KPMG

Managing model risk

Perspectives from the Indian banking industry

Risk Consulting

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Foreword

Models today are increasingly utilised in the banking industry, given their relevance in managing regulatory and accounting requirements as well as facilitating managerial decisions. Prominent examples of its use include evaluating risks and capital, defining funding requirements, understanding customer behaviour , managing data analytics and making investment decisions.

Given its characteristics, a model is usually not perfect as it is just a simplified representation of reality aimed at applying mathematical, financial and economic theories to the available data. As such, understanding the capabilities and limitations of the underlying assumptions is key when dealing with a model and its outputs.

Decisions based on wrongly designed or implemented models, or influenced by a misuse or misunderstanding of models may negatively affect financial institutions (e.g. resulting in financial losses, capital or liquidity shortage or misallocation, loss of customers, flaws in regulatory or financial statements, regulatory penalties, etc.) and should be managed in a similar manner as in the case of other types of risk. To cope with 'model risk', it is then essential that the entire life cycle of a model (development, data management and use) is well addressed and controlled through a sound and reliable governance and validation framework. While dealing with model risk, many aspects are to be considered, such as development of theoretically sound models with an understanding of the model assumptions, data quality and data archiving rules, appropriate use of models, periodic validations, backtesting, and setting up the governance design, documentation and managing version control.

In this context and driven by the huge economic impacts of the recent industry model risk events, regulators have increased their focus on these issues and are asking for an enhancement of the range of practice for model risk management. The U.S. moved first with their seminal document 'Supervisory Guidance on Model Risk Management', while the EU Regulator's interest in model risk has been busted as part of the 'Supervisory Review and Evaluation Process' that explicitly includes it in the scope of the review, as well as in the worldwide regulatory agenda . Of course, the higher standards now required should be intended and implemented according to the materiality intrinsic in both the model and the institution.

With an aim to understand the current model risk management environment in the country, KPMG in India conducted a survey titled 'Model risk management survey 2015-16. The report enables an individual to understand how leading banks in the country use analytical models in daily operations like identifying segments/customers for its products, pricing loans and derivatives, measuring risks of borrowers, planning capital and budgeting, etc. The data has been gathered from discussions with leading public and private Indian banks as well as foreign banks, which has helped to draw a comparison between the practices of Indian banks and their global counterparts. Our findings provide key insights into the challenges faced by Indian banks in a global context.

Jitendra Sharma
Global Leader
Risk Consulting
KPMG in the U.S.

Fabiano Gobbo
Global Leader
Financial Risk Management
KPMG in Italy

Prelude

Indian banks, much like their global counterparts, have been undergoing drastic changes over the past few years, owing to changes in regulatory requirements (such as capital, liquidity, leverage, funding requirements etc.), accounting standards (IFRS 9), local compliance requirements (Know Your Customer (KYC)/Anti-Money Laundering (AML), technological innovations, changing customer expectations and competition.

With increasing dependence on models, banks are required to understand and manage model risk effectively. Inadequate knowledge regarding model development and its usage may lead to suboptimal decision-making and pricing, thereby exposing a bank to additional risks, including regulatory penalties.

Through this survey report, KPMG in India has endeavoured to link their findings to some of the key challenges faced by Indian banks. We hope this document provides new insights to both, the traditional and new-age banking industry.

Mritunjay Kapur
Partner and Head
Risk Consulting
KPMG in India

Himanish Chaudhuri
Partner
Risk Consulting
KPMG in India

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Current scenario

The banking industry has been undergoing radical changes over the past few years. More banks now opt for greater digital presence, in order to expand their customer outreach and market share. As a result of this rapid expansion, certain systemic and institution-specific issues have plagued the industry at large. Regulatory requirements have become even more stringent for banks, with additional capital and liquidity requirements. The focus on internal assessment of risk data is intense, with many banks moving towards an Internal Rating Based (IRB) approach of credit risk estimation. Recent changes in the accounting standards such as the draft Ind AS guidelines have strongly suggested to banks to develop internal impairment models.

Some systemic variations may also prompt this change. Non-performing loans have been on the rise over the past two years. Asset books are growing in single digit rates for a large part of the industry and with the objective being to remain competitive, profitability has become a volumes game for retail lending. Our survey considers some of these critical issues and examines the relevance of deploying automated models in order to identify, manage and mitigate emerging risks in the banking industry.

Emergence of model risk

Model Risk can be understood as the risk of model failure due to incorrect inputs, flawed assumptions, and incorrect model design or model misuse. Banks have continued with the widespread use of analytical models, attracting constant attention on how best to measure, monitor and manage the associated risks. With continued innovation as well as demand for improved sophistication in risk management at an enterprise level across capital, credit and loss forecasting, and liquidity, model use is expected to only rise, with the need to manage model risk likely to become a priority. Faced with these dynamics, many banks find it challenging to establish a model risk management process that is transparent and meets the expectations of multiple stakeholders, including senior management and the board of directors, regulators, external and internal auditors, and shareholders.

To help with these challenges, KPMG in India`s Financial Risk Management practice conducted a survey to gain an insight into current industry practices and issues associated with establishing and maintaining a robust model risk management framework. This survey supports an institutions' efforts to make significant progress toward managing model risk, changes to internal policies and procedures, and substantial investment in processes and systems, while exploring the emerging trends in the banking industry.

1. RBI Report on Trend and Progress of Banking in India (2014 - 2015). URL: https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/0FLTP577BF4E172064685A26A73A6BC9210EC.PDF

Key findings

Back to basics

There is no unified view in the banking industry regarding model definitions and the set of risks associated with the same.

Miles to go

Most banks have implemented basic and intermediate techniques for management of model risk. The classification of model risk management techniques into basic, intermediate and advanced is available in Table 1.

Building skilled teams

Most banks opine that resources with appropriate skill sets are difficult to find and retain. Employees having adequate banking experience and an understanding of statistics/ mathematics, IT and applicable regulatory requirements should be included in the model risk unit. The problem is more acute in public sector banks, where they believe that their staff lacks the skills required for assessment and management of model risk, and validation of models.

Organisational dilemma

Private sector banks prefer a partially centralised approach to model risk policy and framework; whereas public sector banks prefer a fully centralised approach to both, model risk policy and governance structures.

Leading from front

Banks expect the senior management to play a more active role in risk management than they do currently. Senior management should have the skills and understanding pertaining to model outputs. They may provide guidance on the business use of model output.

Self-starter

Off the shelf models with no adjustment are least preferred by all banks. Private sector banks prefer to build quantitative models due to availability of internal data, which public sector banks often lack. Foreign banks use legacy models developed by the parent organisation.

Model Robots

System automation is key to accurate model deployment. Private sector banks deploy internally developed models in an automated environment more often than public sector models.

Sky is the limit

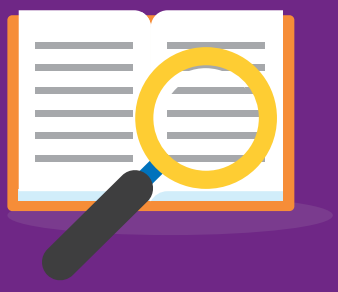
Most banks use various models for decision-making and pricing; however many public sector banks do not use models for setting limits. This use has been explored by private banks to a large extent. Most of the large banks have attempted to deploy models for varied uses within the organisation, while banks with medium to small asset bases tend to use models to the extent required by the regulator.

Closing the loop

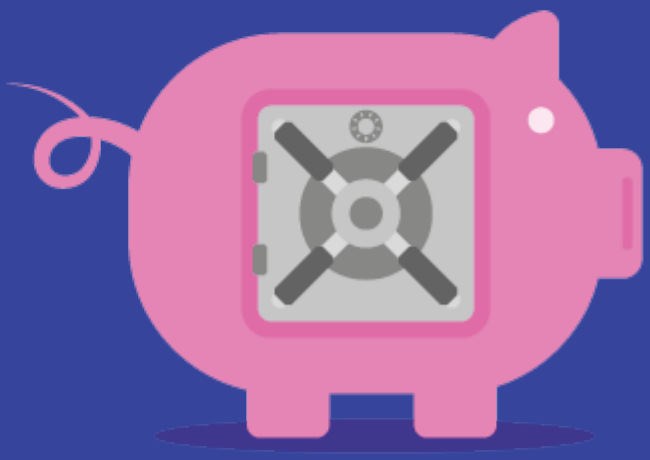
It is critical for banks to engage in periodic model validation activities. Moderately complex models are used by all banks for capital budgeting and planning; however a higher proportion of private sector banks close the loop by conducting back testing.

Level playing field

Regulators in advanced geographies provide more detailed guidance on measurement and management of model risk. Most banks expect the RBI to provide overarching guidance, while leaving the day-to-day management of model risk to the bank's discretion.



A. Key trends in the banking sector



The survey findings have been linked to the emerging trends seen in the industry at large. The same have been presented below:

Trend one: Changing regulatory landscape

Description

The maintenance of capital has become more challenging for banks in the current scenario, especially with the implementation of BASEL III guidelines. With the regulatory thrust on internal portfolio evaluation, especially after introduction of the draft Ind AS requirement for impairment modelling, banks stand to gain from having well-segmented, homogenous portfolios. In addition, deployment of models can help banks reduce their exposure to expected high-risk segments.

Use of models within banks is now more widespread due to the regulatory focus on this issue. Banks should use models to meet their regulatory requirements, but the use of models should not be limited to only capital or liquidity estimation. Banks should consider the regulatory guidance in spirit and attempt to use models to achieve other objectives within the organisation as well.

