



*Regtech Watch is a newsletter published by the Hong Kong Monetary Authority 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 second issue of Regtech Watch focuses on the use of technology in credit risk management. In the course of understanding and examining credit underwriting and risk management processes of banks, the HKMA has observed that some banks have adopted new technologies to overcome certain long-standing challenges. Some of these observations are documented in the form of use cases in this newsletter.

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.

## **Technology in credit risk management**

### **Key challenges**

Banks are constantly looking for ways to improve competitiveness while maintaining cost-effective operations. In the retail lending business, the phenomenal advancement of technology in recent years has led to customers increasingly expecting easier and faster access to banking services. Banks can gain a competitive advantage by adopting technologies that allow them to serve customers or welcome new clients on board quickly and more cost-effectively. In corporate lending, traditional credit assessment processes require extensive

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human efforts to analyse financial statements, verify documents and monitor news related to the borrowers. These manual processes are time-consuming and inefficient, often leading to delayed loan approvals. Such delays may result in corporates being unable to obtain bank financing in a timely manner, or pose a reputational risk to the banks.

### **How can technology help?**

A number of financial institutions have started to adopt new technology, such as artificial intelligence and machine learning (ML) solutions, to overcome these challenges. Applying these technologies to credit risk management may bring greater accuracy to assessments of borrowers' creditworthiness, shorten loan approval time, and reduce the cost of assessments in the long run. With more accurate risk assessment, banks will be able to manage their portfolios more effectively while upholding prudent credit risk management standards. In addition, technology can be used to automate routine and tedious processes so as to reduce human resource needs and potential errors.

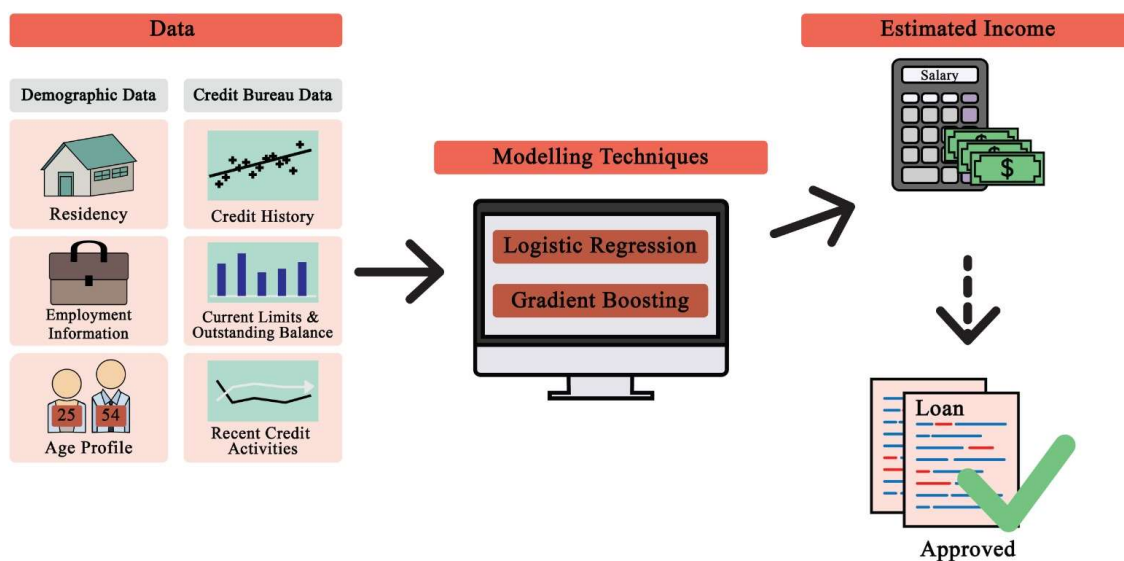
### **Regtech use cases**

The application of technology in credit risk management is gaining popularity across banks in Hong Kong. Three use cases are summarised in the following boxes, covering the use of data-driven income estimation to approve personal loans, ML-based methods to streamline corporate loan underwriting, and linguistic and sentiment analysis to identify adverse news about the borrower.

#### **Use Case 1 – Estimating income through data analytics**

To assess the debt servicing ability of applicants for credit cards and other unsecured personal loan products, banks typically require applicants to submit proof of income. Applicants need to prepare and upload the required documents, while banks have to verify their submissions. The amount of preparation and processing needed means the application process, including income verification, can take several weeks to complete.

