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From validation to optimisation, tackling a growing model landscape

EMEA Model Risk Management Survey

Contents

Foreword

On behalf of Deloitte across EMEA, we are pleased to present the first edition of the *EMEA Model Risk Management Survey*. The survey presents our insights into the current model risk management practices and challenges of banks across Europe, Middle East and South Africa.

As Deloitte it is our mission to help our clients to become a more responsible business in order to both sustain and grow. Models within banks are – directly or indirectly – used in almost all decisions that banks make for their customers, stakeholders and thus ultimately for society. We believe that a mature model risk management framework that creates insights into the entire model landscape of a bank and across all steps of the model lifecycle, enables awareness and mitigation of model risk within banks. This helps our clients to become a more responsible business by ensuring they have appropriate safeguards around the use of models when they make decisions for their clients and society.

We hope that this survey contributes to thinking in banks around model risk management in order to support responsible use of models. It contains insights of 80 banks, ranging in size from balance sheet totals of less than EUR 30 billion to more than EUR 1,000 billion. The survey covers all the crucial building blocks of model risk management across four key themes: model landscape and inventory, governance and model lifecycle, technology, model monitoring and reporting.

Model risk management continues to increase in importance, as banks rely more on models than ever. Recent global events such as the COVID-19 pandemic have also revealed the weaknesses of our models and model risk management practices when the environment around us changes quickly. The survey results show us that leading banks are expanding their model risk management to all core operations within a bank, including financial risk, cyber and compliance models. However, almost all banks mentioned that model governance and ownership of model risk in particular, remains a tough barrier for their roll-out of the model risk management framework. In addition, most banks indicate that resource pressures in both model development and model validation teams remains a key challenge. This increases the need for smarter ways of working across the model lifecycle in the near future, for instance by using automated model monitoring and standardisation, to achieve efficient use of scarce resources.

We want to express our appreciation to all the survey participants for their time and insights.

We hope that the results of this survey provide you with valuable insights for your next steps in model risk management.

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Executive summary

This model risk management survey was conducted between November 2020 and February 2021. A total of 80 banks across Europe, Middle East and South Africa participated in the survey. It covers all the key building blocks of model risk management across four key themes: governance, model landscape and inventory, technology, and monitoring and reporting. We hope this survey will render valuable insights into model risk management that will help banks to be responsible businesses.

Model landscape and inventory: The foundation for efficient model risk management

The model inventory is the central repository for all models and the foundation for efficient model risk management. It contains the scope for model risk management, but is also the source for all information about model risk.

The model inventory starts with a clear and bank-wide definition of a model. This defines the scope of the models that are included in the model inventory. According to the survey, 87% of the banks have a documented model definition.

As the reliance of banks on models increases, the models in the model inventory and the scope of the model risk management framework are also expanded. Model types that are subject to regulation, such as financial risk models (pillar 1 capital and accounting), are most often included in the model landscape and inventory. Large banks in particular have started to include other types of models in their risk management framework financial risk models (pillar 2 capital and liquidity), compliance and other models such as cyber, marketing and HR models.

In general, the larger the size of the bank, the more mature the model risk management framework, and as expected, also the higher the number of models in the model inventory. The average number of models in the inventory is around 90 models for small, 170 for medium, and 650 for large banks. It is not uncommon for large banks to have over 500 models in their inventory.

Views on governance and model lifecycle

Stronger model governance across the entire model lifecycle of models is a key requirement for the model risk management framework.

The role of model owner is key in model governance, and 86% of the banks indicate that they have clearly defined and documented the role of the model owner. However, banks are facing various challenges concerning the adoption of that role. The core challenge for 35% of the banks is how to get people to act according to the responsibilities of the model owner role. For 19% of the banks, the challenge is to make people understand the responsibilities of the model owner.

The reporting structure that is used by the majority of the banks – which also evolves as a bestpractice for banks – is that of the head of model risk management reporting directly to the CRO. Another 24% of the banks indicate that the head of model risk management reports to the head of enterprise risk management, who in turn reports to the CRO.

Executive summary

As the model landscape is expanding, the responsibilities of the committee also increase. This leads to a lot of operational decision making in committees with senior stakeholders. As a result, banks start to make a distinction between operational and strategic model risk management committees. More than half of the large banks indicate that they have different strategic and operational model risk committees.

A large number of banks indicate that the model development and model validation teams do not have sufficient resources. Banks in the survey indicate that a more mature model risk management framework and regulatory compliance are the key reasons for more work for both model development and validation. Finding the right quantitative resources, budget constraints, growing numbers of models in scope and the increasing regulatory requirements are important reasons why there is insufficient capacity for model development and model validation teams.

The role of the internal audit department has become more prominent in the model risk management framework over the last few years. The large majority of the banks indicate that internal audit has a role in model risk management, such as assessing whether model risk management policies are in place, as well as the timely execution of model validation and compliance with the model risk management policies.

Technology and tooling: Potential for improvement

Successful model risk management framework implementations are often supported by model risk management tooling. A valuable model risk management tool integrates the model inventory, document repository, lifecycle management and workflow, analytical and reporting capabilities into a single platform. The tool and the functionalities can greatly contribute to the effectiveness of the model risk management activities.

Although Excel is the most commonly used tool for all sizes of banks, large banks use a vendor solution or an in-house developed solution more often than medium or small banks. Furthermore, some of the medium and small banks indicate they do no use tooling for model risk management at all.

By far the most widely used functionality of the model risk management tooling is model inventory. According to the survey, 97% of the banks use this functionality in their tooling. Also, 65% and 57% of the banks indicate to use the functionalities of storing findings (for example validation findings, regulatory findings) and analytics and risk reporting.

There is great potential for improvement for the model risk management tooling when it comes to using the information that is available for all models more effectively. Especially reporting and analytics components are often lacking at most of the banks.

Mitigating risk: Model monitoring and reporting

Model monitoring can help to alleviate resource pressures in both model development and validation. For instance, it offers more frequent and up to date information on the quality and materiality of models, without performing periodical manual model validations or first line reviews. When model monitoring is automated, the benefits are even bigger. This results in smarter ways of working across the model lifecycle and achieves more efficient use of scarce resources.

Banks indicate that model performance, model outcomes and portfolio characteristics/stability are most often monitored. Also, 87% of the banks indicate that model monitoring for credit risk models is performed, while this is only 64% for market risk models.

Almost two third of the banks indicate that the model monitoring process is not automated.

Executive summary

There is a relationship between the automation of model monitoring and the size of the bank. 82% of the small banks indicate that model monitoring is not automated, whereas this is only 62% and 52% for medium and large banks, respectively.More than 30% of the banks indicate to monitor market risk models at least once a month, a large part of which claim to monitor their market risk models on a daily or weekly basis.

Frequent reporting to senior management and the management board about model risk increases management awareness and strategic ownership of model risks. Of the banks, 77% indicate that they provide periodical reports on model risks to their senior management or management board.

Also, 59% of the banks indicate that they have a risk appetite. However, current market insights teach us that these risk appetite statements are often simple, with a focus on model validation results. As such they do not always cover the full range and depth of model risk within the bank. A lot of banks in the survey indicate that analytics and reporting of model risk management is one of the key improvement areas.

The future of model risk management

Going forward, there are many areas where banks intend to enhance their model risk management framework in the next one to two years.

More than half of the banks have such intentions within the areas of analytics and reporting, the scope extension (including model in scope of the model risk management framework), model risk governance, model risk policies and standards, and standardisation of processes. Of these areas, model risk policies and standards and standardisation of processes are considered as the most challenging areas to enhance.

The results of the survey have pointed out that for most banks there are still many areas to mature and improve their model risk management framework. A mature model risk management framework can lead to more model risk awareness within banks, will help banks to tackle a growing model landscape and become a more responsible business.

More than half of the banks have intentions to enhance their model risk management framework within the areas of analytics and reporting, the scope extension (including model in scope of the model risk management framework), model risk governance, model risk policies and standards, and standardisation of processes.

Why good model risk management is pivotal

Increasing dependence on models and scope extension

Banks rely more and more on models. Models are used for decision making and execution of policies throughout all operations of the bank. Changes and innovations within the bank and the environment also demand more and better models that enable faster decision making, for example loan and mortgages approvals but also transaction monitoring.

Not only is the dependence on models increasing, but the range of models a bank relies on for decision making is also larger. As a result, a growing number of banks start to include for instance compliance and cyber risk models in the scope of their model risk management framework. This increases the number of models in scope and leads to a larger variety of models. Also, models are becoming more and more complex, for instance with the use of machine learning techniques in models.

The findings of the most recent edition of the Deloitte's Global Risk Management Survey support this view. The changes in credit risk due to the economic impact of the COVID-19 pandemic, but also the continuously increasing attention for cybersecurity risks and innovations at banks, ultimately all relate to the use of models. This also emphasizes the importance of good model risk management.

As decisions become more model driven and based on client data, stakeholders such as clients and regulators are also demanding a deeper understanding of the way banks develop, validate, approve, use and monitor models.

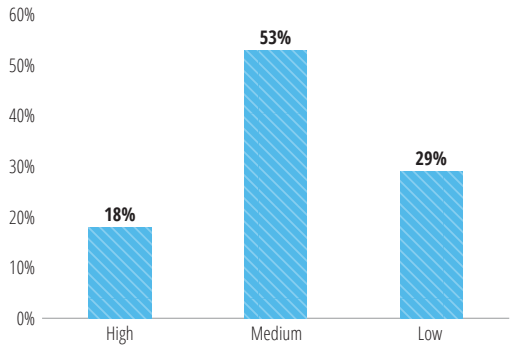
Stronger model governance across the model lifecycle

These developments described above require stronger model governance across the entire model lifecycle of models. The role of the model owner is key in that governance, but banks observe a large amount of challenges around the adoption of that role. More models and more complexity in the model landscape also means that more efficient ways of working need to be introduced to work with the scarce resources available for work on models. Model risk committee structures need to be changed, in order to enhance efficient decision making on both a strategic and operational level for the large model landscape. Finally, the way model development and model validation teams work and interact throughout the model lifecycle needs to change.

Use of technology

In order to create a proper overview of the model landscape and keep track of models throughout the model lifecycle, the role of technology in model risk management becomes more important. More and more banks are developing or buying model risk management tooling as a next step away from low-technology model inventory lists. Technology is also key for model monitoring. Model monitoring reduces the manual work for both model development and model validation and increases the efficiency in the model lifecycle. In addition, it also contributes to a more actual view of the quality of models, especially when it is performed frequently and automated.

Figure 1. Model risk awareness within the bank



Why good model risk management is pivotal

The impact of COVID-19

In 2020, the COVID-19 pandemic directly impacted the businesses of banks, and it still does. The resulting worldwide economic downturn could not have been anticipated by anyone. The unpredictable economic movements that resulted from government measurements caused, and are still causing, an uncertain economic environment.

The COVID-19 pandemic also has a major impact on the risks of a bank. It increases the credit risk but it has also shown that not all models were equipped for the turmoil on the financial markets in early 2020. Banks must be alert in order to anticipate the effects of COVID-19 across the model landscape, while ensuring to remain resilient in their businesses. This impacts both individual models on their methodology and calibration (for example for credit and market risk models), as well as including the new COVID-19 events in stress testing and scenario analysis.

More than ever, this emphasizes the importance of having a solid model risk management framework in place, especially as certain effects of COVID-19 and the corresponding economic movements will likely have an irreversible impact on models.

It is somewhat surprising that with the developments described above and the current economic environment, only 18% of the banks rate their model risk awareness high and that 29% of the banks even rate their model risk awareness as low.

This survey has been performed to obtain insights into the model risk management practices within banks. The goal is to share and interpret these insights, and we hope that this survey will help banks to strengthen their model risk management framework in the near future.

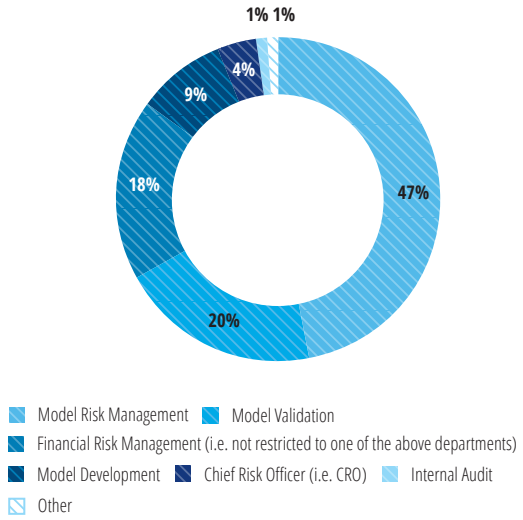
The COVID-19 pandemic also has a major impact on the risks of a bank. It increases the credit risk but it has also shown that not all models were equipped for the turmoil on the financial markets in early 2020.