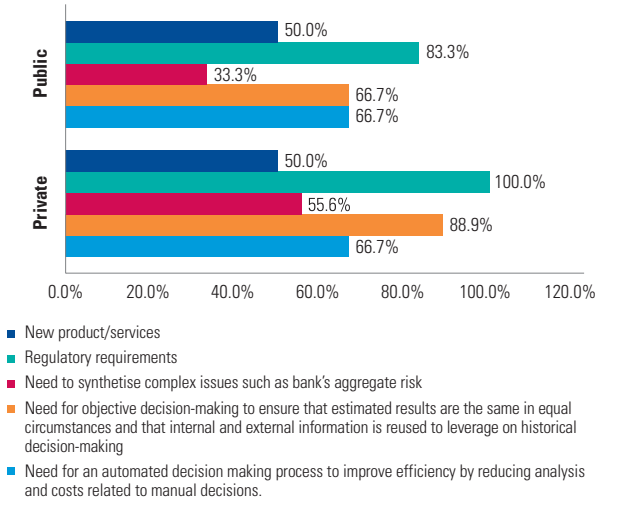
As per the accounting requirements of IFRS 9, provisions based on the expected credit loss model for recognition and measurement of impairment accelerates the recognition of loss. This includes both, already incurred and future expected losses. This requirement opens up a plethora of model development requirements and applications across lending and investment portfolios. In India, accounting standards have been aligned to IFRS 9 via Ind AS. While banks are currently not expected to estimate future losses based on the Probability of Default (PD) - Loss Given Default (LGD) method, models may be required for this estimation going forward.

Survey findings

The purpose for which banks use models largely depends on what triggers them to develop new models. Most banks consider regulatory requirements as a major driver for development of new models. Both public sector and private sector banks place the same amount of importance on automated decision-making as a driver of new model development; however private banks allow for a thorough, risk and industry adjusted model. Public sector banks are also less willing than private sector banks to develop models to tackle complex issues such as estimation of the bank's aggregate risk, complete customer life cycle management, etc. often due to lack of reliable internal data.

Introduction of new products/services ranks low in the set of triggers for model development for both, public and private sector banks. Lack of data, stringent regulatory guidelines (particularly pertaining to regulatory products) and expertise specific to the product in question makes development of both quantitative and qualitative models challenging. Banks usually prefer to use generic models or pilot studies to navigate through the nascent stages of a new product or service. These results are evident from the survey responses summarised below:

Triggers for developing new models



Source: KPMG in India analysis, 2016

KPMG's view

- Banks continue to focus on regulatory requirements to develop models and are yet to explore the holistic usage of models. While private sector banks seem to be more comfortable using models for non-regulatory purposes as compared to their public sector counterparts, all banks should focus on the potential that models provide with respect to portfolio management and risk mitigation.
- Models should not only be used for regulatory reporting, but also as an integral part of risk mitigation as business enablers with respect to the customer, including decision-making, pricing and limit setting.

Trend two: Increase in Non Performing Assets (NPAs)

Description

Stress in the banking industry leads to higher NPAs than expected, as has been observed in the Indian banking industry over the last couple of years. Changes in the landscape of the portfolio's performance are intrinsically linked to changes in strategy, both at a portfolio and a bank-wide level. Risk and business are two sides of the same coin, and banks that are able to unlock these synergies are able to grow faster. While changes in a model and its assumptions may not be dynamic, the use of models should be determined by senior management, who have a holistic view of market movements and the bank's consequent strategy. In addition, models should be well-segmented to the extent possible, to account for the differences in risk drivers of various products.

In recent times the industry has seen higher NPA rates across the board, led by large infra projects, commercial vehicles and construction equipment portfolios. If banks were able to track the increased stress in these portfolios and make commensurate adjustments, they may have pre-empted recoveries in other associated portfolios as well. These vagaries should be accounted for in the assessment of model risk. These are decisions to be taken by the senior management and board. The senior management should also be supported by the internal audit and validation departments, who will independently assess and evaluate the model's performance over time. Such analysis may also include stress testing activities, based on shocks and scenarios that may increase the losses to the bank.

Survey findings

Leading from the front

Role of the Board of Directors

Most survey respondents feel that the Board should play an active role in management of model risk. This view is endorsed especially by private sector banks with over 50 per cent of respondents opining in favour of the Board playing an active role, while the remaining wishing to see them play a proactive role in managing model risk.

In case of public sector banks, we note that a majority of 50 per cent respondents opine that the Board should play a pro-active role in managing model risk, while approximately 33 per cent respondents feel that the Board should play an active role and approximately 17 per cent feel that the role of the Board should be passive in nature, when managing model risk.

Role of the department owning the model

As per survey discussions, banks feel that respective departments (such as credit risk, BIU, treasury and finance) should be responsible to take ownership of the models. Major implementation challenges and the ongoing model performance should be tackled by the respective departments. In addition, the departments should also ensure periodic validation of the models, irrespective of the internal audit activity.

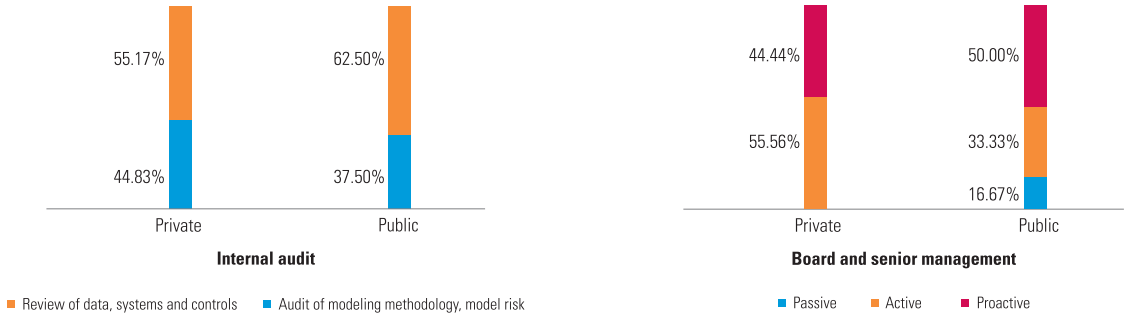
Role of the internal audit department

Survey respondents indicated that the role of the bank's internal audit function (i.e. third line of defence) should be enhanced to include the review of model risk management, independent validation reports and compliance including documentation, procedures, responsibilities, results, and responsiveness to findings.

Most banks are of the opinion that the internal audit department should play a more active approach in managing model risk.

- **Private sector banks** believe that the internal audit department should be more actively involved in model development and review of the model risk policy than they are at present; however, banks are concerned that the internal audit department may not have the skill set to review the modelling methodology and model development procedures present in the bank.
- **Public sector banks** prefer that the internal audit team focusses their efforts on branch and field operations. A separate head office level audit is carried out for data, systems and controls; however, the risk and treasury department may not be covered under the scope of management audit or concurrent audit. Banks would prefer that the internal audit department gradually enhances their scope, such that they audit the head office operations as well, including audit of the model development methodology and model risk policy.
- **Global banks** are well suited to accurately audit their models. They rely on a system of peer review across geographies where they are present. The audit department is augmented with technical specialists having subject matter understanding to provide reliable comments.

Role of the Board, senior management and internal audit



Source: KPMG in India analysis, 2016

Our view

- The board and senior management should play an active role in management of model risk and provide guidance on changes in the regulatory and economic environment, along with directions for managing model risk.
- The internal audit department should review all aspects of the model viz. the model risk policy, modelling methodology, model validation, data audit and systems and controls used in model deployment. The internal audit and risk management department should independently present their model validation findings to the Audit Committee of the Board (ACB) and the risk committee respectively.
- The internal audit department may not have the relevant expertise and hence, should involve independent third parties who may have the knowledge and skills, while taking care to avoid potential conflicts of interest. In addition, an independent third party or specialist review (not as a part of the internal audit) should be a regular feature of the model review by the risk committee. This practice is commonly observed in leading internationally active banks.

Trend three: Stagnant growth and fragmented market share

Description

The banking industry in India is a slow-growing one, with majority of the established banks witnessing single-digit organic growth rates over the past years. Banks that have consistently achieved a double-digit growth rate have done so with the help of judicious use of models to drive their retail credit business, while maintaining the risk appetite on the quality of their fresh disbursals.[1]

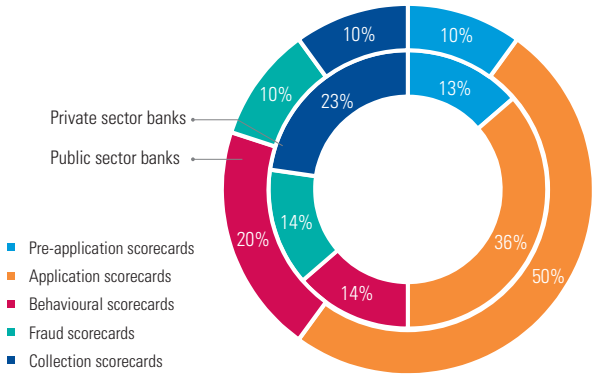
Consumerism is the driving force behind the retail business and consequently, customer loyalty is required to be earned on a continuous basis. Portfolio analytics models offer banks a low-cost method to identify the right segment of customers that they should retain, thus helping them maintain their existing market share. This ability for consolidation is critical at present, considering the extent of competition in the banking industry.

Survey findings

Private banks use quantitative techniques for retail model development more frequently than public sector banks. This is a function of the fact that many public sector banks do not have sufficient reliable internal data. This also reflects the fact that private sector banks are more likely to use models in all phases across the customer life cycle, whereas public sector banks tend to concentrate their efforts on developing and deploying applications scorecards.

> "In a slow growth environment, banks which make efficient use of models/analytics are likely to grow at a higher rate."
>
> Naresh Makhijani
> **Partner and Head**
> Financial Services
> KPMG in India

Types of scorecards used by banks



Source: KPMG in India analysis, 2016

Our view

- Models are essential to the development of the bank's retail business. Efficient use of models helps to reduce customer acquisition costs and enhance the profitability associated with each customer.
- All banks should strive to maintain databases and frameworks with reliable internal information to facilitate the development of quantitative models, in addition to expert judgement and vendor models.
- Internal models usually provide better estimates for a bank from a capital computation perspective as they are customised as per the bank's strategy and risk profile.