## Exhibit 1: Income estimation model



To enable banks to offer a smoother customer experience, the HKMA introduced new guidelines in May 2018 to allow banks to adopt innovative technology to manage credit risks related to personal lending business<sup>1</sup>. Several banks have since adopted data-driven income estimation models to inform credit underwriting and lending decisions. Instead of collecting income proof from applicants, banks make use of these models to generate estimates of applicant incomes almost instantly. These models rely on large batches of data about borrowers' employment, demographics, recent credit history and recent credit activities to train Supervised Machine Learning (SML) models, such as logistic regressions and gradient boosting. Income estimation models aim to find the best predictors of income and, once their precision is validated, could produce reasonably accurate estimates of income. By applying these models to readily available information, banks can take income input into account in their credit underwriting decisions very quickly, resulting in a significantly faster application process.

That being said, credit decisions made with a heavy reliance on models are vulnerable to changes in customer behaviour and market conditions. Banks

<sup>1</sup> <https://www.hkma.gov.hk/media/eng/doc/key-information/guidelines-and-circular/2018/20180509e1.pdf>  
<https://www.hkma.gov.hk/media/eng/doc/key-information/guidelines-and-circular/2019/20190829e1.pdf>

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using these models are cognisant of the need to retrain and revalidate the models routinely to ensure their continued robustness.

## **Use Case 2 – Assessing credit in corporate lending through artificial intelligence**

In conducting credit assessment for corporate lending, banks are usually required to handle a host of manual tasks, such as computing financial ratios and digitising credit-related information. Such information can be voluminous as well as diverse in nature, requiring extensive human resources to compile and process.

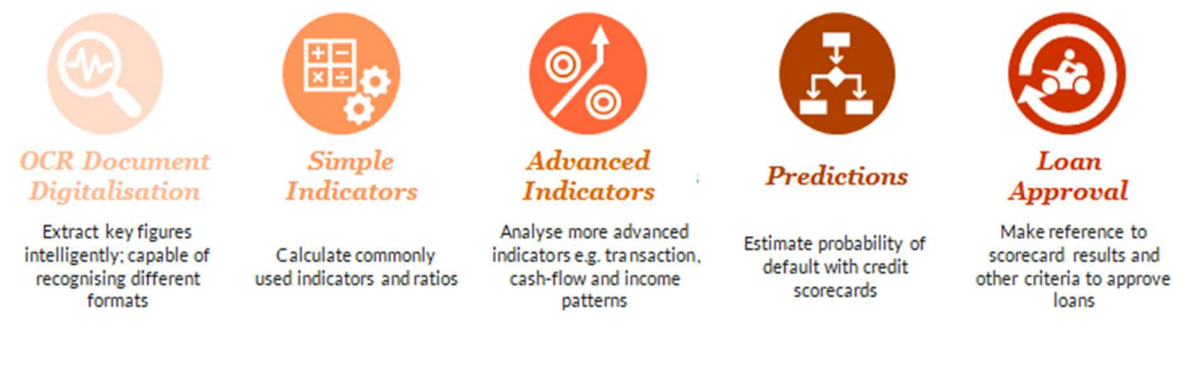
To improve the efficiency of corporate lending decisions, some banks are exploring the use of artificial intelligence and ML in credit assessment. One bank in Hong Kong recently launched a pilot rollout of artificial intelligence engines for financial spreading including the use of Optical Character Recognition (OCR) to digitise physical copies of financial statements: OCR converts the images of printed text into machine-readable format, performs text recognition by matching the text with a list of words commonly found in financial statements. With overlay of computational and extraction engines, key indicators, such as the current ratio and leverage ratio, are generated to facilitate credit analysis.

The adoption of artificial intelligence engines has not only helped the bank reduce human errors in analysing financial ratios, but also improved the timeliness of loan reviews. It has allowed the bank to devote more resources to other value-added tasks, such as understanding the background and structure of borrowers, analysing the viability of their business and conducting site visits to assess their repayment ability.

Another Hong Kong lender has supplemented traditional financial ratios with analyses of more advanced indicators about corporate borrowers, such as by examining the transaction and cash-flow patterns reflected in bank statements. These advanced indicators could reveal a lot about a borrower's activities and are particularly important when conventional financial statements are not

available. The indicators will then be used to estimate the probability of default, which ultimately informs loan decisions.

