation, and commitment to its communities. Our global depth reaches across North America, Asia, Europe, and the Middle East with the collaboration of more than 2,200 lawyers and specialists who provide elite legal services across industry sectors for multinational corporations to startups around the world. For more information about us, please visit www.morganlewis.com.