1. RBI Report on Trend and Progress of Banking in India (2014 - 2015). URL: https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/0FLTP577BF4E172064685A26A73A6BC9210EC.PDF

Trend four: New product evaluation

Description

While the use of models is essential for efficient functioning of the bank's day-to-day activities, the relevance of use of models for different products should be evaluated completely prior to deployment. Banks tend to rely on traditional/plain vanilla structures for fixed income instruments; however, the market demands new structures, based on volatilities and pricing strategies. Frequent foreign exchange fluctuations combined with the pressure for competitive pricing should prompt banks to develop new products with the help of models, in order to address these requirements.

> "The more complex the model, the more its ability to create illusion around its invincibility."
>
> Damodaran C
> **Assistant General Manager**
> The Federal Bank Limited

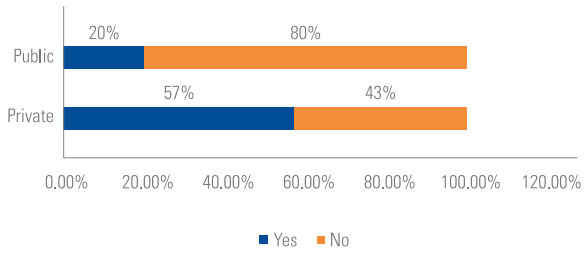
Survey findings

During our survey, we found that banks suffer from incorrect use of credit models, especially in case of new products. Models deployed in this case should be subjective with quantitative or quasi-quantitative models being built when additional data is available.

In terms of market risk models, just over 50 per cent of private sector banks use proprietary models to compute prices of securities in the trading book; however, this is much higher than the mere 20 per cent of public sector banks that use models for this purpose.

Most banks incorporate illiquidity in the price of the security based on the standard haircut based on the type of the security; however, some private sector banks also use proprietary model based haircut, which is a more sophisticated model.

Use of proprietary models to compute price of securities in the trading book



Source: KPMG in India analysis, 2016

Our view

- Banks should adopt proprietary models for computation of security prices and haircuts for illiquidity adjustment.
- These models should be subject to independent review by third party vendors.

Trend five: Need for skilled resources and training

Description

Several banks suffer from a lack of skilled staff, who face challenges in understanding the development, deployment and maintenance of models. Banks may consider providing either internal or external training to existing staff members in order to build these capabilities.

Survey findings

Building skilled teams

There is no unified view on the requisite qualifications of model development and validation units. Broadly, private sector banks seem to prefer including personnel with relevant technical or banking expertise as part of the validation team and consider prior experience in model development to be less relevant.

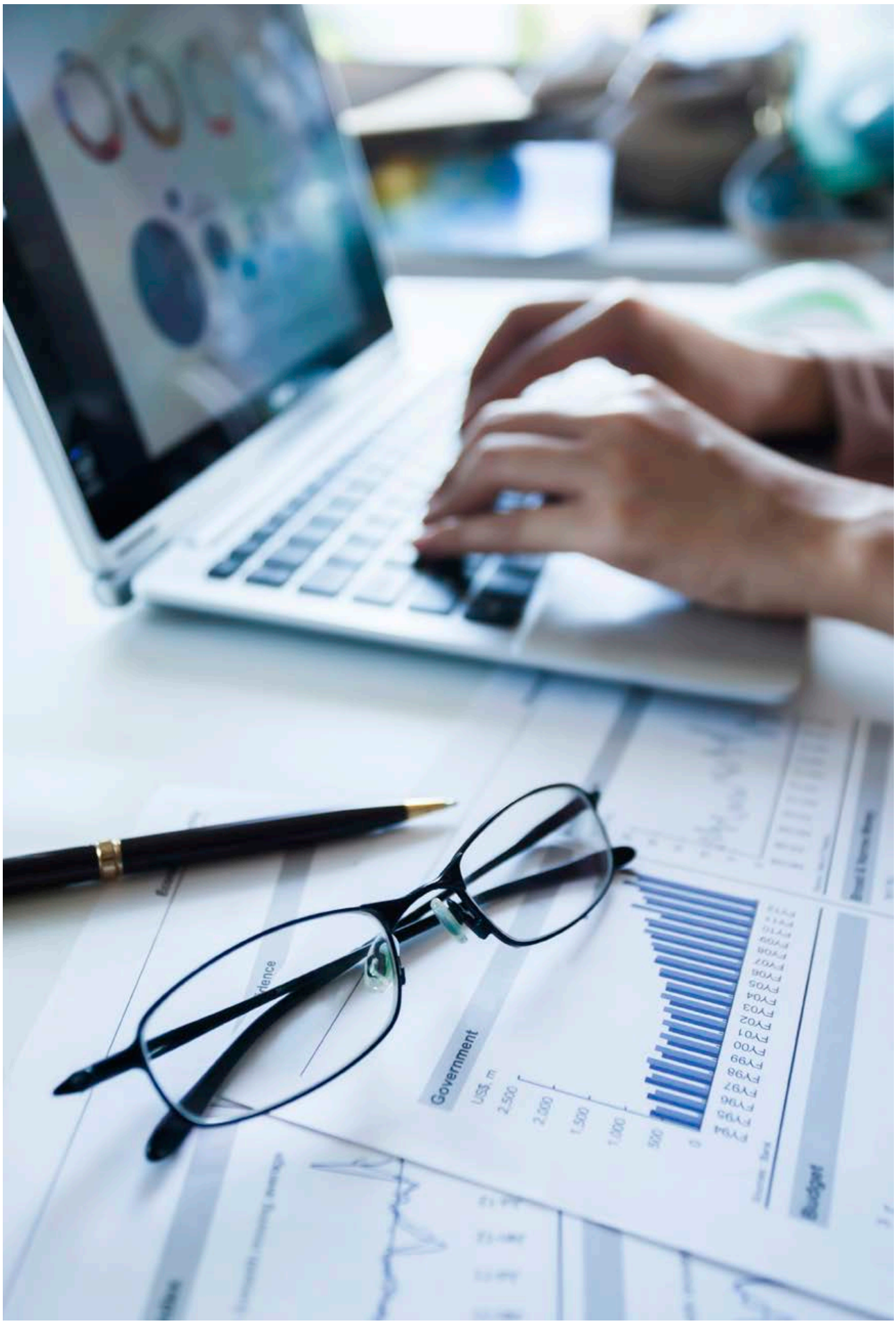
The opinions provided by public sector banks indicate that there is no clear preference to any particular type of characteristic for model validation teams.

> Getting the right mix of individuals who have the technical skills as well as understanding of the dynamics of the banking industry is a key ingredient to building a sustainable model development function which provides effective inputs to the business.

Himanish Chaudhuri
Partner
Risk Consulting
KPMG in India

Our view

- A bank's model development and validation unit should have a good mix of individuals with a banking background, relevant experience, academic background in economics/statistics, knowledge of modelling tools and those who have been previously associated with development/implementation of the type models being used.
- In case of challenges related to skilled resources, banks may seek to outsource key activities in the short-term. However in the long-term, banks should strive to conduct training at regular intervals, by experienced and skilled internal/external personnel.
- Larger banks may tie up with training institutes to help ensure that key personnel develop the necessary skills for model development and validation over a period of time.



B. Model risk-related issues

Certain industry-wide issues have been identified through the course of the survey. These issues have been presented below:

Issue one: Model risk is not a focus area

Description

Banks often use models but do not fully understand the risks associated with the same. Lack of a de-facto industry standard definition of a 'model' and the absence of regulatory guidance regarding model risk (both within India and globally) allows banks to understand and interpret models and model risk in different ways. As a result of this, banks may not adequately check all assumptions and results related to all models deployed within the bank.

Survey findings

Back to the basics

Models and model risk:

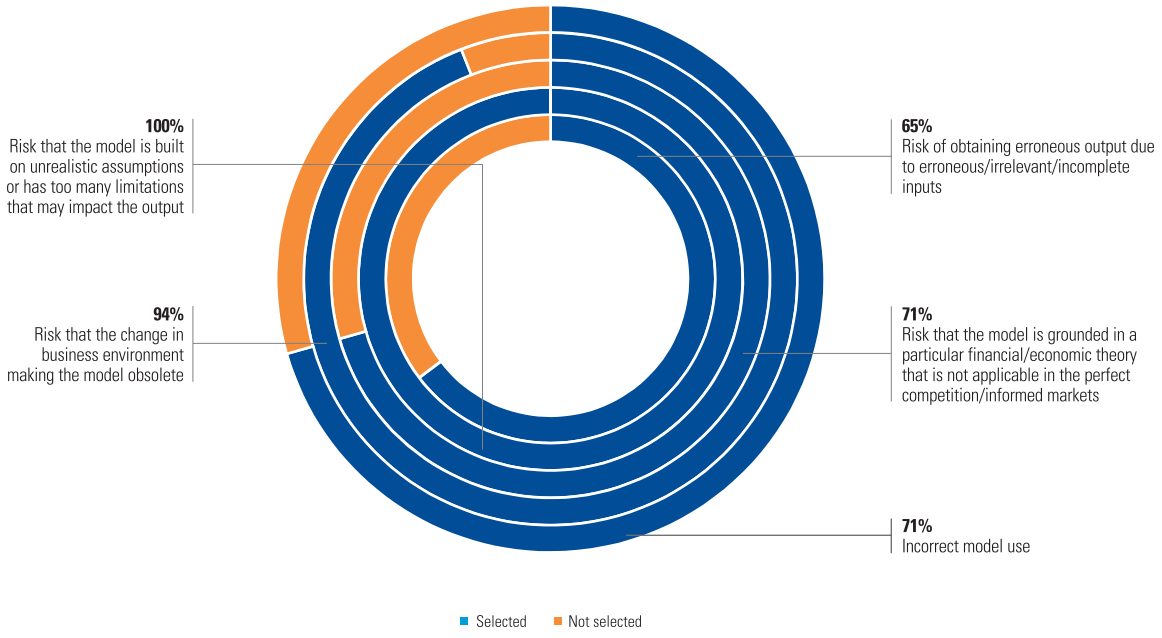
Banks do not concur on what constitutes a model, leading us to assume that they need to put together these definitions. Irrespective of the definition applied, responses received from leading banks reflect an emphasis on providing clarity and explanatory guidance on the interpretation of the definition.