### Exhibit 2: ML in analysing financial statements and bank statements

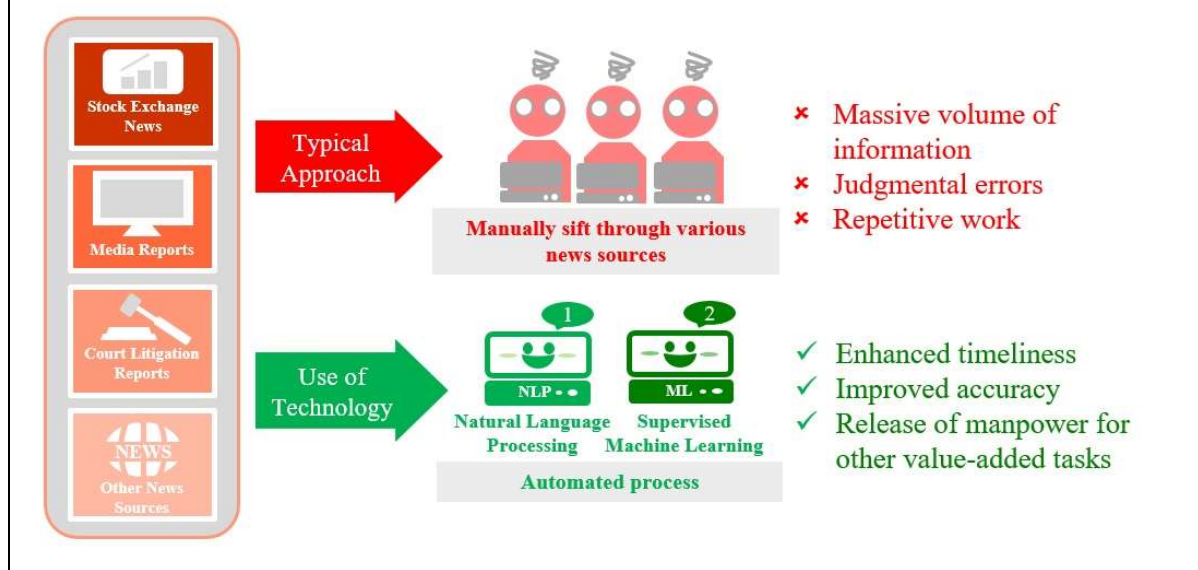


### Use Case 3 – Identifying adverse news

To ensure any major adverse developments relating to corporate borrowers is identified in a timely manner, banks need to review a large volume of news from different sources on an ongoing basis. One typical approach is to have designated bank staff members manually sift through various media reports, stock exchange news and court litigation reports, and notify their relationship and risk management colleagues. This is often a labour-intensive process, and is especially burdensome for banks with a large clientele. Another issue with this approach is that the designated staff members, particularly those with less experience, might misjudge the context of the news.

To overcome these challenges, some banks have started to use tools such as Natural Language Processing (NLP) and SML to automate news screening. This involves the use of linguistic analysis tools to extract relevant information from the news sources, classify the information into different subjects and digitise it in a machine-readable format. The structured data is then fed into trained SML models to determine the sentiment of the news, whether positive, negative or neutral. The technology helps banks achieve more timely and accurate identification of adverse news on borrowers, which in turn improves their ongoing assessment of the borrowers' creditworthiness.

Exhibit 3: Use of technology to facilitate the identification of adverse news



Apart from the above use cases, the HKMA has noticed that banks overseas are now applying emerging technology solutions to credit risk management, particularly with regard to small-business loans. Given the limited credit history of small businesses, the industry has developed credit-scoring models based on alternative data — firmographic information such as borrowers’ firm size and location and social media presence — to facilitate loan approval. Such alternative data has helped banks to arrive at more accurate assessments of the creditworthiness of small businesses which might otherwise be opaque. The benefits of credit scoring with alternative data are being increasingly acknowledged internationally, for example, by the Bank for International Settlements<sup>2</sup> and the Financial Stability Board<sup>3</sup>.

Exhibit 4: Use of alternative data for credit scoring



<sup>2</sup> <https://www.bis.org/publ/work834.pdf>

<sup>3</sup> <https://www.fsb.org/wp-content/uploads/P011117.pdf>

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The above use cases also demonstrate the potential limitations of new technology. In ML credit models, for example, the probability-of-default predictions obtained via different approaches may vary significantly and are not easy to interpret. In addition, the models currently in use have been developed only in recent years, so their performance across a complete credit cycle is yet to be seen. Relatedly, banks often depend on third-party developers for expertise in designing and developing technology applications, giving rise to potential risks in governance and accountability. To overcome these limitations, the HKMA expects banks to implement programmes to recruit, train and retain employees with suitable skill sets and establish effective mechanisms to supervise the relevant staff members. Firms should have adequate in-house skills to train and test Regtech models properly and to provide adequate support for smooth operations.

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

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