About the survey

This report presents findings from the first edition of Deloitte's assessment of model risk management practices. The survey is based on information gathered from 80 banks in Europe, Middle East and South Africa and was conducted from November 2020 to January 2021.

Almost half of the 80 surveys have been completed by the model risk management department, followed by model validation or more general financial risk management teams. The latter two categories primarily contain banks without a dedicated model risk management department.

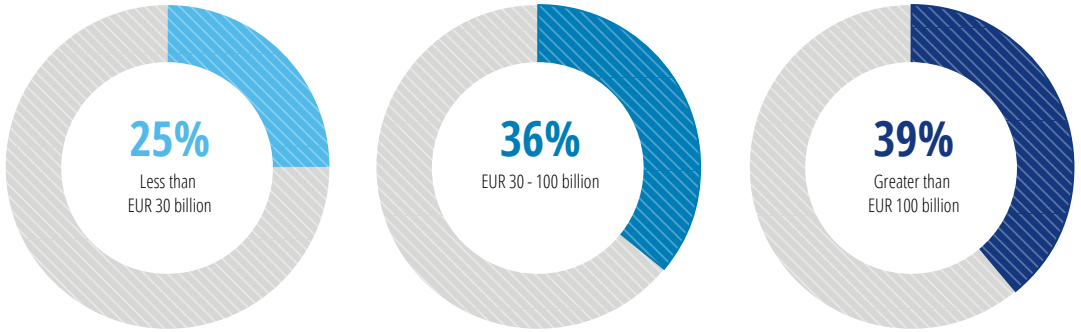
Figure 2. Role within the bank of the participant that completed the survey



In order to distinguish between the different maturities of model risk management practices, the banks are allocated to three different size categories, based on their balance sheet total. This results in a category of small banks with a balance sheet total of less than EUR 30 billion, medium banks with balance sheet totals between EUR 30 and 100 billion and large banks with a balance sheet total of more than EUR 100 billion.

About the survey

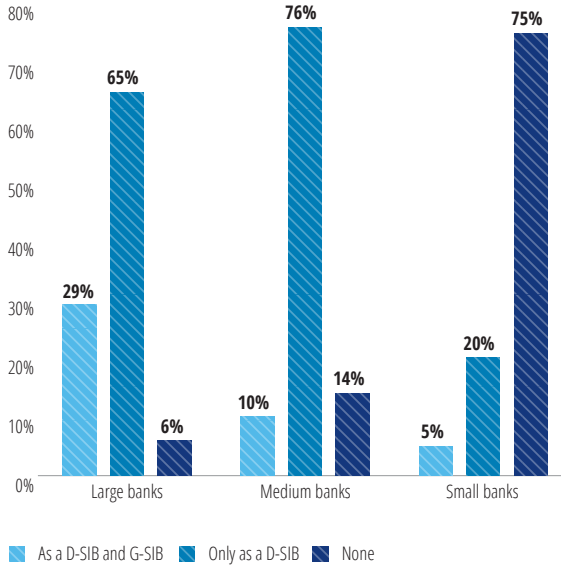
Figure 3. Percentage of banks in each of three size categories



The maturity within these three buckets is further illustrated by two other indicators. The first one indicates whether the bank has regulatory approved AIRB models, and the second whether the bank is either a domestic systemically important bank (D-SIB) and/or a global systemically important bank (G-SIB), according to the definition of the Financial Stability Board.

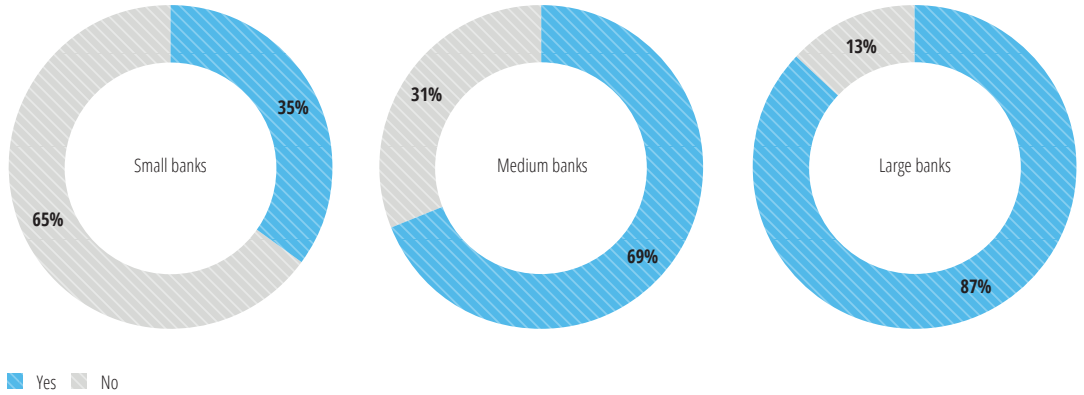
The first indicator shows whether the bank has regulatory approved AIRB models. Although the market practices of having regulatory approved AIRB models diverges across the regions of the survey participants, it is an indicator of the maturity of the credit risk models. Credit risk models are important for almost all banks as they measure one of the most material financial risks. This also means the first indicator gives an indication of the maturity of credit risk model practices and model governance for those models. In addition, it means that the ECB guide of internal models is applied, which also contains guidelines of model risk management.

Figure 4. Percentage of banks that are categorised as D-SIB or G-SIB in each of the three size categories



About the survey

Figure 5. Percentage of banks that have a regulatory approved AIRB models, across each of the three size cateogries



The banks that participated in the survey are from 18 different countries, with the majority coming from Europe.

Figure 6. Percentage of banks in each country

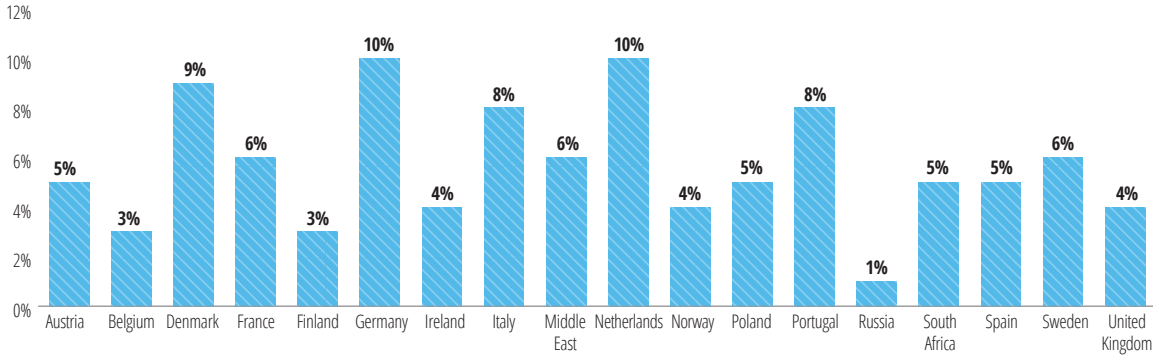
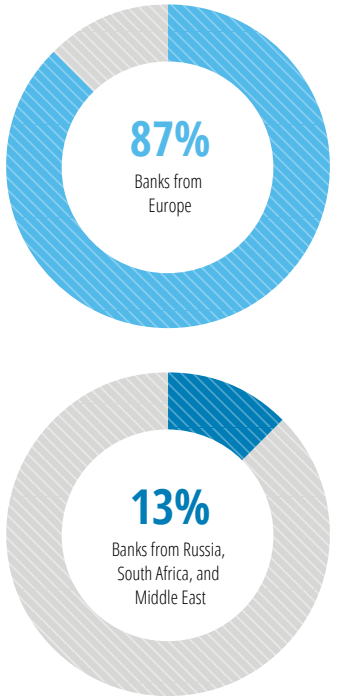


Figure 7. Percentage of banks that participated across Europe, Russia, South Africa and Middle East



Model landscape and inventory: The foundation for efficient model risk management

Model landscape and inventory: The foundation for efficient model risk management

The model inventory is the central repository for all models. It is the foundation for efficient model risk management. It contains the scope for model risk management, but it is also the source for all information about model risk. This includes for instance information about the position of the model in the model lifecycle, information about the quality of the model such as validation results, and the overall model risk appetite statement of the bank for model risk management.

A clear and bank-wide model definition

The model inventory starts with a clear and bank-wide definition of a model. This defines the scope of the models included in the model inventory. According to the survey, 87% of the banks have a documented model definition.

The definition of a model varies across banks, and there is no single definition that works for all of them. However, the large majority of banks indicate that they use a regulatory definition, in most cases enriched with additional guidance or enhancements.

The most widely used regulatory model definition remains the definition from the SR 11-7 document*. This states that "the term model refers to a quantitative method system, or approach that applies statistical, economic, financial, or mathematical theories, techniques, and assumptions to process input data into quantitative estimates".

The banks that have a documented definition of a model, often also have a documented definition of a model owner. Actually, 90% of the banks with a documented model definition also have a definition of a model owner, whereas only 50% of the banks without a documented model definition also have a definition of a model owner.

> "The most widely used regulatory model definition remains the definition from the SR 11-7 document"

Figure 8. Banks that have a documented model definition

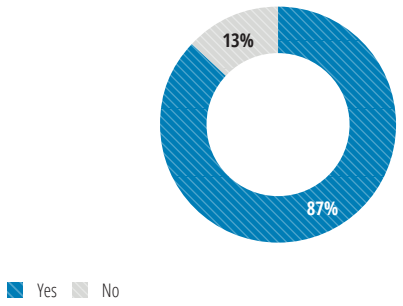
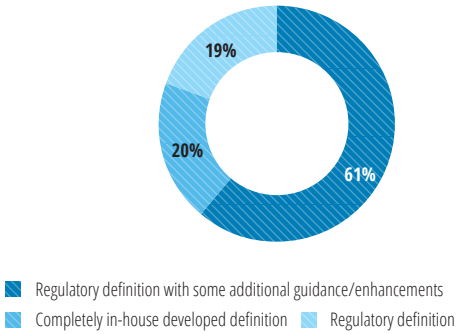


Figure 9. Usage of regulatory and in-house model definition (if there is a documented model definition)



* The Supervisory Guidance on Model Risk Management issued by the Board of Governors of the Federal Reserve System and Office of the Comptroller of the Currency (2011).

Model landscape and inventory: The foundation for efficient model risk management

The model definition – especially when purely based on a regulatory model definition – remains hard to directly assess against when evaluating whether a model candidate is a model according to that definition. In order to overcome this challenge, a list of more practical criteria can be used. A decision tree or a scorecard/questionnaire are used in most cases to assess the model candidate.

The majority of the banks indicate that these methods are used to assess the model candidate, regardless of the size of the bank. Of all banks, 30% use another assessment methodology than a decision tree or a scorecard/questionnaire. It is noteworthy that the majority of those banks – including some large banks – indicate that this is often expert judgement, a qualitative assessment or ad-hoc assessment.

19 model types, four categories

Banks have wide range of model types in scope for their model risk management framework. Throughout the survey a list of 19 model types is used. These 19 model types are allocated to four categories.