In the absence of accepted industry standards, there is some uncertainty leading to inconsistent practices amongst banks regarding the tools to exclude from the model inventory. In the absence of meaningful input from the regulators, banks are highly encouraged to clearly document the rationale and assumptions of what tools do or do not constitute a 'model', including how they are treated for validation or review purposes.

As a result of the inconsistency in the definition, the concept of model risk is not well-understood in the industry. Majority of the survey respondents acknowledged all the major sources of model risk; however, 35 per cent of the respondents did not feel that erroneous/irrelevant/incomplete inputs can lead to inappropriate output. Further, 29 per cent of the respondents did not recognise that incorrect use of any model may lead to model risk.

> "Model risk is the likelihood of loss from decisions based on incorrect model outputs. Mitigating this risk requires robust processes and controls around model development, validation, implementation and use. Equally important is the interpretation of model outputs and the knowledge regarding limitations of the model."
>
> Ripujit Chaudhuri
> **General Manager**
> ICICI Bank

Understanding model risk



Source: KPMG in India analysis, 2016

Miles to go

Model risk management

The activities that a bank may undertake to manage model risk have been classified into the following three categories based on their level of sophistication:

Table 1

Basic

- Model ownership is clearly defined
- Data and computation sheets are verified
- Calculations/excel sheets and formulae are password protected and shared on a need to know basis.

Intermediate

- Deployed in controlled IT systems
- Periodic model validation
- Independent data audit/ verification
- Periodic model review to ascertain applicability, relevance and accuracy of the model with respect to the objective.

Advanced

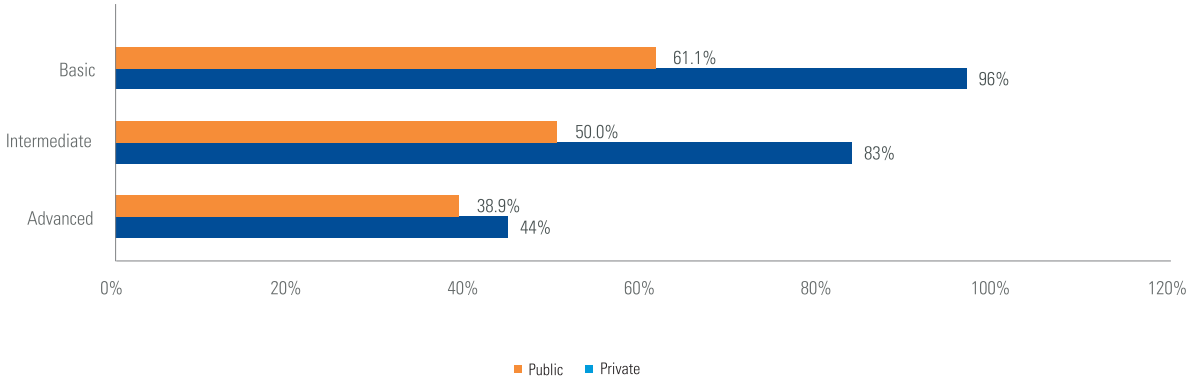
- Regular training on model usage conducted
- Models managed under a formal governance framework
- Existence of a model risk quantification unit.

Source: KPMG in India analysis, 2016

Majority (96 per cent) of the private sector respondents perform basic activities with regards to model risk management, however only 44 per cent of them have adopted advanced measures to manage model risk. In case of public sector banks, 39 per cent of the respondents feel that they perform advanced activities with regards to model risk management but only 61 per cent have adopted the basic measures.

Most of the private sector banks seem to follow a phased approach to implement model risk management techniques. In case of public sector banks, this systematic approach is less apparent.

Measures taken to manage model risk



Source: KPMG in India analysis, 2016

Level playing field

Regulatory guidance

While banks accept the importance of managing model risk, they consider the current scenario to be premature and would prefer to wait for the regulator to publish guidelines on the same.

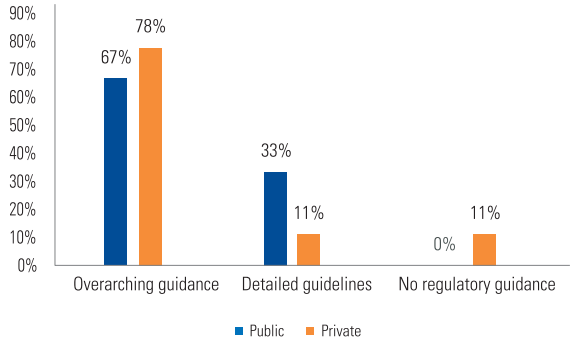
Some of the foreign banks have adopted model risk management practices from their parent banks and are expecting the regulator to provide overarching guidance on model risk management, leaving the management of model risk to respective banks.

Regulators in some geographies have issued detailed and structured guidelines for management of model risk. Office of the Comptroller of the Currency (OCC) in the U.S. has issued SR11-7 Supervisory Guidance on model risk managment. Almost all the survey respondents are of the opinion that regulatory guidance is required with regards to model risk managment.

Private sector banks expressed their views which involves the regulator only to the extent of providing a broad framework for managing model risk, while leaving a large part of the day-to-day management to the bank's discretion.

Many public sector banks supported this view as well; however, the percentage of public sector banks in favour of detailed guidelines was higher than that in case of private sector banks.

Regulatory guidance



Source: KPMG in India analysis, 2016

Our view

- As per the OCC guidelines, the term 'model' can be defined as a quantitative method, system, or approach that applies statistical, economic, financial, or mathematical theories and techniques to process input data into quantitative estimates, used for decision making, pricing or regulatory reporting.
- Model Risk can be understood as the risk of model failure due to incorrect inputs, flawed assumptions, and incorrect model design or model misuse.
- In the absence of industry standards, every bank has to itself decide the scope of what should constitute a model and identify the sources of model risk. This scope at times may be uncertain and might require high degree of subjective judgement.
- Since several banks in India do not currently have any internal process for managing model risk, the RBI may issue guidelines with respect to the same in order to provide clarity to banks regarding model risk measurement and mitigation techniques. These guidelines are expected to address effective model risk management, while allowing banks to manage the risk in line with the risk profile and sophistication of model use within the bank.
- The RBI may also account for the fact that different types of models might be associated with different levels of scrutiny for compliance with model risk guidelines, according to the systematic risks they present to the banking industry.

Issue two: Organisational dilemma

Description

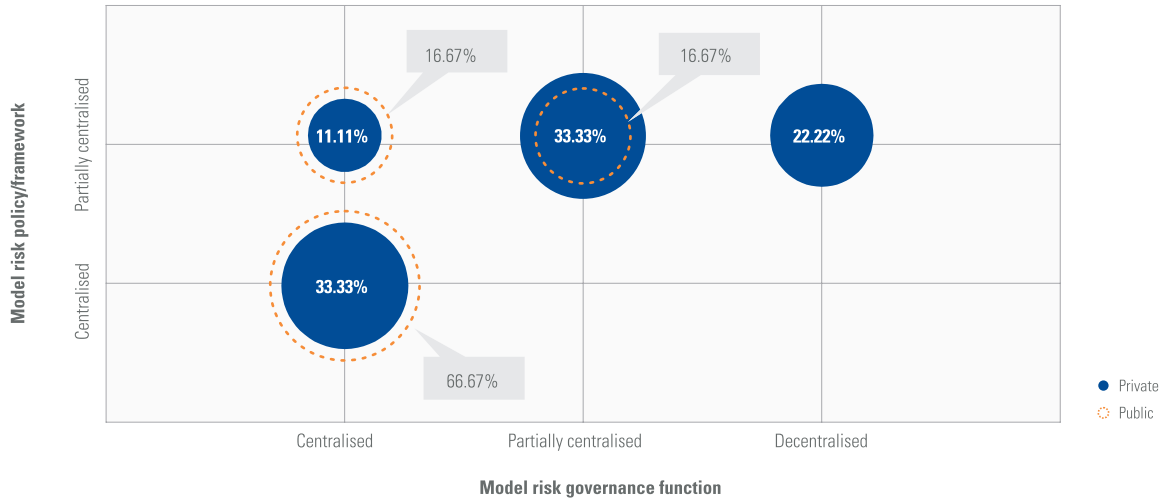
Models are only as useful as the extent of their applicability. Models developed in a certain scenario may no longer be relevant in case of unexpected fluctuations in the industry. Consequently, models should adequately capture both, the industry and product specific characteristics and strategic decisions within the bank, related to industry-wide trends. A fully decentralised model governance and management structure is likely to operate in a silo and miss systemic changes that might eventually affect all portfolios. On the other hand, a fully centralised structure can incorporate only the larger picture, and miss the risk areas pertinent to a product.

Survey findings

A core component of an institution's governance framework is the clear delineation of appropriate model risk management roles and responsibilities assigned to each function (e.g., model owners, developers, users, validation, compliance, etc.). Banks specifically understand the importance and necessity of Board involvement in the model risk management process. Most banks also agree that model risk should be managed by a central unit. Of the respondents, 83 per cent of the public sector banks prefer a fully centralised governance function. In case of private sector banks, 44.5 per cent respondents are in favour of a centralised model. However, a large percentage (33 per cent) would prefer a middle ground by way of a partially centralised model.

This distinction is also present in the deployment of the model risk framework; majority (two-third) of the private sector banks prefer a partially centralised approach, whereas majority of the public sector banks prefer a fully centralised approach.

