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Regtech Watch is a newsletter published by the Hong Kong Monetary Authority (HKMA) to promote the adoption of regulatory technology (Regtech) by the banking industry. It provides information on actual or potential Regtech use cases rolled out or being explored in Hong Kong or elsewhere. The objective is to assist authorized institutions (AIs) in adopting innovative technology to enhance their risk management and regulatory compliance.

Background

This sixth issue of the Regtech Watch focuses on how new technologies can help banks manage risks associated with their treasury activities, including operational risk, legal risk, liquidity risk and market risk.

It should be noted that the sole purpose of this newsletter is to provide AIs with information on the latest Regtech developments. The HKMA does not endorse any use cases or solutions described in this newsletter. If an AI intends to adopt a particular solution, it should undertake its own due diligence to ensure that the technology is suitable for its circumstances.

Regtech for treasury activities

Key challenges

Treasury activities traditionally involve a number of manual processes. Managing the risks associated with these activities often requires collation and analyses of large volumes of data maintained at different systems of a bank. Meanwhile, back-offices of banks need to perform reconciliation on trade information due to uncoordinated practices adopted by different banks in recording such information. These processes can be labour-intensive, time-consuming and prone to human errors if proper controls are not in place. The challenges are especially pronounced when a bank has sizable treasury activities involving complex products and multiple markets across different jurisdictions.

How can Regtech help?

As with other risk areas, the ability to meaningfully analyse vast amounts of data is essential to manage the risks associated with treasury activities. Having a single and standardised representation of a transaction across trading parties can enhance the efficiency of banks' back-office processes with lower operational and legal risks. The HKMA notes that a number of banks have adopted Regtech solutions to enhance their risk management and trade processing capabilities through, for instance, the use of big data analytics tools and artificial intelligence in trade pattern recognition and analyses, applying distributed ledger technology (DLT) to capture trade information, as well as adopting machine learning (ML) to predict customers' behaviours.

Regtech use cases

The application of Regtech solutions to treasury activities is not as prevalent as in other banking operations, possibly because treasury has been one of the most tightly controlled functions with well-established systems of controls and the need for enhancement is not pressing. Three use cases are nevertheless identified and summarised in the boxes below to provide a flavour of how technology may be leveraged and the benefits it may offer to banks.

Use case 1 – Detection of rogue trading activities

Rogue trading incidents caused a number of banks to suffer significant losses in the past. In many cases, the reputation of the banks concerned was also severely tarnished. These incidents underscored the need to put in place a robust system of controls to prevent traders from conducting unauthorised transactions.

While banks have generally established a front-to-back control framework for managing rogue trading risk, the identification of suspicious transactions and the ensuing investigations often require considerable amounts of resources. In particular, the processes would need data inputs from multiple parties and systems in order to facilitate a holistic assessment. Collating and analysing a

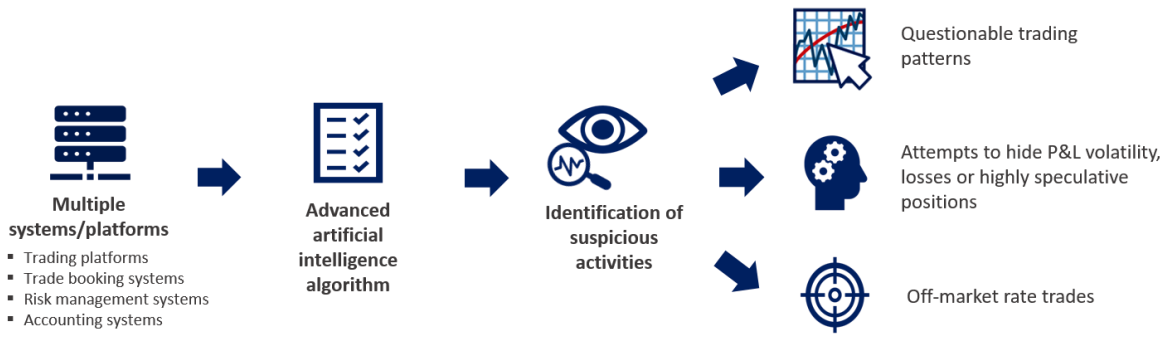
range of different data through conventional means can be time consuming or otherwise ineffective in identifying anomalies. To overcome these limitations, some banks have started to explore the use of big data analytics and artificial intelligence solutions offered by technology firms in tracking traders' activities. The underlying data models can continuously learn from and adapt to changes in trading behaviours and activities.