Figure 10. Use of decision tree, scorecards/questionnaires to assess model candidates

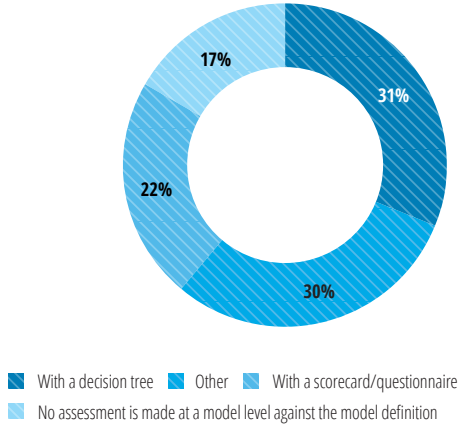


Table 1. Model types and model categories used in the survey

Model type	Model category
Credit risk (& impairment) models for capital calculations	Financial risk models (pillar 1 capital and accounting)
Credit risk (& impairment) models for provision calculations	
Credit risk (& impairment) models for risk management and operational processes (for example scorecard type models)	
Market risk models for capital calculations	
Market risk models for risk management	Financial risk models (pillar 2 capital and liquidity)
Liquidity risk models	
Operational risk models	
Credit decisioning models (for example credit underwriting models)	
Economic capital models	
Asset and liability management models (including for example NII)	
Stress testing models	
Transaction monitoring/AML/Fraud models	Compliance models
KYC models	
Financial instrument valuation and pricing models	Other models
Accounting models (for example Fund Transfer Pricing models and IFRS models (excluding IFRS 9))	
Business decision making models	
Marketing models	
HR models	
Cyber risk models	

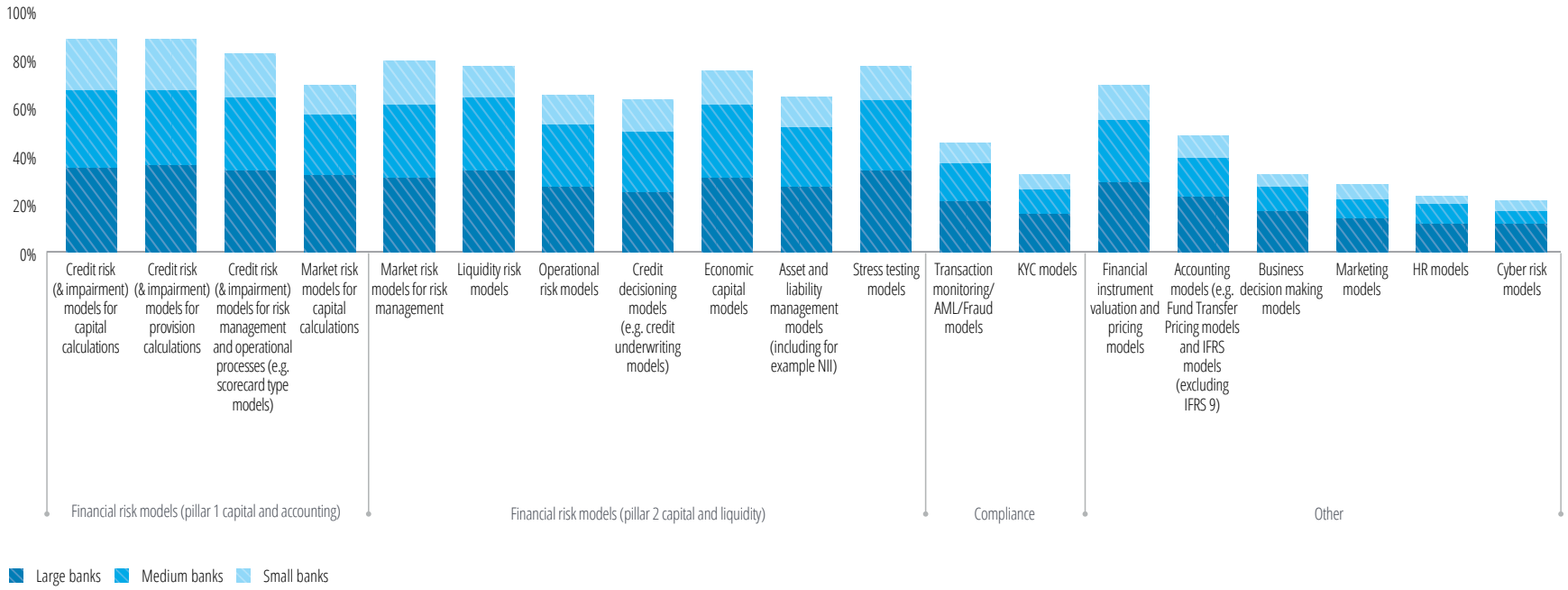
Model landscape and inventory: The foundation for efficient model risk management

Scope of the model risk management framework

Of the four model categories, the financial risk models (pillar 1 capital and accounting) are most often in scope of the model risk management framework. It is not surprising, given regulatory attention, that these models for credit risk and market risk are most often in scope.

The banks that include the financial risk models (pillar 2 capital and liquidity), compliance and other models in their model risk management scope, are mostly large and medium banks with a mature model risk management framework. Whereas the model categories of compliance and other, with a few exceptions, are often mainly in scope of model risk management frameworks of large banks.

Figure 11. Scope of the model risk framework for each of the model types

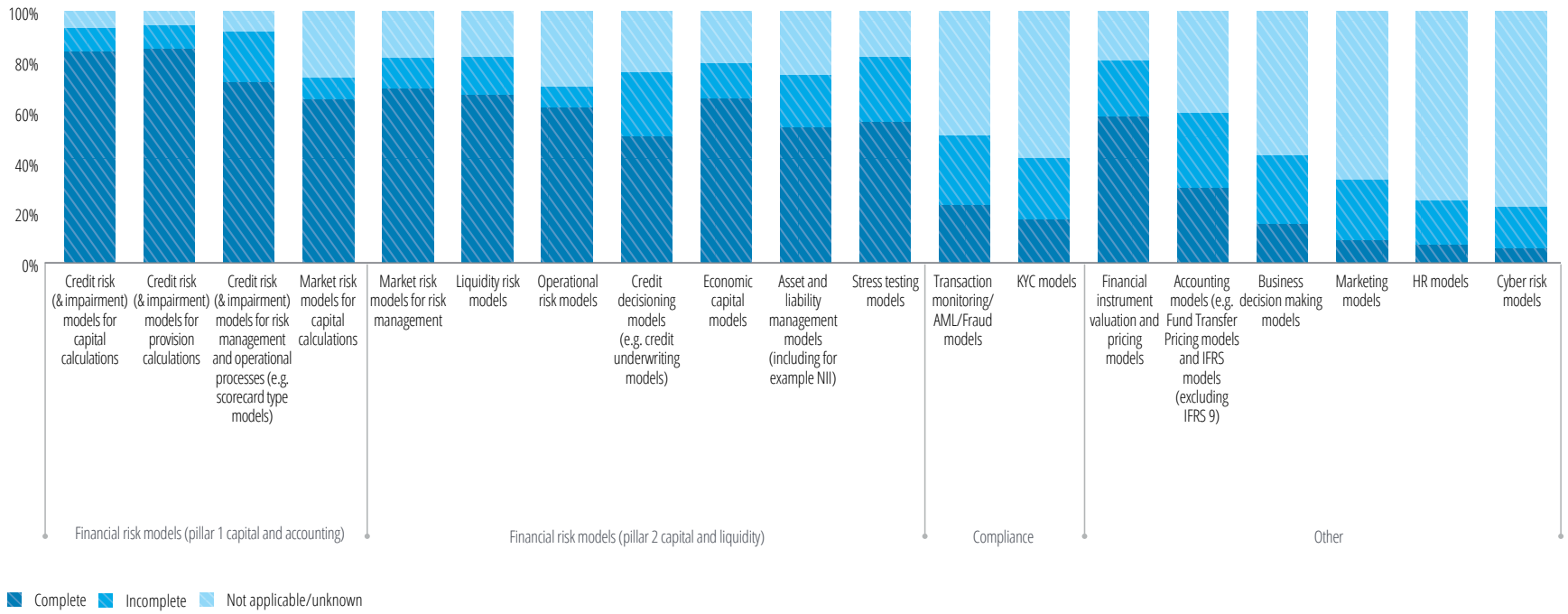


Model landscape and inventory: The foundation for efficient model risk management

Completeness of the model inventory

The completeness of the model inventory shows a picture that is similar to the scope of the model risk management framework, when comparing the different model categories and model types. The model inventory of banks is most complete for the financial risk models (pillar 1 capital and accounting), followed by financial risk models (pillar 2 capital and liquidity).

Figure 12. Model inventory completeness for each of the model types



Model landscape and inventory: The foundation for efficient model risk management

Model inventory size

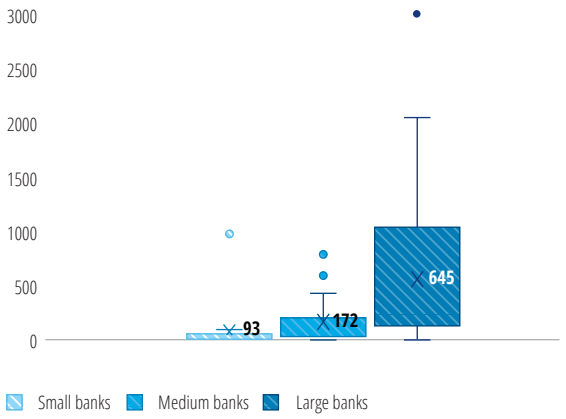
The number of models in the model inventory is constantly subject to change. The scope extension of the model inventory is one of the key themes that banks have indicated that they will be working on in the next few years.

The current model inventories show that practices widely diverge between small, medium and large banks. This is not unexpected, as large banks have more mature model risk management frameworks and also include more model types, as shown in the previous figures.

Small banks indicate that they have an average of 93 models in their model inventory, medium banks have 172 models and large banks 645 models. These figures should be compared cautiously, as the model definition used by each bank also defines at what level the model is defined. For instance, in a credit risk context it defines whether a model is a single rating system or an individual PD model. Therefore, this also impacts the number of models.

However, especially between large banks the inventories differ in size. The lowest 25% of the large banks have a maximum of 142 models and the highest 25% of the large banks have more than 1,000 models in their inventory. The current limit seems to be set at several thousands of models for the time being. These numbers are from large banks that also indicate that they consider their model inventories to be more or less complete currently.

Figure 13. Number of models in the model inventory

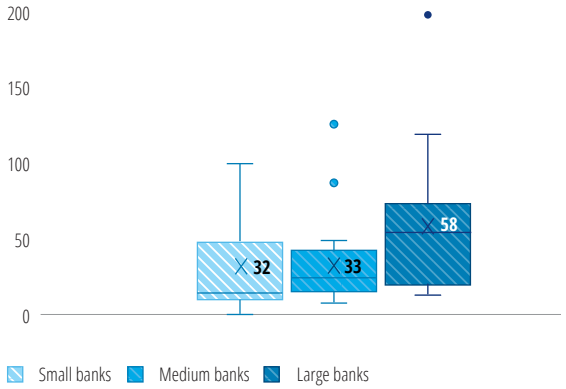


Model inventory information

A model inventory can store large amounts of information at the individual model level. Structured and high quality information is the foundation of efficient model risk management. Small and medium banks store on average approximately 30 data fields on the models, where large banks on average 58 data fields in their model inventory.

Although these differences may not be very impressive in absolute numbers, they do mean that large banks store – and need to maintain – approximately 25 data fields more than the small banks and medium banks.

Figure 14. Number of fields in the model inventory at an individual model level

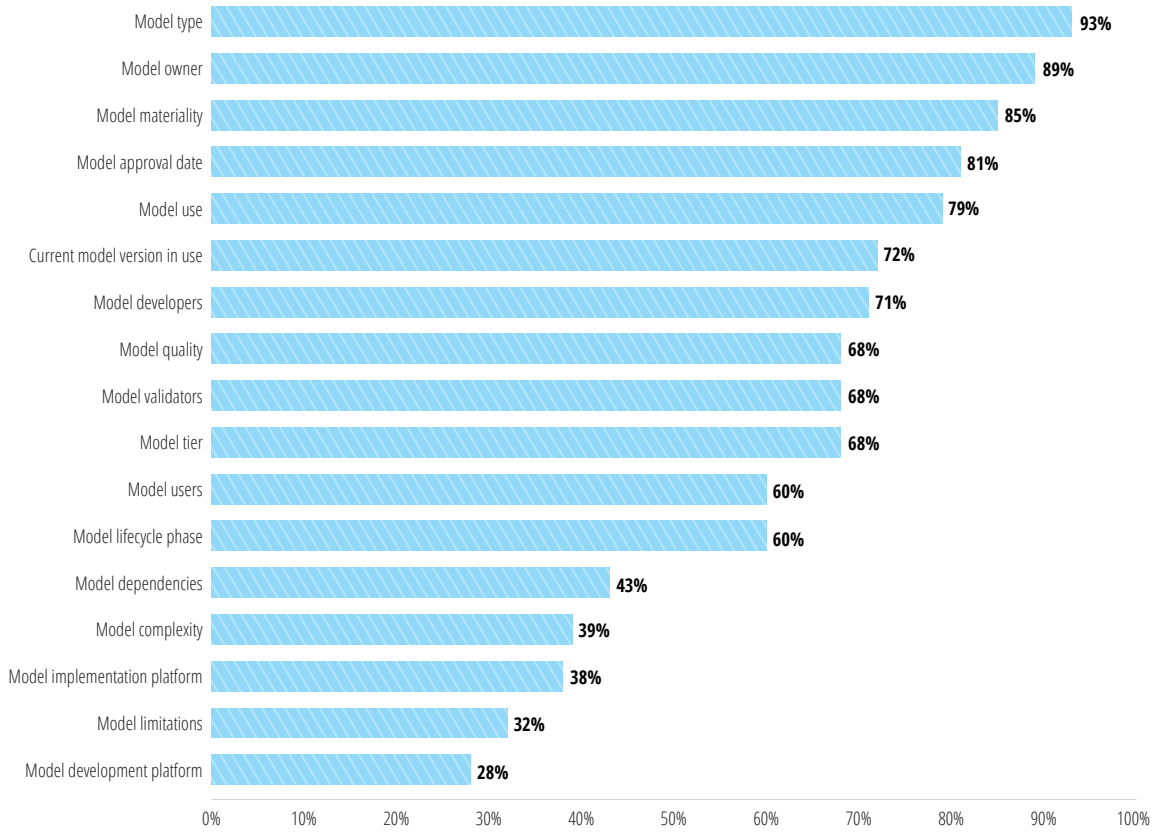


Model landscape and inventory: The foundation for efficient model risk management

The majority of the banks at least store information that is considered key for model risk management, including the model owner, model materiality and model quality, and model use.