Model risk framework and governance structure



Source: KPMG in India analysis, 2016

Our view

- In order to manage model risk, banks should form a central model risk management function which provides broad guidelines and a basic model risk measurement policy/framework.
- The responsibility for actual implementation of the policy and day-to-day management of model risk may lie with the individual department as each model is different in its use, deployment and consequently in terms of the associated risks. We hence recommend a partially centralised model, as is observed in leading internationally active banks.

Issue three: Extent of model use

Description

The use of models in credit and market risk mitigation and customer acquisition is widely understood in the industry; however banks tend to ignore the more innovative use of models. Often, banks do not recognise these as models, thus limiting their scope and applicability. Judicious use of models across the customer life cycle can help banks make better use of their resources and reduce costs.

Banks also develop their Risk Adjusted Return on Capital (RAROC) frameworks for the purpose of regulatory reporting. Banks have now begun to recognise the relevance of RAROC from the perspective of driving business growth in high-return segments, but have not used low return as an indication to restrict exposures.[1] Banks should use portfolio specific and RAROC based models in conjunction with each other, to identify specific target areas in order to manage their exposure strategy in the market.

Survey findings

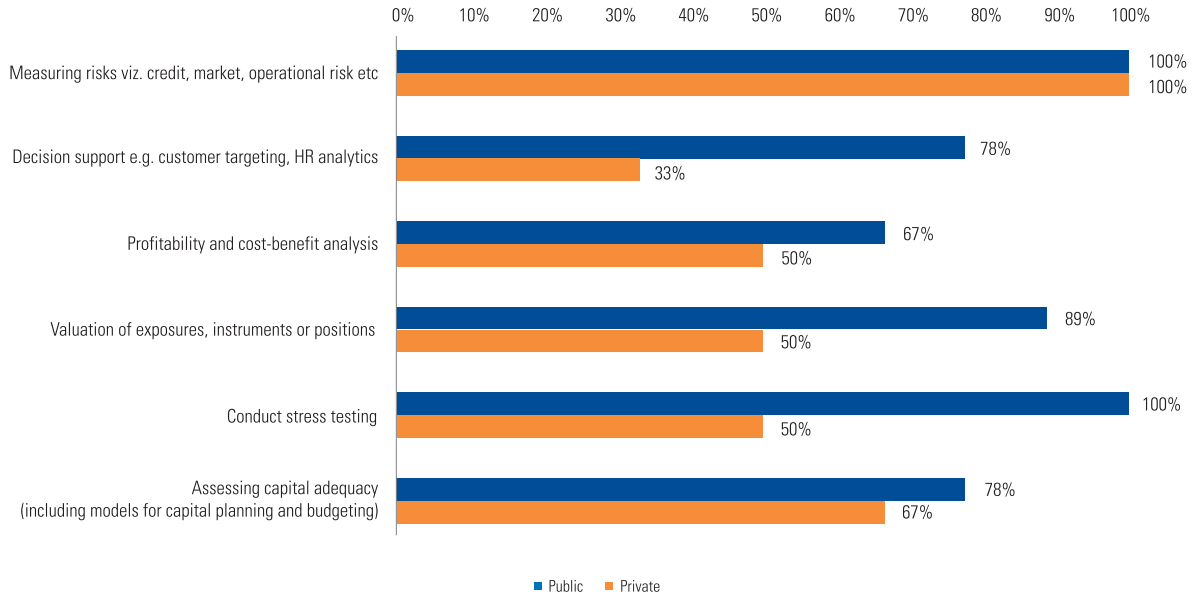
Sky is the limit

The use of models among Indian banks is dependent on the institution size and the lines of business. While all banks use models for measuring risk, majority of the public sector banks do not use models for decision support viz. customer targeting, HR analytics, etc. All private sector banks use models for conducting stress testing; however, half of the public sector respondents do not seem to use models for this purpose.

To the extent of capital budgeting, models are reasonably well-developed, with most banks involved in moderately complex model development, where a granular portfolio-wise split is considered for arriving at capital numbers, and the capital plan is intricately linked to the business plan of the bank.

While both private and public sector banks are involved in the development of moderately complex models, most private sector banks (approximately 90 per cent) perform back-testing of their models. This proportion is much higher than in the case of public sector banks (60 per cent).

Use of models



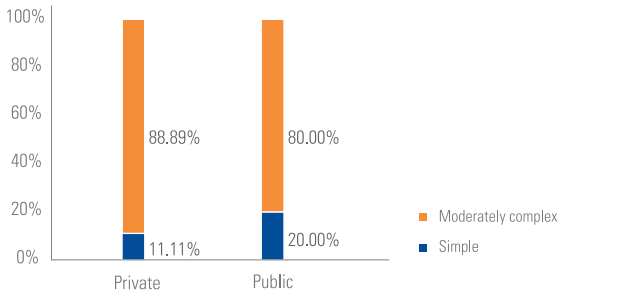
Source: KPMG in India analysis, 2016

1. KPMG in India's analysis, 2016

> The way financial and risk models are becoming an integral part of the decision-making process and the manner in which these models are growing in complexities, the risks emerging from the same have also been amplified. Therefore, model risk management and governance framework is assuming greater significance today.

Amit Anand
Assistant General Manager
Bank of India

Approach followed for capital planning and forecasting



Source: KPMG in India analysis, 2016

Our view

- Banks have not explored the full scope of model use, especially in non-risk related areas.[2] An added focus on analytics can help banks reduce costs and improve efficiency by applying models to all nodes that require any decision support or evaluation.
- Taking into consideration the current level of model use in the industry and the extent of availability of reliable data, it is appropriate for banks to adopt a moderately complex approach in developing models for capital budgeting and planning, by using a portfolio level granularity to arrive at a capital number. However, banks should seek to close the loop by performing backtesting and validation of these models at regular intervals.

2. KPMG in India's analysis, 2016

Issue four: No data quality standards

Description

Banks suffer from a lack of standardisation and accuracy at the time of data entry.[3] The responsibility for data entry often lies with individuals who are assigned the task of generating new business and have no incentive to ensure that the data entered is accurate, clean and complete.

While global standards are available in this regard in the form of the circular BCBS 239, banks are yet to adopt and adhere to these standards.[4] Absence of quality data limits the applicability and accuracy of internally developed models for banks.

Survey findings

Data quality and availability

Self-starter

Majority of the PSU respondents were unable to rely on internal data and acquired off-the shelf models. Most of these PSUs made some necessary changes to these models to suit the risk profile of their bank. The model manuals provided by the vendors contain a generic model development process which, in many cases, is the only document related to model development that these banks have.

Private sector banks typically employ a wide range of methods for model development, with majority of the banks relying on their internal data to develop quantitative and quasi-quantitative models for their retail portfolios and other applications. The least preferred method of model development for private banks is using off-the-shelf/vendor models with some entity specific adjustments.

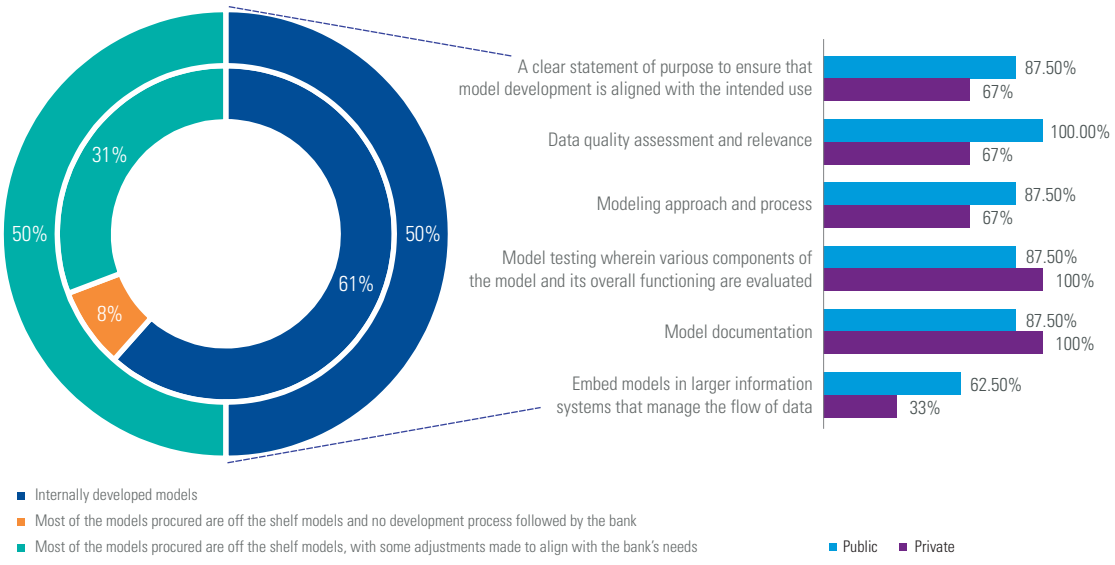
All the foreign bank respondents have adopted the models used by their parent bank. Some of the banks made minor changes to these models to suit their local requirements. Model development is done by the parent bank and thorough model development documentation is shared with the local banks. These banks document the rationale of the changes made by them to the models, but may not have a complete understanding of how the parent model works.

Model performance and effectiveness

Model robots

The steps involved in internal model development are followed rigorously by all banks; however, private sector banks tend to integrate the model as part of an automated process/data flow more frequently than public sector banks.

Types of models used by banks and steps involved in model development



Source: KPMG in India analysis, 2016

3. KPMG in India's analysis, 2016
4. KPMG in India's analysis, 2016

> Banks should adhere to global risk data quality standards, as prescribed in the BIS guidelines. Absence of quality data, limits the applicability and accuracy of the internally developed models.

