

The Future of Risk Modeling

Taking the risk out of next-generation risk modeling – from data to decision



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Risk Modeling in the Digital Age

Like organizations in other industries, banks are on a journey of digital transformation on two fronts: by realizing step-level improvements in efficiency through automation and by fully exploiting their data for competitive advantage. For example, companies are looking to improve efficiency by automating mundane processes and tap into fresh sources of big data to uncover new insights, innovate, and differentiate their business.

Risk modeling is now mainstream within the banking industry - and over the next few years, it's poised to explode in terms of pervasiveness, complexity and opportunity. Banks face growing market demand, regulatory pressure to adopt more sophisticated, transparent risk modeling practices, and requirements to run their risk calculations at scale and at the most granular level of analysis.

At the same time, new risk models powered by artificial intelligence (AI) and machine learning (ML) hold immense transformational potential to improve accuracy and efficiency and help banks proactively detect stress signals. For example, these innovations in risk modeling have the potential to:

- Automate the delivery of highly personalized customer services that consider risk levels and smart capital allocation.
- Accelerate risk insights so risk impacts can be assessed when making real-time decisions (for example, pre-trade assessment of risk).
- Make models more accurate by improving algorithms (for instance, by comparing incumbent models to AI- and ML-enabled challenger and validator models).
- Continuously learn from data to reflect the latest customer and market dynamics.
- Reveal complex relationships hidden in data for better predictions and risk optimization.

These benefits are not hype. Innovative risk models give businesses tremendous power and opportunity. However, as explored in this paper, with this power comes great responsibility - to your business, as well as to regulators and customers. As the following questions suggest, using and scaling next-generation risk models - especially those powered by AI and ML - is a complex endeavor full of both incredible opportunity and considerable risk. Regulators around the world, still reeling from the last global financial crisis, know just how big the risks of dependence on complex models can be. So as your bank deploys complex and interconnected risk models, anticipate intensifying regulation worldwide and expectations for model explainability and accuracy, data protection, ethical conduct, treatment of customers and more.

Are your modeling deployment and decisioning systems and processes up to the task? To assess the risk of your current risk modeling initiatives, answer the following questions:

- Do you trust the quality of the data used to train your models?
- Is the data running through your models truly model-ready?
- Can you centralize, cleanse, and make the right data easily accessible to those who need it?
- Are you effectively governing your data so that it's fully traceable, so regulators can validate that it's being used in compliant ways?
- Are your models interpretable and easily explainable to business and regulatory audiences?
- Do you have the talent and tools to effectively build and manage a growing body of models?
- Can you scale complex models into the thousands while ensuring compliance and preventing contagion risk across your growing model ecosystem?
- Can you develop and deploy models quickly – even in one day – before the data used to train them is out of date, or the business need passes?
- Can you use the latest open source tools to develop models while maintaining control of your intellectual capital and ensuring model understandability and auditability?
- Can you empower your risk models to pull data from any source – both traditional and nontraditional?
- Can you validate with confidence that models are not inadvertently taking protected characteristics such as race, gender and other data into account to bias results?
- Can you insert models into decision flows across the enterprise to automate decisioning – and keep track of where they are being used, when they are beginning to degrade, and when to update them before they degrade and drive bad decisions?
- Will your current model development and management processes be able to cope with the evolution of new types of risks as they emerge – for example model contagion and cyber risk?

As these questions suggest, as you deploy both traditional and innovative risk models more widely, your challenge will be figuring out how to take the risk out of risk modeling – all while empowering the rapid development and deployment of new models, safely scaling their proliferation and realizing their full potential.

How Will You Take the Risk Out of Risk Modeling?

Achieving this will require more than just the traditional patchwork of bolted-together model development and management tools, and IP borrowed from “trusted sources” used by different lines of business (see sidebar, “Traditional Approaches and Risks”). History has proven time and again that important steps in the model development process and details may fall through the cracks of such fragmented efforts and cobbled-together IT resources – even when they are best-of-breed.

Why? Because they can’t support a truly end-to-end process – one that operates like an efficient and integrated platform that provides:

- **Choice** – via flexible data access and innovation.
- **Governance and control** – for model tracking, monitoring and compliance, without hindering scalability, model development and deployment speed.

As model volumes increase, governance and control will be especially key to your success. For example, self-learning ML models can “learn” and change with every little bit of data they consume, which may enable greater accuracy and predictability compared to traditional models. They can also enable hyper-personalization of customer services (see callout below). But this changeability also substantially increases model risk (including hidden bias) and makes models harder to explain. To avoid deployment delays of self-learning models, you’ll need tools with built-in interpretability and support for a governance process that streamlines model approval and deployment. The dynamic nature of these models also means that they require more frequent performance monitoring, constant data review and benchmarking, better contextual model inventory understanding, and practical contingency plans. So to truly scale risk model utilization, you’ll need to automate tasks and processes – or risk overwhelming even a sizeable team of risk managers using traditional tools.

Self-Learning Model Use Case: Hyper-Personalized Services

Self-learning models will help banks meet evolving customer service expectations. For example, on the credit risk front, they can support “segment of one” services that tailor prices, products and offers to each individual customer consistently across channels. To scale such personalization, banks will need to assess risks in real time and make decisions without human intervention. This can only be achieved through rapid, continuous development and deployment of literally thousands of models that uncover complex, nonlinear patterns in massive volumes of data. Each model must be interpretable and approved for use before it can be incorporated into live decision flows (like the loan applications process). Once deployed in production, the models must also be governed constantly and closely.