Information that requires more effort to retrieve and also to keep track of continuously, such as model dependencies and limitations, are much less available in the inventories of the banks.

Figure 15. Information stored in the model inventory at an individual model level



Views on governance and model lifecycle

Views on governance and model lifecycle

The three lines of defence governance model details the appropriate roles in model risk management of business units, functions, the risk management, and internal audit. The three lines of defence framework integrates the full model stakeholder universe, across all lines of defence and management bodies. It aligns the roles and responsibilities with the existing organisational structure and centralises important model approvals in model risk management committees or delegations of other committees.

The model comprises the following components and summary roles for model risk management:

First line of defence

Model risk origination and ownership, including development, use and maintenance of the model.

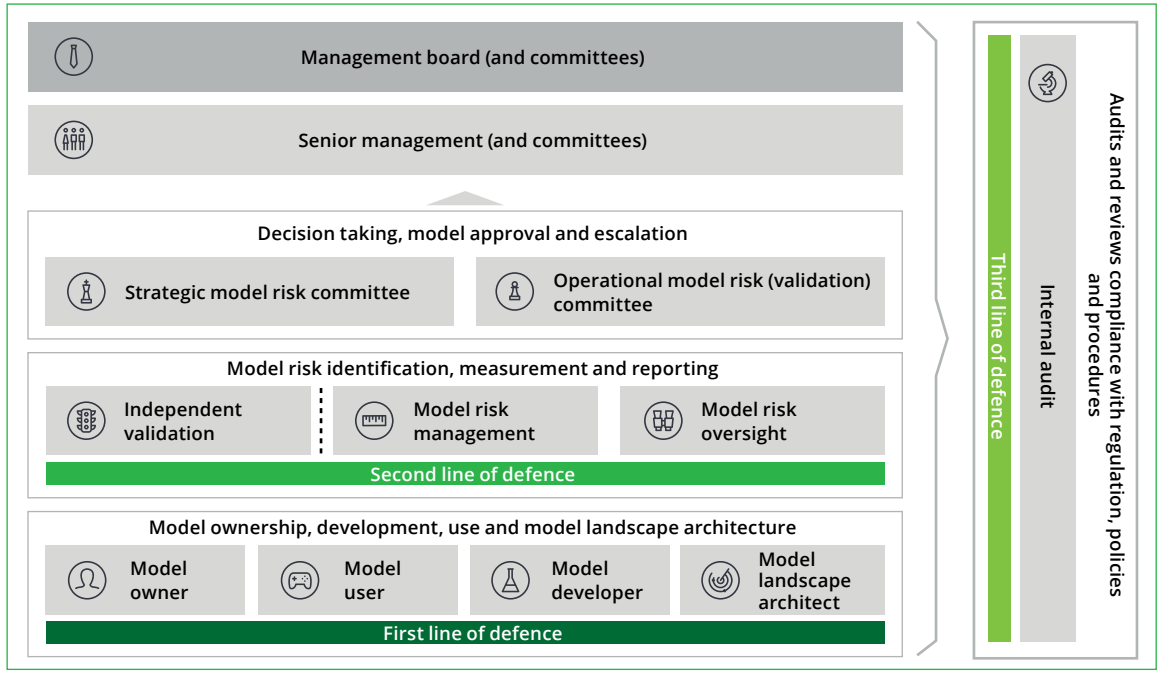
Second line of defence

Independent validation of models and design and implementation of model risk management framework to assess, monitor and report on the model risk of banks.

Third line of defence

Internal audit function to assess the effectiveness and completeness of the model risk management framework.

Figure 16. Model risk management three lines of defence model



Views on governance and model lifecycle

The model owner

One of the key roles for model risk management is that of model owner. The model owner is responsible and accountable for a specific set of models, including the quality of those models. The model owner also acts as a bridge between the first line of defence and others, for instance by ensuring that findings from independent model validation are resolved with appropriate means and within time. Most banks (86%) have indicated that the role of the model owner is clearly defined and documented. There is almost no distinction in the answers between large, medium and small banks.

The results show that the appointed model owner for the majority of the banks is someone from model development. Although it depends on the organisational governance of each bank, having a model owner role with model development responsibilities could create conflicts of interest with model use, for instance around resource deployment and development priorities.

However, adoption of the model owner role remains a challenge and greatly varies between the different model types.

Figure 17. Banks that clearly defined and documented the role of the model owner in the model risk management documentation

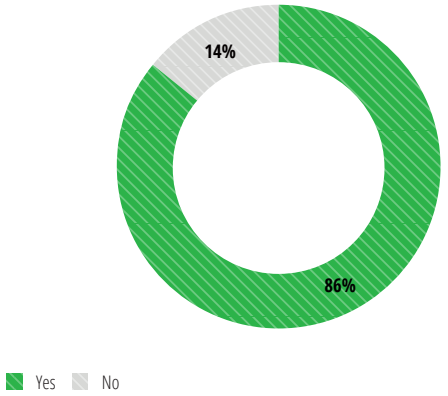
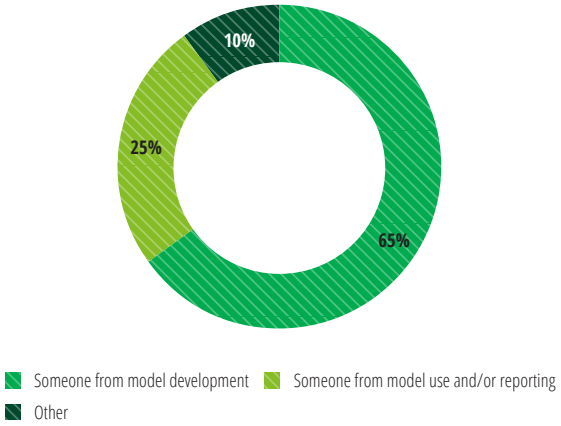


Figure 18. Most often appointed model owner



Views on governance and model lifecycle

Model ownership

According to 35% of the banks, when it comes to model ownership adoption within the organisation, the biggest challenge is to get people to act according to the responsibilities of a model owner. The second biggest challenge (19% of the banks) is to get people to understand the responsibilities of the model owner. The ambiguous responsibilities and expectations, accepting the responsibilities and identification of people who can act as a model owner are named as core challenges in model ownership, each by around 10% of the banks.

The highest adoption rates are seen for financial risk models (pillar 1 capital and accounting), where most banks indicate that the model owner role is adopted for all the models in that category, followed by financial risk models (pillar 2 capital and liquidity). The category compliance and other models shows the lowest adoption rates. An exception in the category other models are the financial instrument valuation and pricing models. For these models, the level of adoption is comparable to the level of the financial risk models (pillar 2 capital and liquidity).

Figure 19. Core challenges in getting model ownership adopted

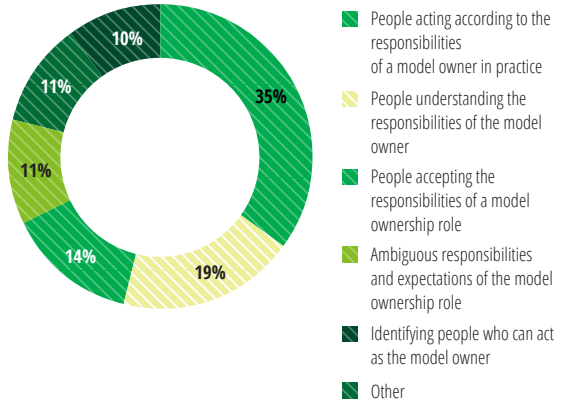
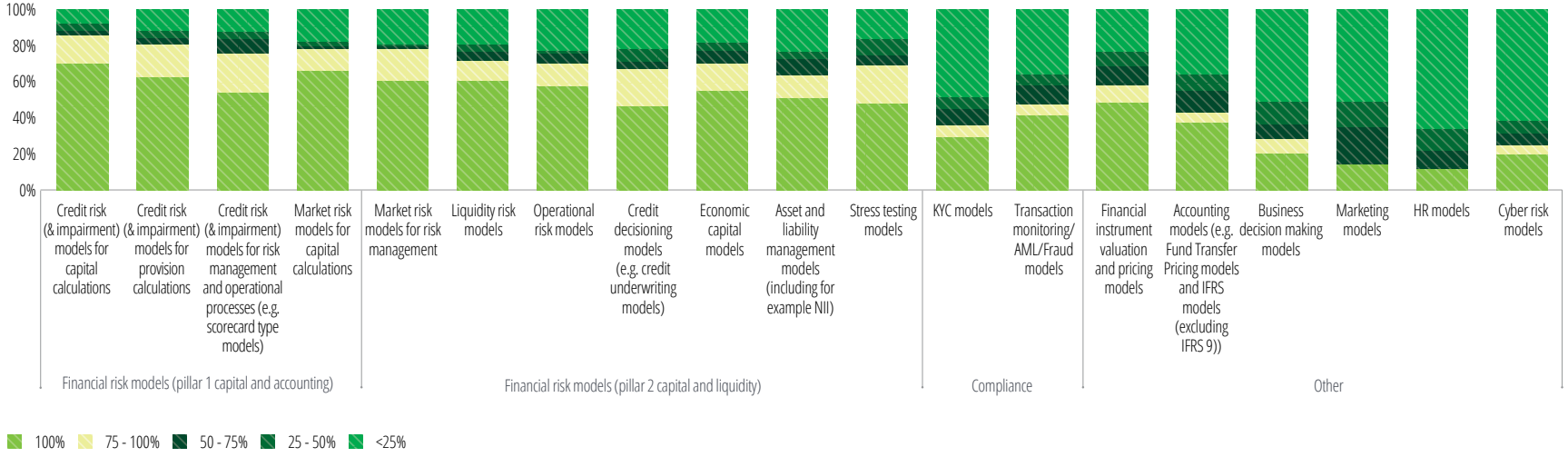


Figure 20. Share of the model landscape for which the model owner role is adopted for each of the model types



Views on governance and model lifecycle

Model risk management teams

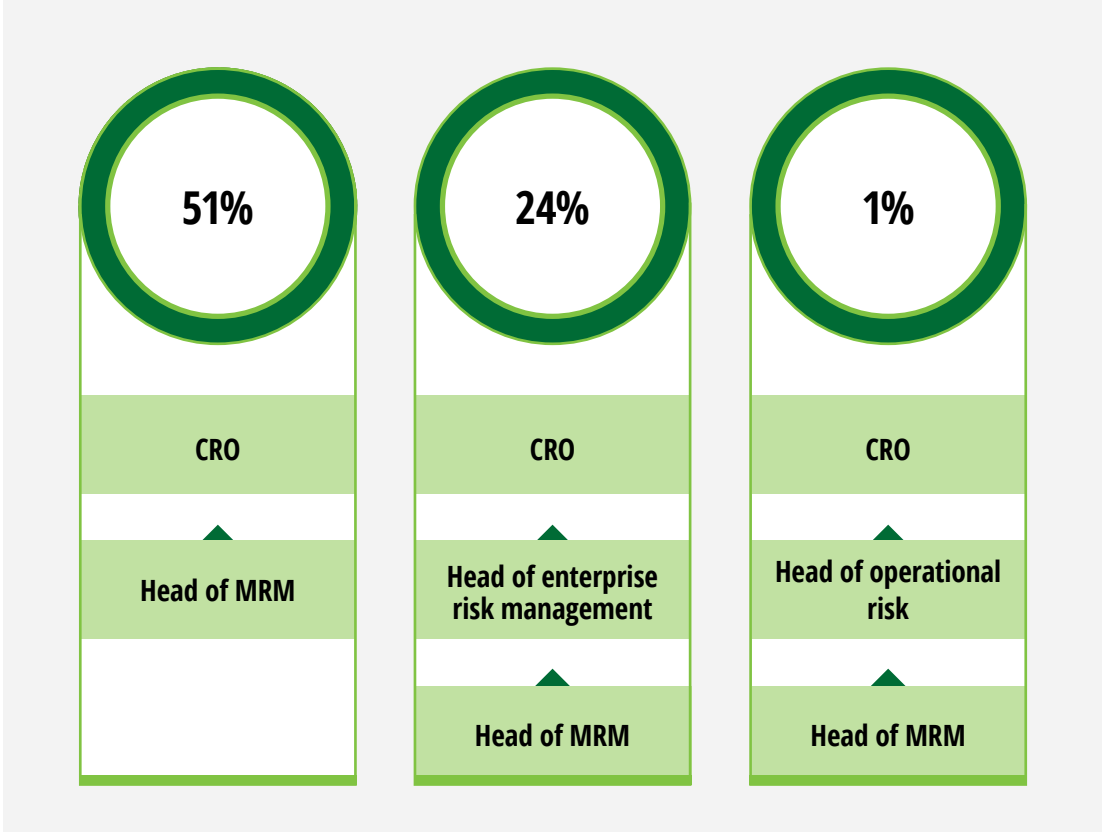
Model risk management, model validation and model risk oversight are all in the second line of defence. However, the organisation of the second line of defence varies between banks.