Solutions with big data analytics tools extract and pool data from various systems and databases of a bank to build an inclusive data model. The data captured encompass trade and order data from trading platforms; deal capture, amendment and cancellation records from trade booking systems; confirmations from settlement systems; mark-to-market valuations from pricing systems; communication records from surveillance systems; and performance management data from accounting systems. While the aggregate volume of these data is huge and their nature differs, these solutions enable users to examine the data simultaneously and comprehensively to discover any trend, pattern and correlation using algorithms such as clustering and regression. Unsupervised algorithms for anomaly detection such as isolation forest can also help identify irregular patterns and potential misconduct by capturing designated outliers automatically, thereby allowing banks to detect suspicious activities more efficiently and effectively. For instance, users can combine and scrutinise deal amendment and cancellation records, traders' communication records and valuation data together to pick up any questionable trading patterns, and attempts to hide trading losses, P&L volatilities, highly speculative positions, off-market rate transactions, as well as delayed or even missing deal inputs. Users can also compare and look into different traders' activities jointly in order to identify any collusions among them. Although banks may perform these analyses in traditional ways, big data analytics and artificial intelligence can greatly enhance banks' capabilities in this regard by, for example, reducing the amount of false positives under traditional methodologies. Some solutions can provide in-memory analysis functionality, which means data are accessed from computer main memory instead of hard disk, to further enhance data processing performance.

Some solutions are also equipped with ML functionalities. Using historical data (e.g. P&L) containing rogue trading events as training data, these solutions

are capable of recognising suspicious trading patterns by inspecting whether there are similar structure or characteristics in a trader's book. Apart from identifying irregular trading patterns with known modus operandi, some of these solutions are said to be able to flag novel rogue behaviours. For these solutions, data from normal trading activities (i.e. without rogue trading events) are used as training data, and traders whose books and activities exhibiting unexpected characteristics, as inferred by ML algorithms, will be highlighted for further investigation. Together with big data analytics tools, solutions with ML functionalities can help strengthen banks' capabilities to detect suspicious trading activities more effectively and at an earlier stage.

Exhibit 1: Use of artificial intelligence in surveillance of traders' activities



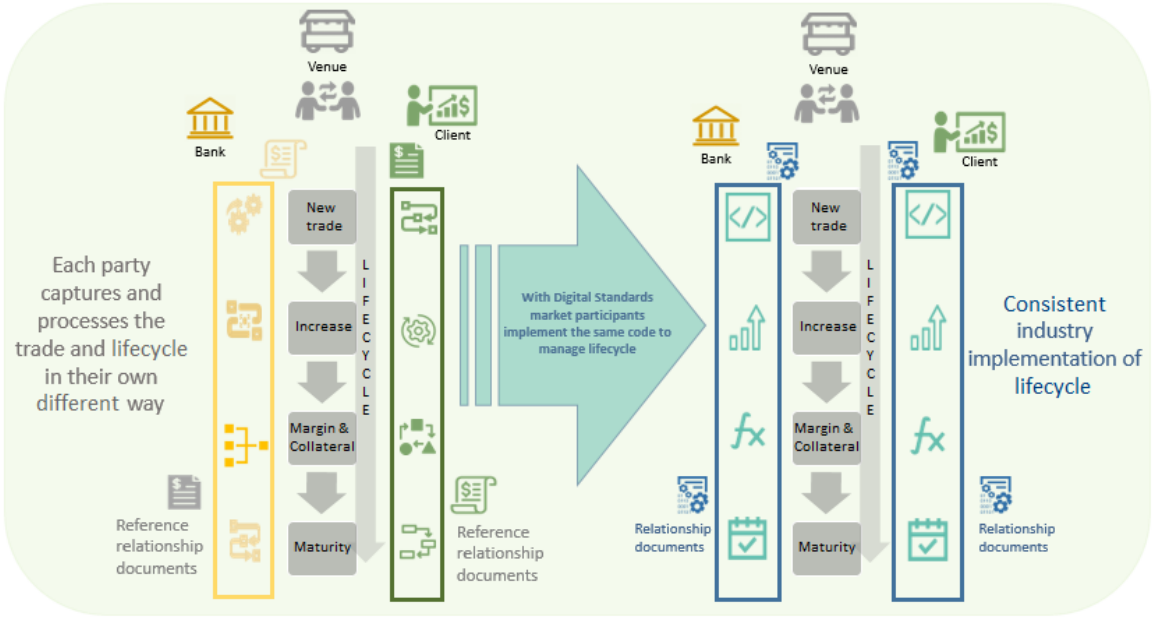
Use case 2 – Synchronised representation of derivatives trades across institutions

Derivatives markets, especially over-the-counter (OTC) markets, encompass a wide variety of products and market participants. There is a lack of standardisation of how participants record trade information as each party involved in a derivatives transaction has its own systems, formats and terminology. These uncoordinated practices have resulted in inconsistencies or even inaccuracies in trade records maintained by different parties involved in the same transaction. As a result, manual checking and reconciliation are often required as part of banks' back-office operations to ensure accurate capture of trade information.