Kuntal Sur
Partner
Risk Consulting
KPMG in India

Our view

- Banks should take a cue from the recent regulatory changes and focus their efforts on building a framework with reliable internal data.
- The data may be used in the form of development of quantitative or quasi-quantitative models, or to validate qualitative/expert judgement models.
- Banks should adopt global standards for data collection and aggregation, as mentioned in circular BCBS 239.
- Data ownership is one of the most critical limiting issues for effective risk data aggregation. Neither the key business heads nor the senior management for IT, take responsibility for the quality and integrity of data. Senior management should assign individuals to take ownership of data quality.
- Banks should adopt a holistic approach to data governance, wherein the focus on risk data aggregation shifts from mere regulatory compliance. Banks may then be able to harness the full potential of the data at their disposal, using it for efficient decision-making on automated platforms.

Issue five: Model validation and maintenance

Description

The assumptions underlying models and the set of data used at the time of model development may no longer be relevant as banks move through the product life cycle and the economic peaks and troughs. Any model is prone to deterioration due to the vagaries of the business cycle and industry, as well as any change in the strategy within the bank. It is hence essential to conduct timely and thorough model validation activities.

However, just validating models is not enough. Banks often continue using the same models with reduced performance, simply to avoid changing/building a new model. A well-documented structure of circumstances under which to effect a model change might help banks to streamline these efforts and avoid losses due to the continued usage of sub-par or outdated models.

Survey findings

Closing the loop

Model validation practices generally depend on the bank's model classifications and are required to periodically review and validate models with increased frequency when classified as having a high risk or a material financial impact. High risk/impact classifications may result in more stringent documentation standards, review by more experienced staff, detailed model development scrutiny and challenge, and more stringent back testing and outcomes analysis. Most of the banks follow a regular cycle of model validation, which is dependent on the type and use of the model. Regulatory models are validated at least annually.

Most foreign banks conduct an independent validation of models by recruiting personnel from a different department within the bank, which is independent from the department using the model. This helps to enhance the scope of work for resources working in otherwise niche areas, while lending an independent view to this exercise.

Principles of model validation

Almost all banks have established a model validation methodology that includes developmental evidence, ongoing monitoring, and outcomes analysis. In addition, the survey results also reflect several key principles of the model validation process followed by banks.

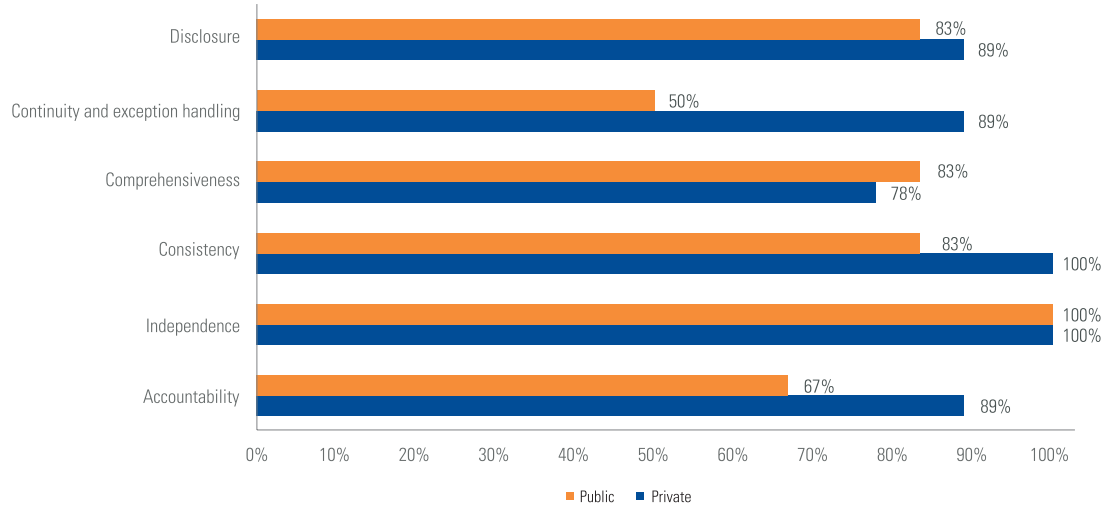
> Model risk cannot be eliminated, only mitigated by good management. A combination of expert modeling and robust validation, while necessary, is not sufficient to eliminate model risk.

Mritunjay Kapur
Partner and Head
Risk Consulting
KPMG in India

> Why you must have a strong validation framework: For every two ways you can build a model, there are four ways you can implement it badly.

Ashish Abraham
Senior Vice President
HDFC Bank

Principles of model validation



Source: KPMG in India analysis, 2016

Model validation issues

Despite having established the core model validation programme, respondents continue to report ongoing validation execution issues, namely:

- Input data and assumptions: Data integrity and reliability from certain data sources, heavy reliance on the management's subjective assumptions, etc.
- Process: Controls around assumptions: Manual data input, model updates, data output and reporting, change management, etc.

- Model use: Models are being used for purposes other than what they were originally intended for when the model was designed and implemented.
- Lack of support: Inability to validate qualitative assumptions and judgements
- Staffing: Despite having upgraded in some respects, there is a continued shortage of experienced and qualified staff to build and validate the models. This is especially true in public sector banks. Personnel with a combination of technical skills and banking knowledge are required for model validation.
- Scheduling: Challenges scheduling validations in a timely manner
- Documentation: Lack of comprehensive model documentation (e.g., supporting model assumptions and limitations, an ongoing monitoring plan, evidence reflecting when models under development go into production, and model changes).

Model use and maintenance

Most banks use models for decision-making and pricing for at least a part of their portfolios; however, the private sector banks use models for limit setting as well. This aspect of model use is not popular amongst public sector banks.

Most banks do not carry out model maintenance and validation activities in a structured manner, and are often not differentiated from one another. Where banks do have a separate process for model maintenance, the activity is carried out on an ad-hoc basis.

Model change

- 60 per cent of banks have a standard well-documented process for model change; however, this proportion is higher in case of private sector banks, 67 per cent of which have a well-documented policy as compared to only 50 per cent of public sector banks.

The key principles followed by banks in relation to model updates are mentioned below:

a. Model changes are triggered by observations made during the validation or maintenance activities

b. Changes to the model are executed
   i. on an ad-hoc basis, as and how they are observed
   ii. only as a part of the annual review, and are not undertaken in the interim period
   iii. as and when vendor model upgrades are available

c. Approvals are sought from their senior management as per the governance structure, prior to making any model changes

d. Revised model is tested prior to deployment

e. Model changes are officially communicated to all the concerned stakeholders

f. Model version control is maintained; model versions are signed-off by the senior management.

Our view

- The efficacy of model validation in model risk mitigation is based on the independent analysis and review of the decisions made at the time of model development. In addition, the validation activity spans over the cycle of model implementation, deployment and use. The frequency and sophistication of the model validation activity should be commensurate with the level of risk the model represents.
- Documentation requirements for high-risk models could consequently be more stringent than those for lower risk models. Thus, model use, complexity and materiality are key drivers to determine the rigour and intensity associated with the model validation activity.
- Banks can use an independent system for model validation.
- Banks should have an independent model validation unit consisting of individuals with the requisite knowledge and skills. There is also a need to separate model maintenance activities from model validation. The process for model validation, model maintenance and the process for model change should be formalised and documented.

Issue six: Inadequate documentation

Description

Banks have been using vendor-developed and off-the-shelf models with some customisation for risk mitigation. This is especially true for corporate/commercial banking portfolios, where the product offerings and target customers are not differentiated across organisations.

Over time, these models tend to deteriorate in performance; however, banks are unable to either track or address these changes due to lack of adequate documentation from the vendor. Model owners within the bank often operate these models as a 'black-box' along with the lack of complete understanding regarding the model, leading to inefficient use across the business cycle.

Survey findings

Model assumptions and limitations

Private sector banks prefer using internal models, while public sector banks tend to use internal models and off-the-shelf models with some adjustments. The option of using off-the-shelf models with no customisation for specific use within the bank is the least preferable option for all banks.

Survey respondents overwhelmingly indicate the lack of model development documentation (i.e., either insufficient documentation or where documentation exists it does not meet the policy standard) as the largest issue associated with model development and implementation. This issue appears to be consistent irrespective of the institution's size or complexity.

> "Modern day 'model' is like ancient Indian astrology. The inherent risk can be mitigated by practicing continuously on the subject."
>
> Ashutosh Choudhury
> **Deputy General Manager**
> Risk Management
> Oriental Bank of Commerce

Our view

- Banks should have a clearly documented model development process covering at least the following:
  - Clear statement of purpose
  - Modelling approach
  - Modelling process
  - Model testing process
  - Model assumptions and limitations.
- In case banks have procured off-the-shelf models, they must understand the model development process adopted by the vendor, and customise it as per their specifications. Further, banks should procure appropriate model development documents from the vendor, including the data used for developing the models.
- Banks should maintain an appropriate version control mechanism on all key documents. This is done in order to facilitate tracking of key changes in the model over its life history.

C. Overview of the global landscape

The analysis of model risk in India is incomplete without benchmarking the prevalent practices to those of global standards. These findings are presented in the following sections:

Practices through the model life cycle

The table below presents a comparison of the extent to which good practices are employed in developed and emerging markets globally, with respect to the current scenario in India. These practices are analysed through the various stages of the model's life cycle.

Table 2

Model aspects	Developed markets	Emerging markets	India
Definition of the model and its scope Stage where model requirements are identified and the model objective, scope, design, materiality and approach for development are agreed upon.			
Model governance Stage where model ownership and approval process is defined.			
Data validation Stage where data is verified for accuracy and completeness. Risk data standards as set by BCBS 239 should be adhered to.			
Model development and testing Stage where a model is developed by model owners as per defined standards and tested for consistency of performance.			
Model implementation Stage where the model is embedded into a controlled system.			
Model use Stage where the model is used by the business.			
Periodic validation Stage where the performance of the model is evaluated.			