The reporting structure that is used by the majority of the banks – and also evolves as a best practice for banks – is where the head of model risk management reports directly to the CRO.

Another 24% of the banks indicate that the head of model risk management reports to the head of enterprise risk management, who in turn reports to the CRO. Only a very limited number of banks indicate that the head of model risk management reports to the head of operational risk.

In addition to the centralised model risk management function, some banks also have decentralised model risk management functions. They sometimes report to the central model risk management team and sometimes directly to local CRO. Some of the approaches that are mentioned in the survey are separate model risk management departments for key risk types or model risk management per specific business unit. The challenge of a decentralised model risk management function is the consistency of the policies, documents and procedures across the various risk types, business units and with the central model risk management department.

Figure 21. Reporting lines to the CRO



Views on governance and model lifecycle

The emergence of stand-alone model risk management teams

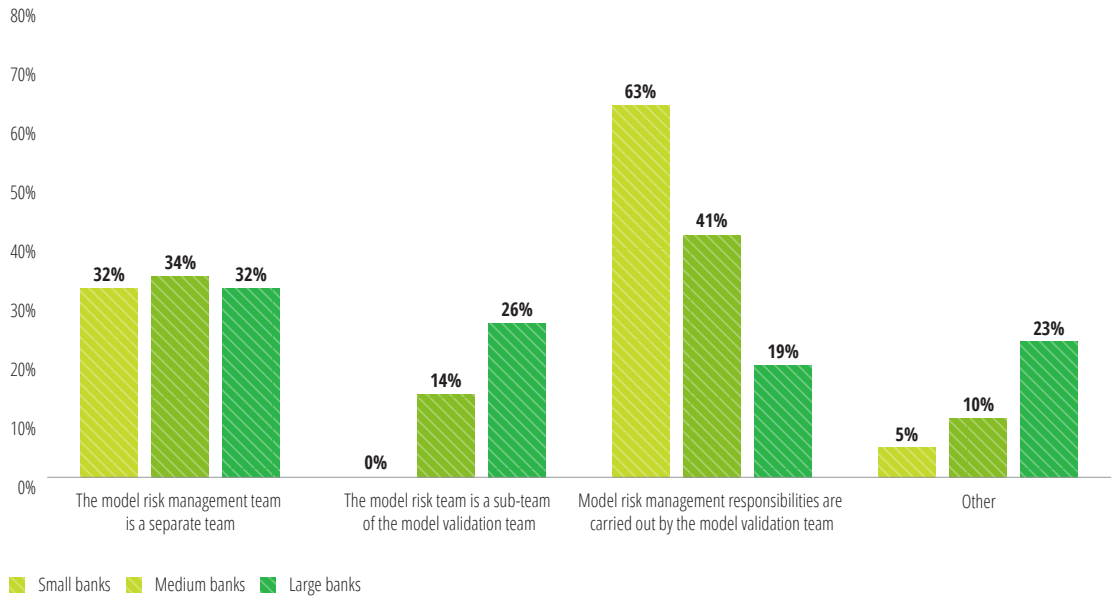
After the publication of the SR11-7 document that set the starting point for model risk management, the model risk management responsibilities often started to emerge from already existing model validation functions.

Ten years later and a few years after more specific guidance in Europe, stand-alone model risk management departments or teams have emerged, especially at the larger banks.

Most large banks indicate that model risk management responsibilities are carried out by a separate team or jointly carried out by the model risk and the model validation team.

In contrast, 63% of the smalls banks indicate that model risk management responsibilities are still carried out by the model validation team. This can partly be explained by the number of models and available resources. Fewer models often results in less model validation and model risk management responsibilities, which might make it unnecessary to have a separate model risk management team. However, a mature model risk management framework requires a separation of model risk management responsibilities and model validation responsibilities.

Figure 22. Model risk management organisational structure



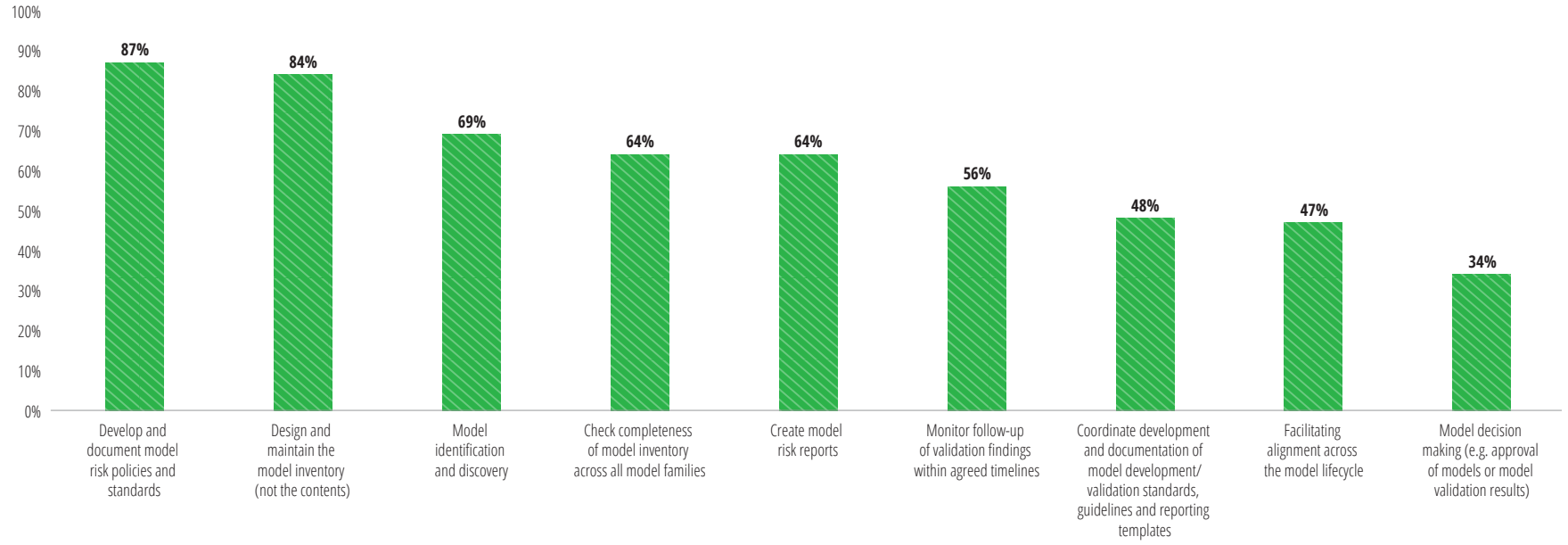
Views on governance and model lifecycle

Responsibilities of the model risk management team

Banks indicate that the two key responsibilities of the model risk management team are developing model risk management policies and standards, and designing and maintaining the structure of the model inventory.

Other important responsibilities for more than half of the banks are "design and maintain the model inventory", "model identification and discovery", "check completeness of model inventory across all model families", "create model risk reports", and "monitor follow-up of validation findings within agreed timelines".

Figure 23. Key responsibilties of the model risk management team within banks



Views on governance and model lifecycle

Model risk management committees

Model risk management committees are a crucial decision making body in the model risk management framework.

Of the banks with a model risk committee, around three quarters indicate that the model risk committees are responsible for the approval of models and approval of model risk framework documents. Slightly less than half of the banks indicate that their model risk committee is also responsible for the identification of overarching and/or future model impacts (e.g. COVID-19, IBOR reform).

Other examples of responsibilities of the model risk committees are approval of model monitoring and model validation results, as well as approval modelling process and model portfolio (planning, operational decisions).

However, with an increasingly complex model landscape the responsibilities of the committee also increase. This leads to a large amount of operational decision making in committees with senior stakeholders. As a result, banks start to make a distinction between strategic and operational model risk management committees. Of the large banks 53% indicate that they have different strategic and operational model risk committees, compared to 41% of the medium banks and 31% of the small banks. Several factors contribute to this difference, such as the maturity of the model risk management framework and size of the model inventory, and subsequently also necessity for this distinction.

Another interesting observation is that the 31% of the medium banks indicate that they do not have a model risk management committee at all. Only 16% of the small banks and 10% of the large banks indicate that a model risk committee does not exist within their bank.

Figure 24. Responsibilities of the model risk management committees

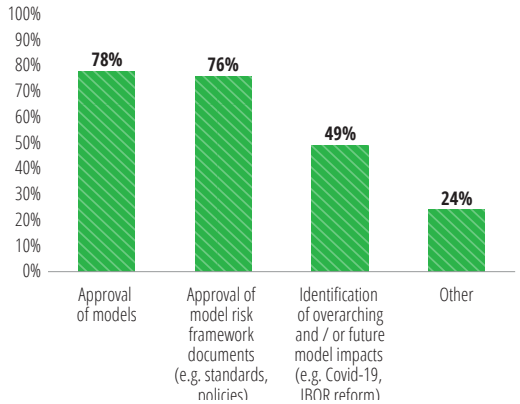
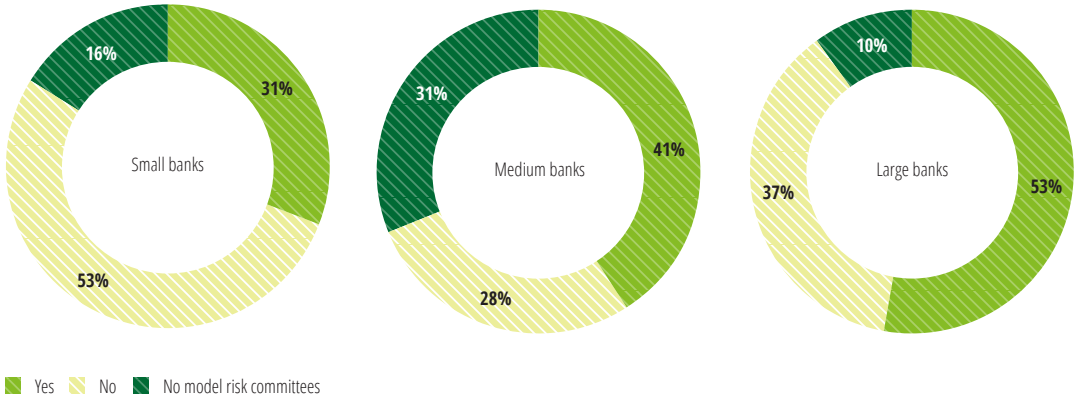


Figure 25. Banks that make a distinction between strategic and operational model risk management comittees



Views on governance and model lifecycle

Model development and model validation teams

As discussed before, banks are having more and more models in their model inventory and in scope for their model risk management framework. These models need to be developed and validated, leading to increasing numbers of FTE in both model development and model validation.