Some Regtech solution providers are offering products aiming to enhance the efficiency in processing trade information, and eliminate operational and legal risks arising from inaccurate trade records and non-standardised documentation through the use of DLT and smart contracts. DLT allows participants to create, disseminate and store data efficiently and securely to enhance data trustworthiness while smart contracts improve the versatility of DLT by executing designed actions automatically upon satisfaction of pre-defined conditions.

One Regtech solution provider, for example, has developed a data model that establishes a standard digital representation of derivatives products, as well as the associated events and actions that may occur throughout the trade cycle (e.g. termination and exercise of option). The adoption of this data model among trading parties may enhance the consistency of trade information recorded in their systems. By applying DLT to the data model, a single representation or "golden record" for each derivatives transaction can be created across all nodes of the DLT network and used by trading parties (i.e. the DLT network participants). This can further ensure information accuracy and consistency across trading parties, and eliminate the need for duplicative reconciliation processes. This technology is particularly beneficial to collateral management because, under the new regulatory margin requirements for non-centrally cleared OTC derivatives, trade and collateral information needs to be updated frequently for determining the amount of margin required. Traditionally, banks will need to perform reconciliation upon these updates. This reconciliation process can be avoided with the golden records created using DLT.

Exhibit 2: Standard digital representation of derivatives trades



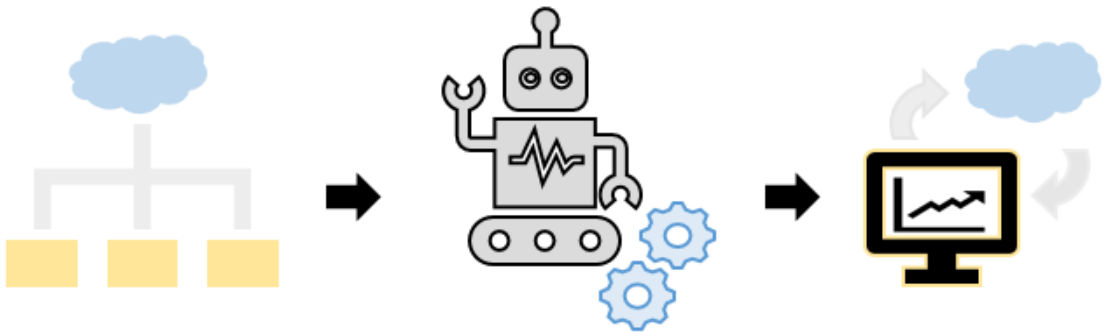
The Regtech solution provider also offers another product which allows users to create standardised draft agreements for derivatives transactions based on a clause library. This helps address the issue of market participants using different wording to describe the same product or process in their contracts. These draft agreements are then delivered to an online platform which is designed to assist trading parties in negotiating documentation electronically and generating a digitised trade agreement in standardised format. Efficiency is improved as trading parties are no longer required to review and update multiple versions of draft documents which are passed among them throughout the process. The Regtech solution provider is exploring the use of this product as a building block for developing smart derivatives contracts, which can automatically execute, control and document events and actions according to the terms of the contracts, thereby reducing operational and legal risks associated with the transactions.

Use case 3 – Data management and analytics for liquidity risk management

Many banks need to process a large volume of granular balance sheet data for producing management information reports on liquidity risk. Traditionally, this can take considerable turnaround time and may cause delays in liquidity risk monitoring, especially if the process is spreadsheet-based and involves manual operations. System capacity constraints also limit the use of sophisticated tools by banks to analyse and project depositors' behaviours, which is an important ingredient for effective liquidity risk management. To address these limitations and challenges, some banks have adopted cloud-based data management solutions to improve their efficiency in liquidity risk monitoring by building and utilising a centralised cloud-based hardware power house to run sophisticated, resources demanding risk models. The enhanced capacity brought about by these solutions also enables banks to explore the use of ML models for predicting depositors' behaviours.

One bank, for example, has created a central data repository on a cloud platform to collect, store and process data from its branches and subsidiaries. This has reduced the operational risk arising from manual errors in consolidating the data submitted by various entities. The bank mitigates data security risks by using data encryption and virtual private cloud, which is an isolated resource within a public cloud platform as defined by a security perimeter. The solution's enhanced scalability and flexibility for data management enables the bank to cope with surges in data processing needs due to reasons such as seasonality or business growth. Furthermore, the adoption of the cloud platform has strengthened the bank's data analytic capabilities, which are no longer subject to limitations of existing on-premises hardware. Utilising the analytical tools available in the cloud platform, the bank is now able to transform a large volume of data into dashboards and reports to provide a holistic view of its liquidity risk profile at the group level, as well as delaminated analyses at regional and local levels. It can also handle ad hoc queries more efficiently. Data query performance can be enhanced by other technologies featured in the analytic tools available in cloud, such as columnar database which stores data by columns instead of rows to achieve more efficient retrieval of data for analysis.