Note:

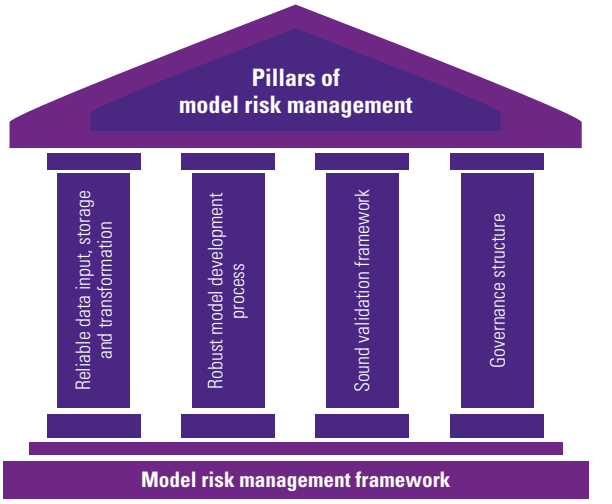
1. Grades are provided for each sub-heading in terms of a monotonic scoring scale, as follows:
   - 1-Poor: Standards met by less than 20 per cent of the banks in the industry
   - 2-Moderate: Standards met by 20 to 50 per cent of the banks in the industry
   - 3-Good: Standards met by 50 to 90 per cent of the banks in the industry
   - 4-Excellent: Standards met by more than 90 per cent of the banks in the industry
2. Data represented in the table is based on KPMG in India's findings, survey results and market research.

What do the global regulators say

> The expanding use of models in all aspects of banking reflects the extent to which models can improve business decisions, but models also come with costs. There is the direct cost of devoting resources to develop and implement models properly. There are also potential indirect costs of relying on models, such as the possible adverse consequences (including financial loss) of decisions based on models that are incorrect or misused. These consequences should be addressed by active management of model risk
>
> - Office of the Comptroller of the Currency, Board of Governors of the Federal Reserve System (Supervisory Guidance on Model Risk Management - SR Letter 11-7)

Global regulators feel that model risk should be managed like other types of risk. Banks should identify the sources of risk and assess their magnitude. Model risk increases with greater model complexity, higher uncertainty about inputs and assumptions, broader use, and larger potential impact.

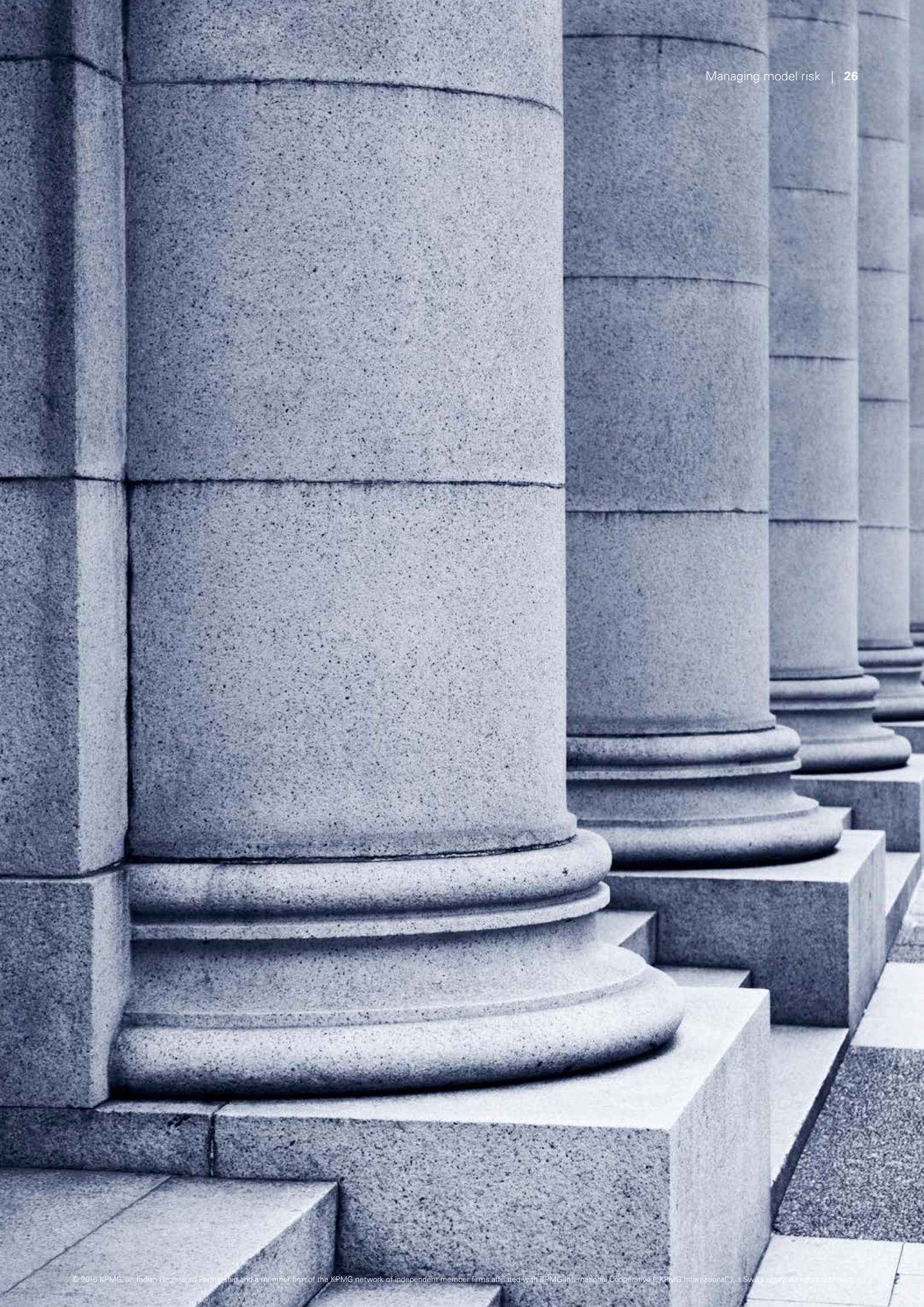
They opine that banks should consider risk from individual models as well as on an aggregate basis. Aggregate model risk is affected by the interaction and dependence amongst models; reliance on common assumptions, data, or methodologies; and any other factors that could adversely affect several models and their outputs at the same time. After understanding the source and magnitude of model risk, the next step is to manage it properly.



Based on: SUPERVISORY GUIDANCE ON MODEL RISK MANAGEMENT (SR Letter 11-7) Office of the Comptroller of the Currency (OCC) of the US Federal Reserve

Model risk management depends upon robust model development, implementation, and use. Another essential element is a sound model validation process. A third element is governance, which sets an effective framework with defined roles and responsibilities for clear communication of model limitations and assumptions, as well as the authority to restrict model usage.

1. http://www.federalreserve.gov/bankinforeg/srletters/sr1107.htm



D. Learnings for small banks and payments banks

RBI has recently adopted a differentiated structure to traditional banking, with the introduction of small banks and payments banks, following the recommendation of the Committee on Financial Sector Reforms in 2009.[1]

These banks have been designed to serve the unorganised sector, in order to provide lending and remittance facilities to low income households, rural populations, small businesses, farmers and the daily-wage workforce. It is expected that the average ticket size of each transaction at such small banks and payments banks would be too low for businesses to remain profitable without higher volumes and higher rates of interest.

The RBI has opined that small banks should focus on high-technology and low cost operations, thereby making this sector ideal for the use of models. Models here may not refer to pure statistical models, but may be deployed as quasi-quantitative models to provide decision support across the vagaries of the various joint-liability, low ticket size products offered by such banks. This decision support is likely to apply to fresh sanctions as well as auto-renewal cases.

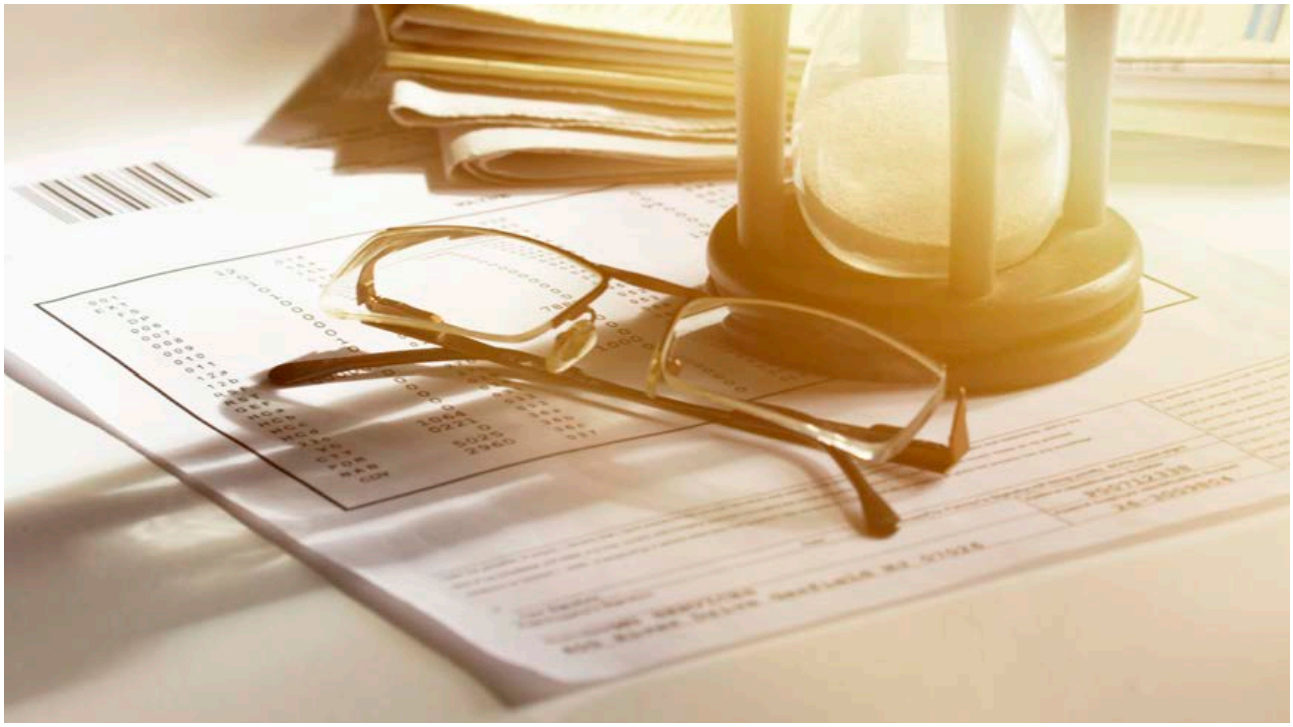
In the case of both these types of banks the use of models is not limited to risk evaluation. Additional areas of model use could include:

- Development of triggers for balance transfer by leveraging bureau information
- Selection of appropriate portfolios for securitisation
- Estimation of core and surplus funds
- Fraud detection at the obligor level
- Fraud detection at the transaction level
- Dynamic policy/strategy changes based on intelligent MIS
- Tracking performance of credit officers and collection agents
- Target setting and performance evaluation of branches.