The average size of model validation teams is smaller than the size of the model development teams across the range of banks, from small to large. It is interesting to note that more banks indicate that they do not have sufficient resources for model validation, as compared to model development. Although a large part of the banks indicate that teams have insufficient resources.

Banks in the survey indicated that a more mature model risk management framework and regulatory compliance are the key causes that lead to more work for both model development and validation. Banks indicate that finding the right quantitative resources, growing numbers of models in scope and the increasing amount of regulatory requirements are important reasons why they do not have sufficient capacity for model development. There are similar reasons for insufficient capacity for model validation teams, including the extended scope of models that need to be validated, budget constraints and finding the right quantitative resources.

Figure 26. Sufficient resources for model development

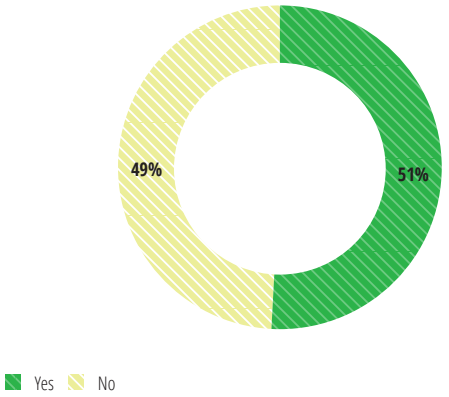


Figure 27. Sufficient resources for model validation

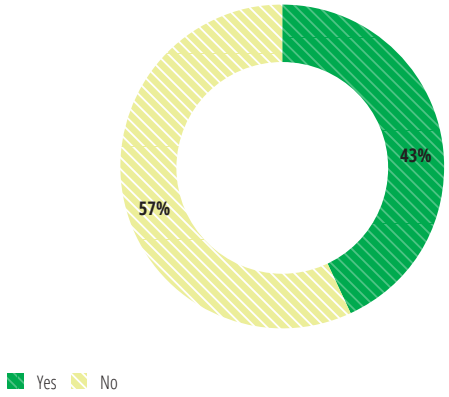


Figure 28. Total FTEs in model development

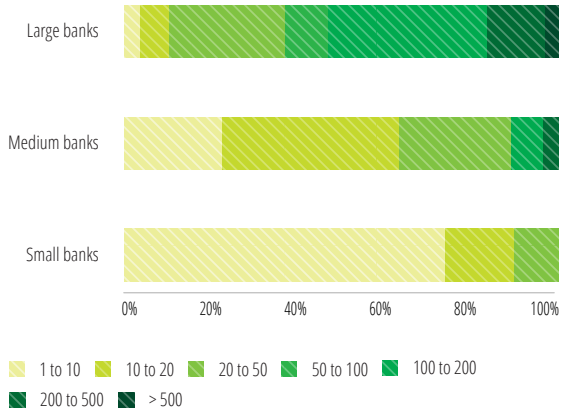


Figure 29. Total FTEs in model validation

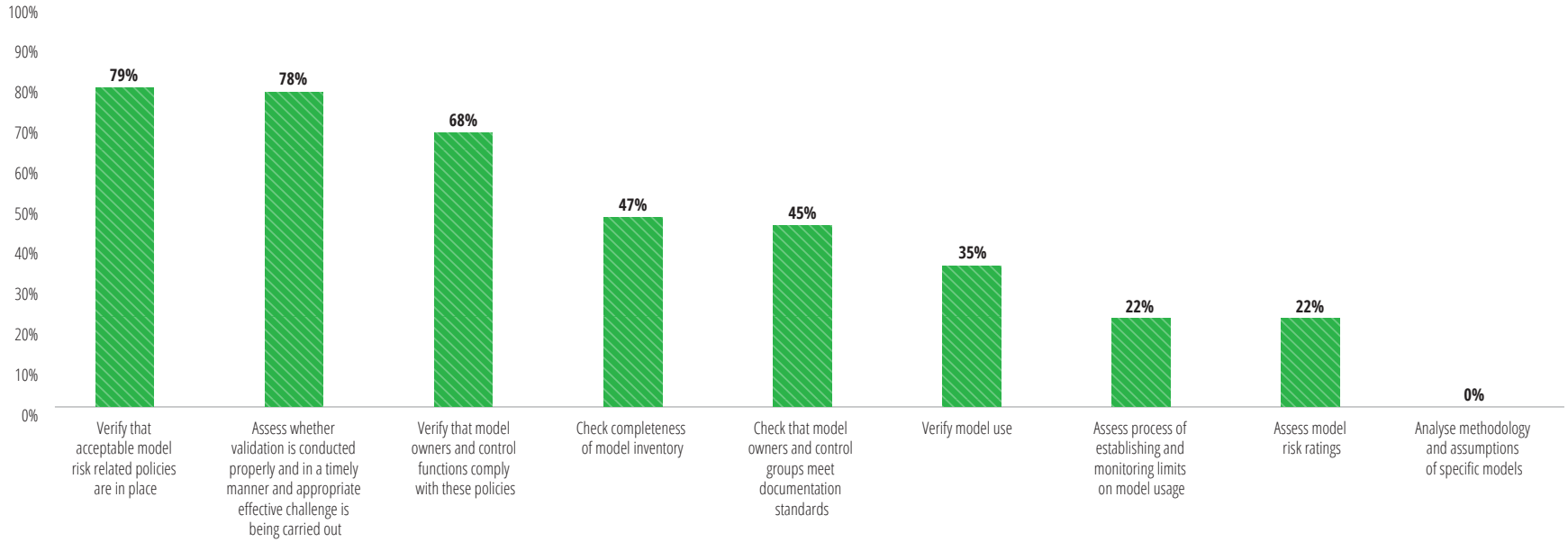
Views on governance and model lifecycle

Internal audit: Role and responsibilities

The role of the internal audit department has become more prominent in the model risk management framework in the last few years. The large majority of the banks indicate that internal audit plays a role in model risk management.

The most common responsibilities for internal audit relate to assessing whether availability model risk management policies are in place, the timely execution of model validation and compliance with the model risk management policies.

Figure 30. Key responsibilities regarding model risk of the internal audit department



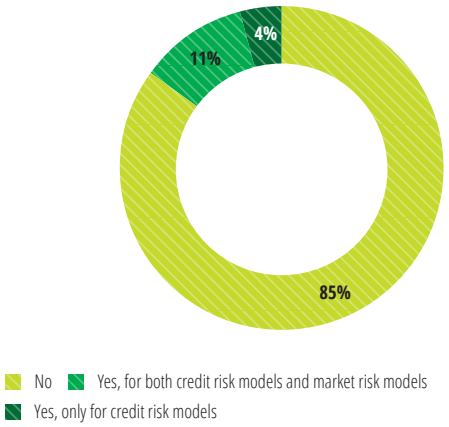
Views on governance and model lifecycle

A strategic perspective on the model landscape: the model architect

A relatively new role in the model risk management governance is the role of model architect.
The model architect has a strategic perspective on design and maintenance of (a specific piece of) the model landscape.

The model architect considers all perspectives and requirements of different model uses of a specific model type in the model landscape (for example all credit risk models) to design and maintain an optimal model landscape, including rationalisation and reduction in number of models and optimal model dependencies. The role of the model architect has emerged in recent years, which can be seen in the survey results as well. Still, 85% of the banks indicate that their organisation does not have a model architect role in place. The ones that do, are distributed across the range of differently sized banks, from small to large.

Figure 31. Banks with a model architect role in place



Still, 85% of the banks indicate that their organisation does not have a model architect role in place. The ones that do, are distributed across the range of differently sized banks, from small to large.

Views on governance and model lifecycle

The model lifecycle

The model lifecycle concept is key to an effective model governance. It helps to define roles and responsibilities in each step of the model lifecycle.

The model lifecycle differs between banks, but several key steps are included in most frameworks, even though the wording can be different.

It can be seen that seven out of the nine model lifecycle phases are used by more than three quarters of the banks. Model decommission and data collection are the only lifecycle phases that are less frequently used. The model decommission or model retirement phase is important as a mechanism to stop using models that should not be used anymore, for instance because an alternative model or a new version is available. Having the right governance around this step, also prevents that obsolete model documentation or outstanding model validation findings are still included in the model risk management framework.

Figure 32. Use of the most common lifecycle phases

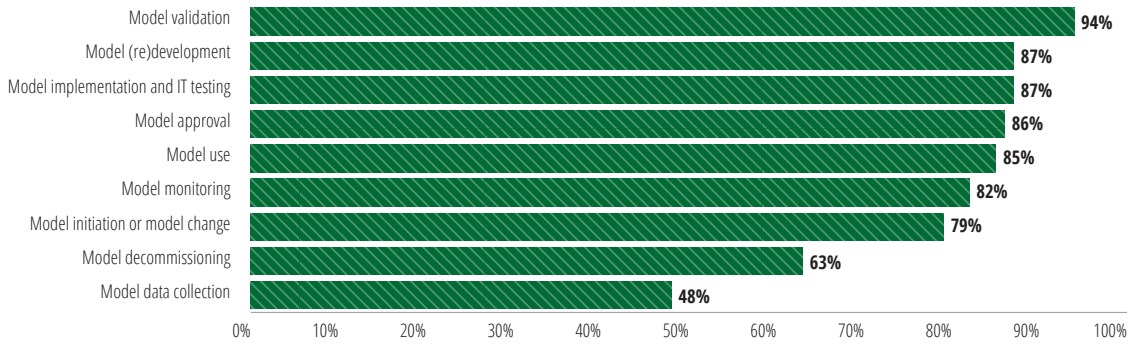
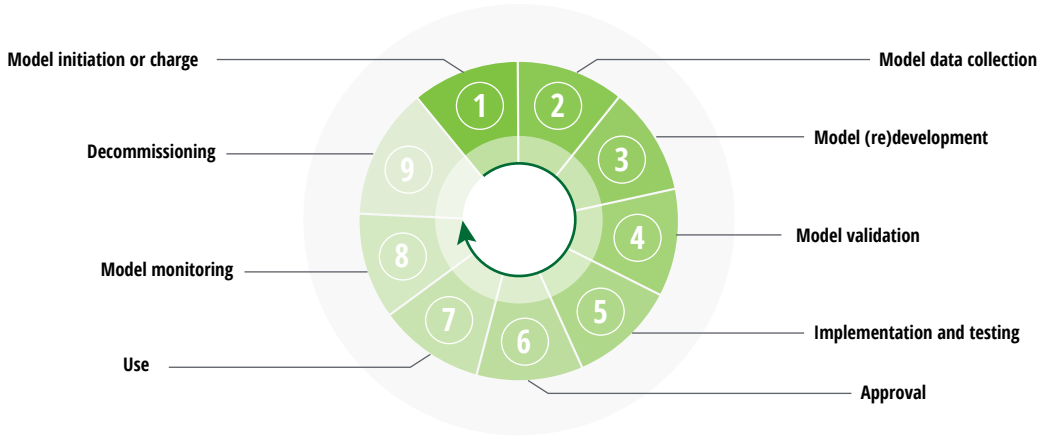


Figure 33. Model lifecycle example



Views on governance and model lifecycle

Machine learning models

The use of machine learning models is becoming more common within banks across the different model types. Less than a third (31%) of the banks indicate that machine learning techniques are not used at all in model development.

However, 61% of the banks do not have specific model risk standards (for example model validation standards) for machine learning models in place.