Exhibit 3a: Cloud-based data management



Data of a bank's branches and subsidiaries in various jurisdictions are uploaded to a central data repository in cloud

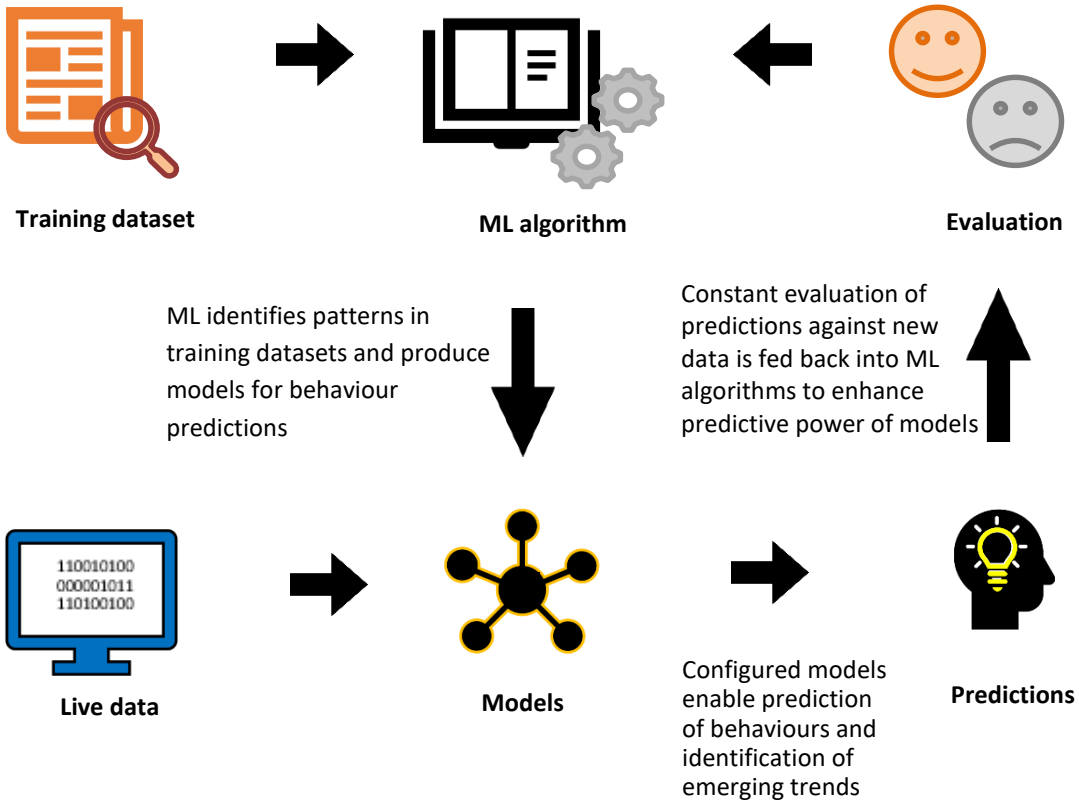
Data are processed and analysed using tools run in cloud, which are scalable and flexible to meet users' needs

Data are transformed into dashboards and reports at both group level and regional/local levels

The availability of big data and relevant analytics tools have opened the door for banks to adopt more sophisticated tools for managing their risks. Banks can now mine their valuable data collected in isolated blocks through ML algorithms. As an application to liquidity risk management, some banks have been exploring the use of ML in modelling and predicting depositors' behaviours. Training datasets comprising historical data on depositors' behaviours (e.g. withdrawal or rollover) and factors which might have affected these behaviours (e.g. account balance, product type, interest rate and depositors' particulars) are fed into supervised ML algorithms such as decision tree and random forest. Generally speaking, decision tree is a modelling approach that enables predictions to be made through the use of learning decision rules based on key features of the training data, while random forest is composed of multiple decision trees in combining and concluding predictions. These algorithms can automatically identify which of those factors are the key drivers of depositors' behaviours and generate models accordingly for making predictions using live data. Some solutions are also capable of producing a decision tree diagram depicting how depositors' behaviours are predicted from the key drivers. The predictions together with this decision tree diagram can provide actionable insights into banks' risk management and business decisions. These solutions also allow banks to maintain or even enhance the predictive power of models over time by injecting newly available data into the training datasets. When there is a change in depositors' behaviours that may

lead to a deterioration in model performance, the algorithms will automatically "learn" from the new data and adjust the models' parameters accordingly.

Exhibit 3b: Modelling of depositors' behaviours using ML



This newsletter is benefitted by input and ideas contributed by the following companies:

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