Small banks and payments banks may also learn from the challenges faced by larger banks due to data insufficiency and inadequate IT infrastructure, and accordingly invest in technology, data systems and other good practices in the industry.

Banks may also recognise good practices in terms of governance structures and deploy them right at the initial stages.

1. Banking Structure in India - The Way Forward, August 27, 2013



E. Conclusion

Models are being used extensively across a variety of applications by many Indian banks. While individual validation units exist for a lot of major models (especially those associated with regulatory scrutiny), the assessment and management of model risk is not as well-understood as the usage of the models themselves.

This is partly due to the fact that there is no unified view in the banking industry regarding model definitions and the set of risks associated with them. In the absence of established industry standards, banks tend to use simple risk management techniques to manage model risk. Consequently, almost all banks have implemented basic techniques for mitigation of model risk. Several private banks have also implemented slightly more advanced techniques.

There are varied views in the banking industry regarding the type of governance that should be associated with model risk. While all banks wish for more active senior management involvement in the administration of model risk, public sector banks prefer a fully centralised approach to both, model risk policy and governance structures, with bulk of the decision-making and policy-making ability residing with a central model risk management unit. Banks agree that this unit should comprise of employees having banking experience and an understanding of statistics/ mathematics, IT and applicable regulatory requirements. However, public sector banks in particular, have expressed their concerns regarding the availability of such resources within their organisation.

Private sector banks also support the presence of a central model risk management unit, but prefer a partially centralised approach to the model risk policy and framework. Under this framework, broad guidelines and overarching principles are expected to be provided by the central unit but day-to-day management of model risk shall continue to be the responsibility of individual units.

This difference of opinion is perhaps due to the larger diversity in the type of models employed by private sector banks. Specialised models are often built by individual teams in private banks, using internal data. A central unit may not be able to capture all the risks associated with the nuances of these models. Such models are built less frequently in public sector banks due to the lack of availability of internal data, amongst many other reasons.

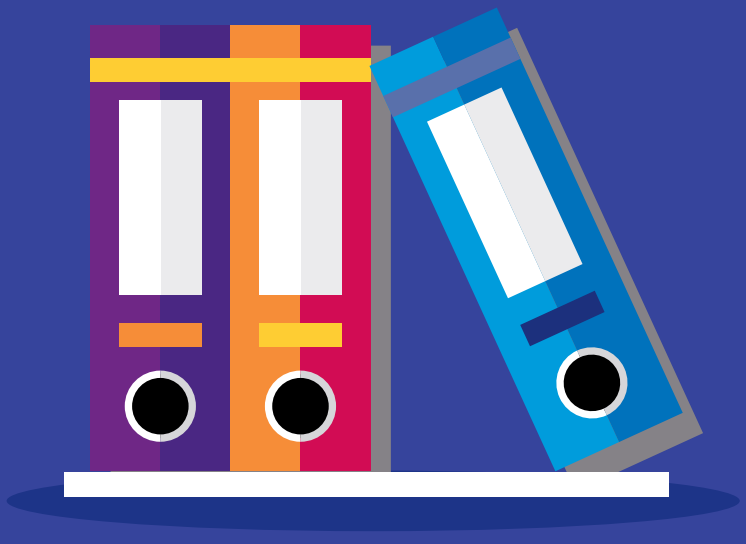
Where models are developed internally, the steps used in development are broadly the same for public and private sector banks; however, private sector banks deploy internally developed models in an automated environment more often than public sector banks. System automation is key to accurate model deployment and this helps to reduce model risk.

The scope of application of models has been explored extensively by large banks, while banks with medium to small asset bases tend to use models to the extent required by the regulator. While many banks use models for decision-making and pricing; many public sector banks do not use models for setting limits. This use of models is explored by private banks to a large extent.

All banks use moderately complex models for capital budgeting and planning; however, a higher proportion of private sector banks close the loop by conducting back testing.

Model risk management principles could be standardised by the RBI by providing guidance on measurement and management of model risk. Banks expect that RBI shall provide overarching guidance, while leaving the day-to-day management of model risk to the bank's discretion.

F. Appendix



The survey was conducted mainly through personal interviews with the various risk, treasury and analytics professionals in leading banks. Responses from a few respondents were obtained through an online survey as well.

Questionnaire structure

The questionnaire was segregated into the following categories:

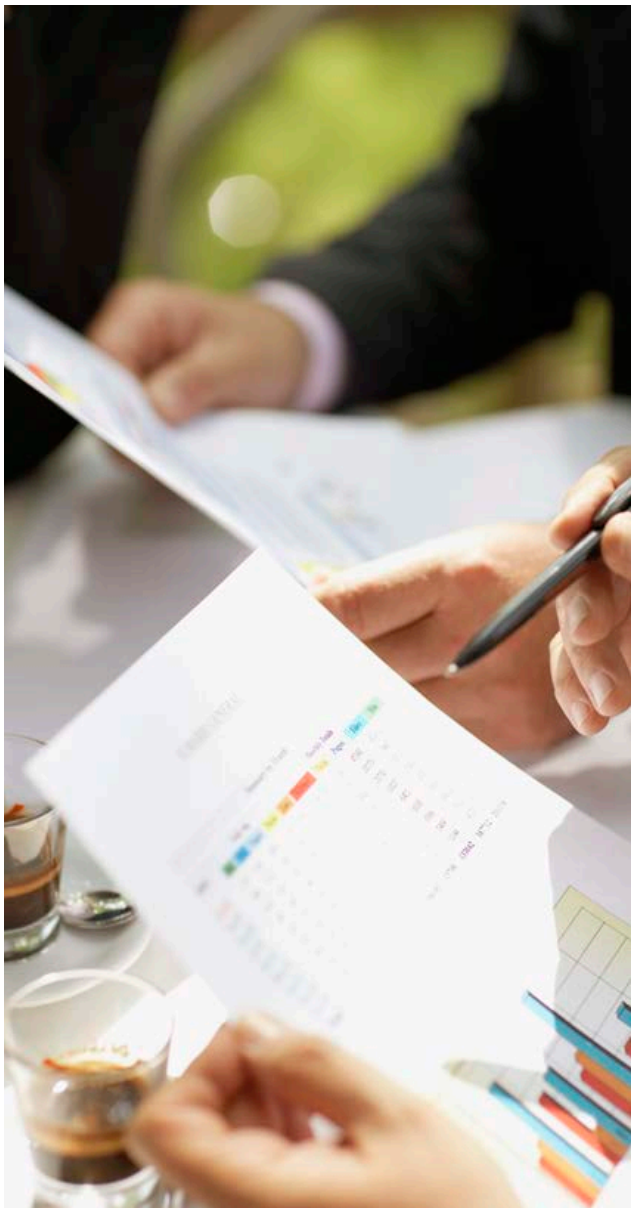
1. Understanding model definition: This section aimed to conceptualise what can be categorised as a model and looked at the various types that could ideally be a part of a bank`s model inventory.
2. Understanding model risk: This section assessed the basic understanding of model risk and what efforts are currently being undertaken by various banks in India to address it.
3. Model risk governance: This section covered several aspects of governance and sought to understand the existing framework of various banks in India.
4. Model development: This section looked at the various approaches of model development adopted by banks in India.
5. Model validation: This section aimed to understand the philosophy and methodology of model validation adopted by banks in India.
6. Model deployment, maintenance and use: This section evaluated the extent of the use of models for decision-making in the bank.
7. Integration in risk management: This section attempted to understand the importance given by banks to model risk management within the overall risk management framework.
8. Credit risk management: This section attempted to understand the importance given by banks to model risk management within its credit risk management framework.
9. Capital budgeting and planning: This section attempted to understand the importance given by banks to model risk management within its capital planning framework.
10. Treasury and market risk management: This section attempted to understand the importance given by banks to model risk management within its treasury and market risk management framework.

Coverage

The survey conducted covered 66 per cent of the listed banks by asset size, based on data obtained from the annual reports of the relevant banks as on March 2015.

Survey respondents

The survey respondents were a mix of public sector, private sector and foreign banks based out of India. 35 per cent of the survey respondents were from public sector banks, 53 per cent of the survey respondents were private sector banks and 12 per cent of the survey respondents were foreign banks.



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Sharon D'silva
Shreela Nair
Sheekha Panwala

A special thanks to all our survey respondents.

KPMG in India contacts:

Nitin Atroley
Partner and Head
Sales and Markets
T: +91 124 307 4887
E: nitinatroley@kpmg.com

Mritunjay Kapur
Partner and Head
Risk Consulting
T: +91 124 307 4797
E: mritunjay@kpmg.com

Naresh Makhijani
Partner and Head
Financial Services
T: +91 22 3090 2120
E: nareshmakhijani@kpmg.com

Himanish Chaudhuri
Partner
Risk Consulting
T: +91 22 3090 1770
E: himanish@kpmg.com

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