Figure 35. Availability of specific model risk standards (for example model validation standards) for machine learning models

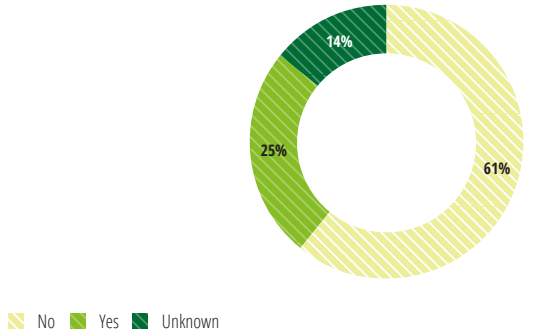
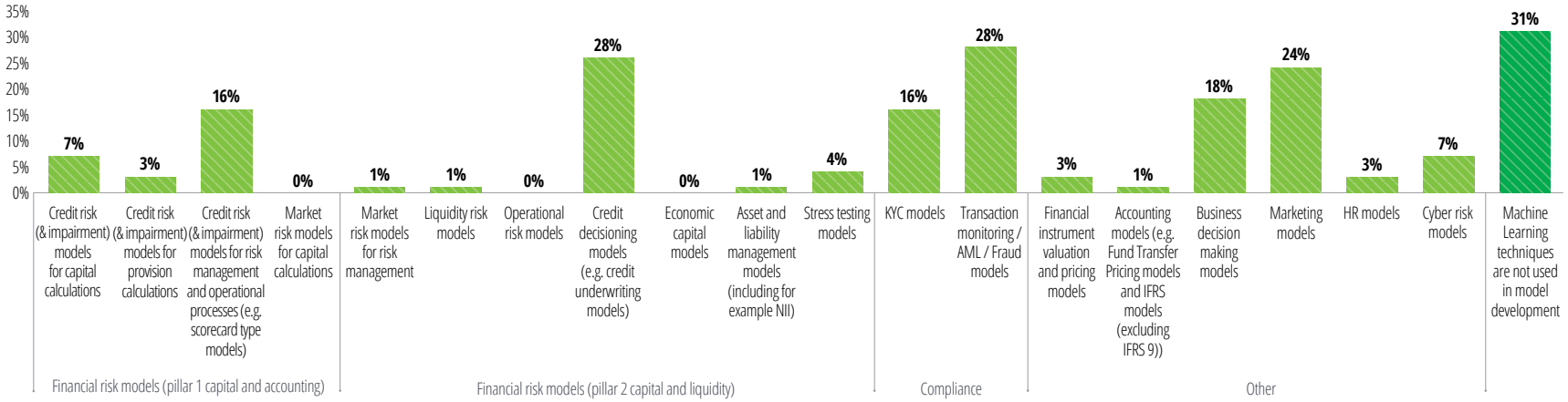


Figure 34. Model types for which machine learning techniques are used



Technology and tooling: Potential for improvement

Technology and tooling: Potential for improvement

Successful model risk management framework implementations are often supported by model risk management tooling. A valuable model risk management tool integrates the model inventory, document repository, lifecycle management and workflow, analytical and reporting capabilities into a single platform. The tool and the functionalities can greatly contribute to the effectiveness of the model risk management activities.

Tooling types: From Excel to solutions developed in-house

According to the survey results, 42% of the banks use Excel as their model risk management tooling, making this the most commonly used tooling. Another 30% of the banks indicate they use a vendor solution. Less frequently, banks use either SharePoint or a solution that was developed in-house. Some banks indicate that they use a combination of tooling, such as Excel and SharePoint, in order to have all the required functionalities of the tool at hand.

Although Excel is the most commonly used tool for all sizes of banks, large banks use a vendor solution or a solution that was developed in-house more often than medium or small banks.

Furthermore, some of the medium and small banks indicate they do no use tooling for model risk management at all.

Figure 36. Tooling used for model risk management practices

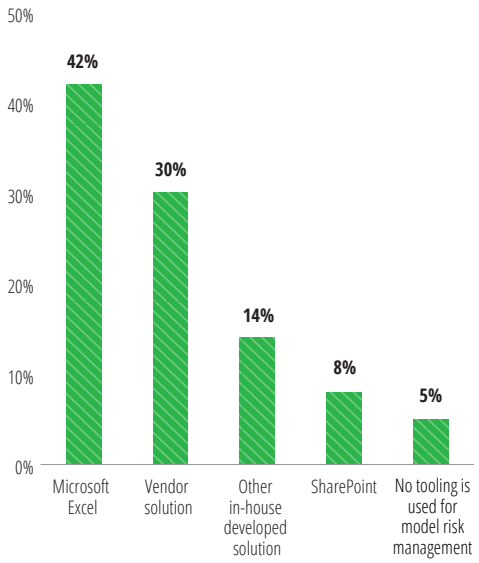
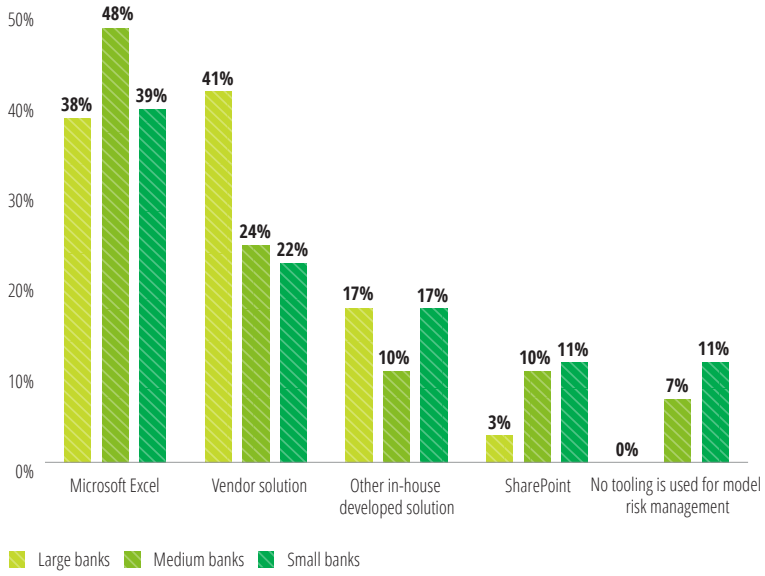


Figure 37. Breakdown of tooling used for model risk management practices by banks by size



Technology and tooling: Potential for improvement

What functionalities are used?

By far the most widely used functionality of the model risk management tooling is model inventory. According to the survey results, 97% of the banks use this functionality in their tooling. Furthermore, 65% and 57% of the banks indicate to use the functionalities of storing findings (for example validation findings, regulatory findings) and analytics and risk reporting.

Lifecycle management, workflow and resource planning functionalities can greatly enhance both the maturity and efficiency of model risk management. However, these are only used by a minority of the banks.

Banks that use Excel as their model risk management tool make much less use of certain functionalities than banks that indicated to use other types of tooling (such as a vendor solution or an in-house developed solution).

Figure 38. Functionalities of the model risk management tool used

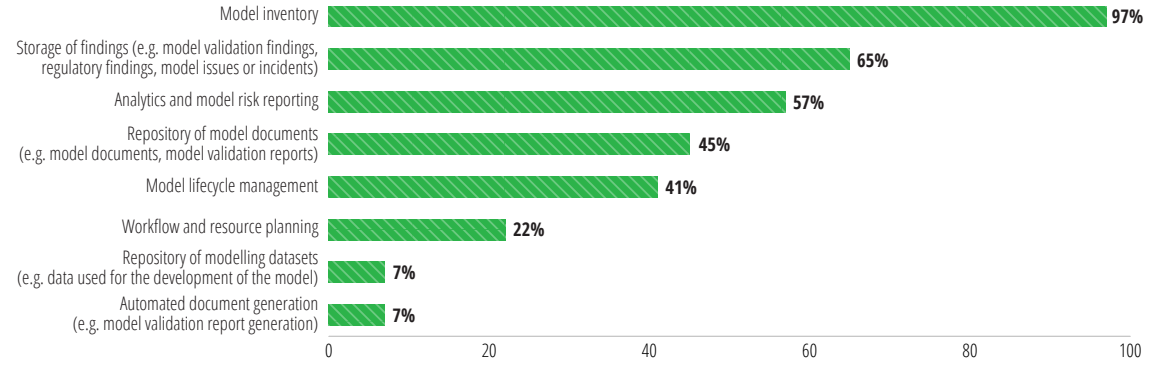
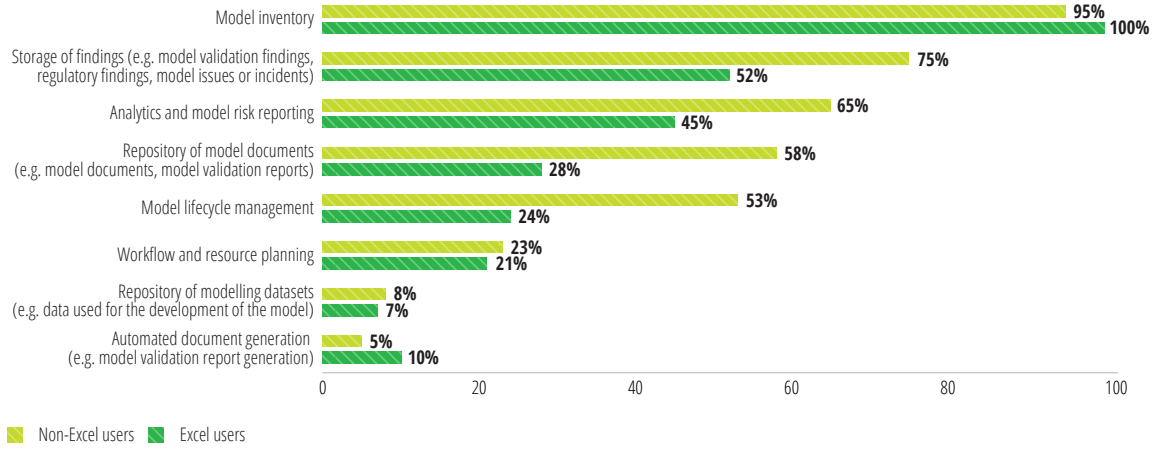


Figure 39. Functionalities of the model risk management tool used by Excel users and non-Excel users



Technology and tooling: Potential for improvement

Tooling in practice

Although most banks are aware of the benefits of using model risk management tooling, the answers to the statements show that this tooling does not yet support all building blocks of model risk management for the majority of the banks.

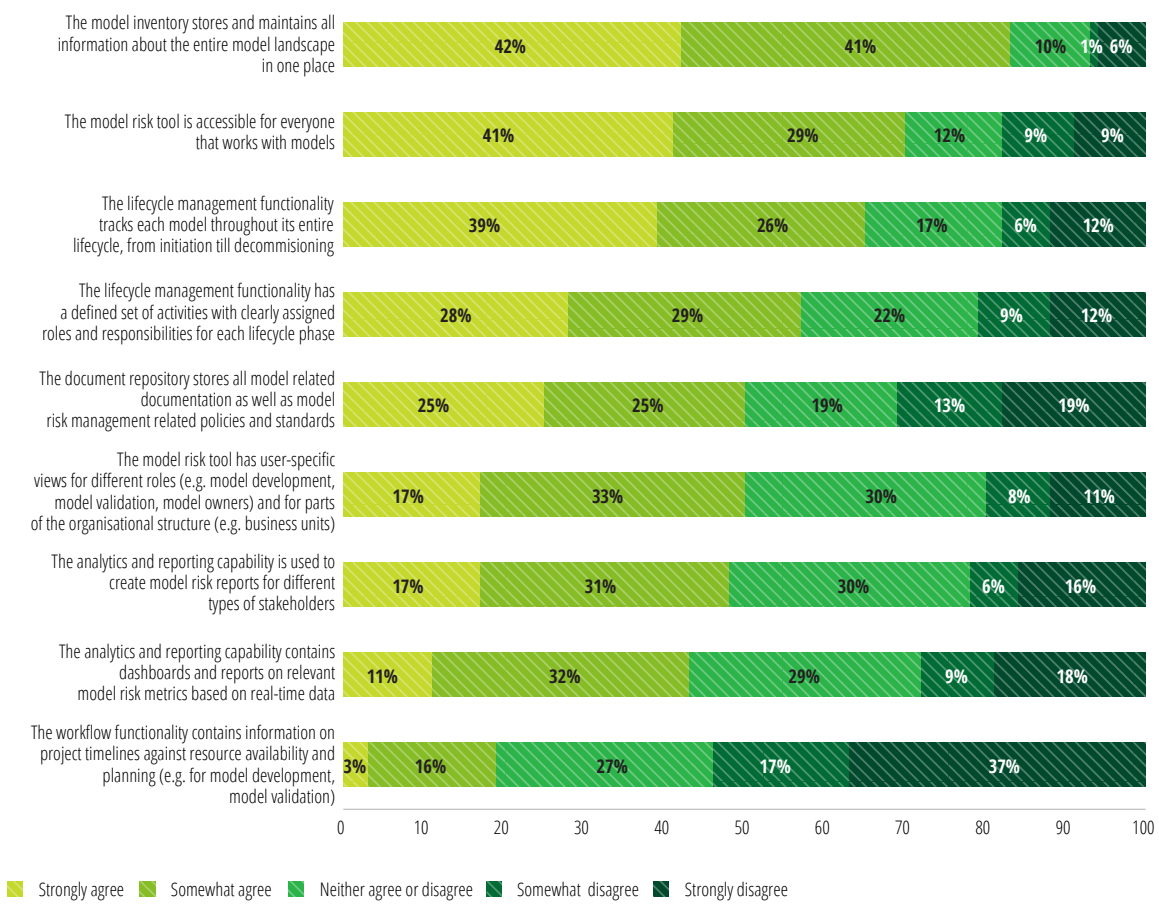
The large majority of the banks strongly agree or somewhat agree that the model inventory stores and maintains all information about the entire model landscape in one place. The results are similar for the accessibility of the tooling and the functionality of the tooling to track models throughout its entire lifecycle.

However, the results for user specific views, storage of all model and model risk management related documents, and especially the reporting and analytics components, are often lacking at most of the banks.

Almost no bank is using functionality to analyse project timelines against resource availabilities, for instance for model development and model validation.

This outlines the great potential for improvement of the model risk management tooling. This can help to make more effective use of the information that is available for all models.

Figure 40. Agreement with statements regarding the model risk management tooling



Mitigating risk: Model monitoring and reporting

Mitigating risk: Model monitoring and reporting

Model monitoring can help to timely identify deteriorating model quality (for example violating model assumptions), changes in the portfolio (for example materiality of the model), other model issues and data quality. When model monitoring is automated, these benefits are even bigger. This results in smarter ways of working across the model lifecycle and a more efficient use of scarce resources.

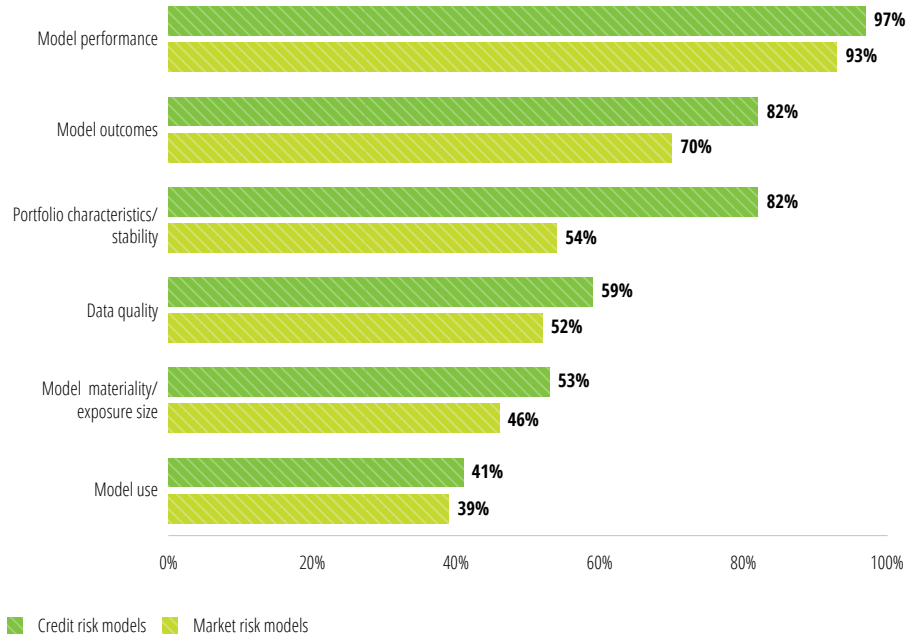
Model monitoring can therefore help to alleviate resource pressures in both model development and validation. For instance, by having more frequent and up to date information available on the quality and materiality of models, without performing periodical manual model validations or first line reviews.

Monitoring in practice

Model monitoring in the survey is assessed for credit risk and market risk model types only as these are currently considered the most mature areas of monitoring. Banks indicate that model performance, model outcomes and portfolio characteristics/stability are most often monitored. In the case of model monitoring for market risk models, portfolio characteristics/stability play a much smaller role than for credit risk models. This is less relevant for market risk models.

Model monitoring is more often performed for credit risk models than for market risk models. Of all banks, 87% of the banks indicate that model monitoring for credit risk models is performed, while this is only 64% for market risk models. At the large banks these numbers are closer for both credit risk and market risk models, while small banks tend to perform model monitoring for credit risk models more often than for market risk.

Figure 41. Aspects that are monitored during the model monitoring process



Mitigating risk: Model monitoring and reporting

Increasing efficiency with automated model monitoring

Automation of model monitoring can increase the efficiency, and after implementation of the model monitoring framework, it will reduce manual involvement in the performance of the monitoring. This creates time for both model development and model validation resources to analyse the results. Furthermore, automation makes it easier to increase the frequency of model monitoring and to link it to the risk appetite of the bank.

However, despite these benefits, almost two third (62%) of the banks indicate that the model monitoring process is not automated. There is a relationship between the automation of model monitoring and the size of the bank. At 82% of the small banks, model monitoring is not automated, whereas this is only the case for 62% of the medium banks and 52% of the large banks, respectively.

Monitoring frequency

As expected the model monitoring frequency is often higher for market risk models than for credit risk models. Market risk models, especially those related to financial markets activities of banks, use for instance inputs, assumptions and calibrations that change quicker than the development of credit risk inputs, assumptions and calibrations.

More than 30% of the banks indicate that they monitor market risk models at least once a month, a large part of which claim to monitor their market risk models on a daily or weekly basis. For credit risk models, banks indicate that daily or weekly frequencies are not used in line with the explanations above. Instead, quarterly model monitoring for credit risk models is used by almost half of the banks.

Figure 42. Automation of model monitoring

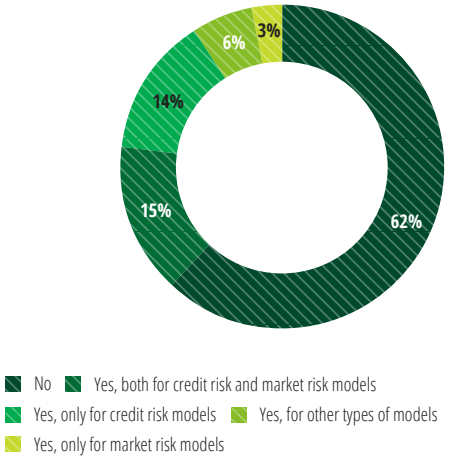
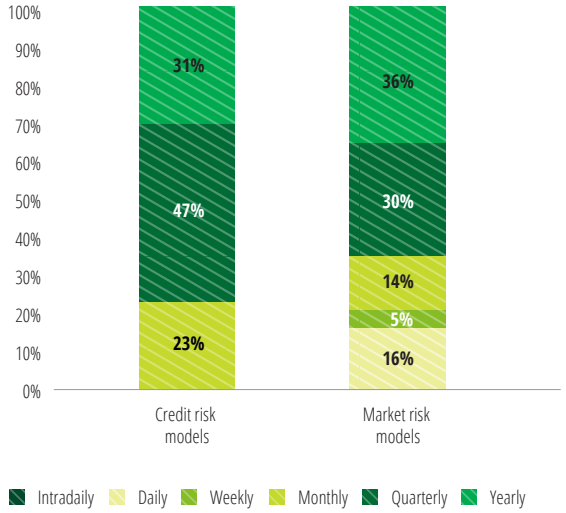


Figure 43. Average frequency of model monitoring for credit risk and market risk models



Mitigating risk: Model monitoring and reporting

Reporting

Frequent reporting to senior management and the management board about model risk increases management awareness and strategic ownership of model risks. 77% of the banks indicate that they provide periodical reports on model risks to their senior management or management board. This emphasizes that most banks acknowledge the importance of increasing model risk awareness at management level.

The key to understanding the overall model risk is the model risk appetite for model risk - more specifically, having certain limits and tolerances for model risk items. 59% of the banks indicate that they have a risk appetite. However, current market insights teach us that these risk appetite statements are often simple, with a focus on model validation results. As such they do not always cover the full range and depth of model risk within the bank. Hence, banks should implement a model risk appetite framework and demonstrate that model uncertainties are adequately understood, managed, monitored and reported.

Automating the reporting process or having up to date data available in the model risk management tooling, makes it possible to for example link model monitoring with the model quality of a model, and in turn link that to the risk appetite for model risk management. As described in Figure 40, 48% of the banks indicate that analytics and the reporting capability of the model risk management tooling are used to create model risk reports for different types of stakeholders.

Figure 44. Percentage of banks that provide senior management /management board with periodical reports on model risk

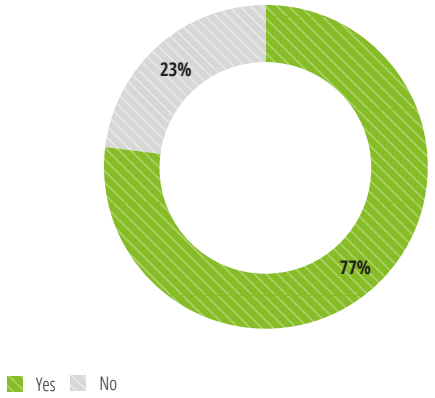
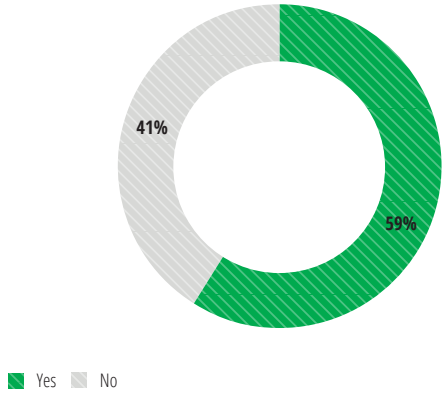


Figure 45. Percentage of banks that have a risk appetite (or specific limits) for model risk as a risk type



The future of model risk management

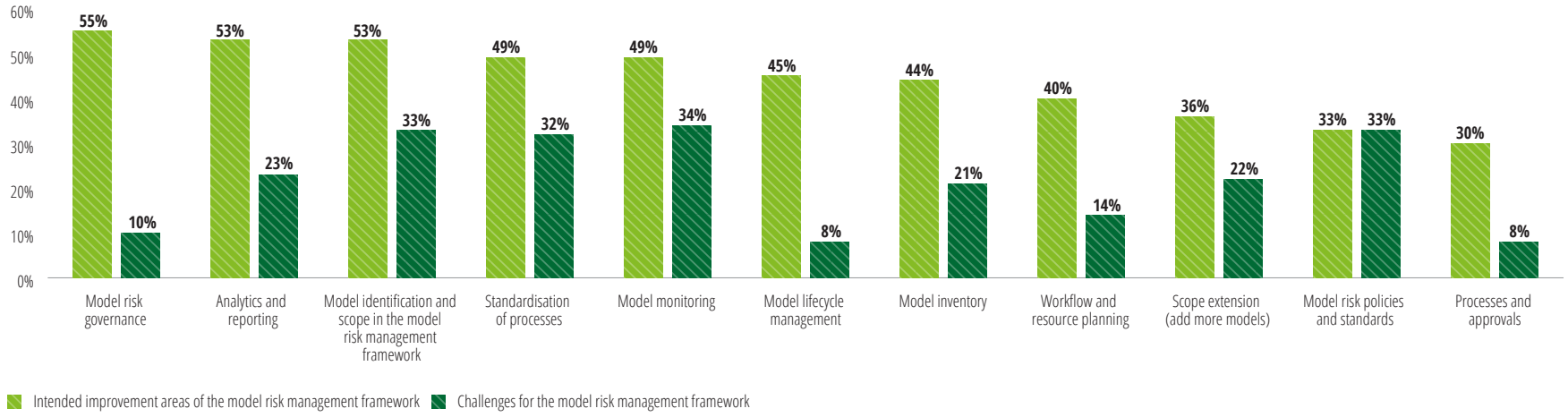
The future of model risk management

Over the last few years, model risk management has received more and more attention from banks. As economic conditions can change quickly, banks must continuously monitor their models in order to address changing model conditions and to mitigate arising model risks. As already mentioned in the introduction, the COVID-19 pandemic has emphasized the importance of having a mature model risk management framework in order to mitigate model risk and perform ongoing monitoring of models.

Going forward, there are many areas where banks indicate that they intend to enhance their model risk management framework within the next one to two years. At least more than half of the banks intend to enhance their framework in the areas of analytics and reporting, the scope extension (including models in scope of the model risk management framework), model risk governance, model risk policies and standards, and standardisation of processes. Of these areas, model risk policies and standards and standardisation of processes are considered to be the most challenging areas to enhance.

The results of the survey have pointed out that most banks still identify many areas where they can mature and improve their model risk management framework. A mature model risk management framework can lead to more model risk awareness within banks, will help banks to tackle a growing model landscape and become a more responsible business.

Figure 46. Intended improvement areas and challenges for model risk management



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