As banks increase their dependence on models, they will also need faster, more efficient ways of developing new models. For example, modelers will need a diversity of interfaces so they can work according to their own preferences. These interfaces should be open (so they can flexibly use preferred vendor and open source analytics) and make the development of models easy and intuitive (so banks can harness their existing talent - people who already know their firm's data and domain).

In addition, they will need faster, better ways of operationalizing models into decision flows. There won't be time to wait months for development, weeks for final approvals, and time to recode model logic to align with where it's going to be used. Models will need to be created and executed in one to two days across the enterprise - and in the case of ML models, be governed more closely than any traditional model has ever been governed before.

Finally, regulations for risk models will keep changing - and to stay compliant, you must be able to identify which models deployed across your enterprise are affected by changes, adapt or rebuild them, and then deploy your risk models within a tight timeframe. This will require highly efficient model development and deployment capabilities and exceptional model governance (so you can isolate models affected by regulatory changes and where they have been deployed across the enterprise).

Making Informed Technology Choices for the Future of Your Bank

The point of this discussion is not to dissuade you from investing in the scaling of risk models across your bank. (For example, in credit risk decisioning, financial technology providers have automated processes and deployed more sophisticated risk models to drive faster, more accurate and more competitive pricing. This example illustrates how the nature of banking is changing, and to evolve with it, why you need the flexibility to innovate and scale your use of models). Rather, it's to heighten your awareness about the seriousness of this endeavor and make you a more informed evaluator of risk model development platforms and tools.

Given these challenges and expectations, what's needed is an agile, open and trusted platform for risk model development and deployment that:

- Is built for enterprise security, scalability and data volumes.
- Supports every step in the risk model life cycle in a holistic and interconnected way - from development to deployment and decisioning.
- Has built-in AI and ML capabilities.
- Provides built-in regulatory compliance and auditability features, including data lineage and ongoing model monitoring capabilities.
- Enables you to centrally manage and map in real time a large-scale model ecosystem to proactively mitigate model drift and contagion risk.
- Delivers automation and trusted, prebuilt IP specific to bank risk scenarios to vastly accelerate model development and reduce human error.
- Builds transparency and explainability into every model.

SAS: Delivering an Open, Agile Risk Modeling Platform for the Enterprise

With over 40 years working with enterprises of all sizes around the world, SAS has the experience to solve specific and relevant business challenges in risk management (see Figure 1). SAS has extensive expertise to help banks evolve their risk modeling capabilities for the digital economy. We do this by delivering a single, integrated SAS risk modeling and decisioning framework that empowers risk modelers to access and prepare any data; develop, deploy and monitor any kind of risk model; and use a combination of data, business rules and the output from models in the bank's risk-based decision strategies.

This comprehensive offering covers data management, modeling, governance, reporting, batch execution, real-time scoring and decisioning as part of an open platform of integrated, modular solutions that can address expanding customer needs. (See Figure 1.)

This open approach supports the risk function's evolving needs with the emphasis on cross-functional collaboration and organizational alignment.



Figure 1: A single platform covering diverse risk areas.

Auto-Generated Risk Barometers

The platform continuously auto-generates a number of widely used risk barometers such as probability of default, loss given default and exposure at default – all measures used for regulatory capital calculations, IFRS 9 and other risk management activities such as enterprise stress testing and recovery planning. The estimates generated by the platform are compliant with regulations and used extensively by other risk solutions, saving time and effort.

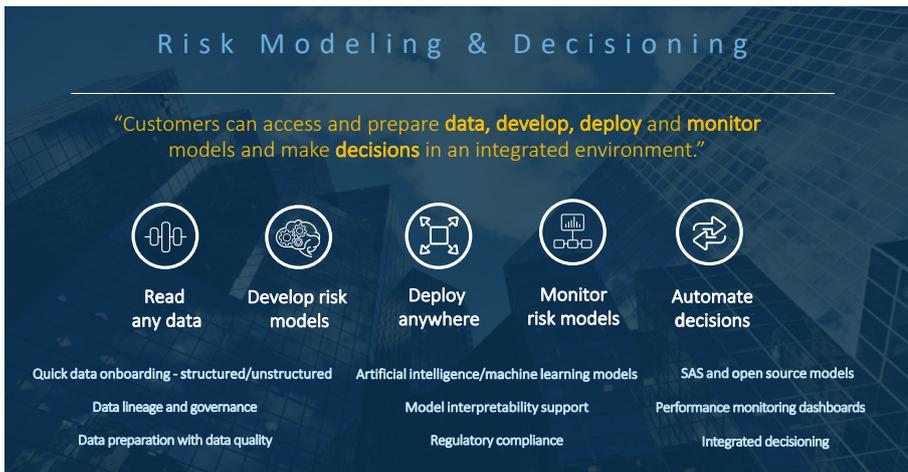


Figure 2: Access and prepare data, develop and monitor models, and make decisions in an integrated environment.

As shown in Figure 2, this integrated, end-to-end environment enables risk modelers to:

- **Read any data**

The SAS framework enables you to access and onboard any data (both conventional and non-conventional) from any source, whether it's inside or outside your organization – even very large data sets. It also supports end-to-end data preparation, improving data quality before it is used in models. As data is managed and used in models, the platform keeps track of data lineage so auditors can trace the results back to the source. It also tracks what variables have been used so there's a record of the variables and their transformations that went into developing the model. The SAS Platform includes an analytical data builder that manages the creation of data preparation logic via a user interface, and risk-specific data structures of useful variables – all of which help fast-track the development of models.

- **Develop risk models**

With the SAS Platform, you can develop any type of risk model - linear, nonlinear or AI- and ML-driven models – with incredible speed and agility. The models can easily be developed via a graphical or programmatic user interface, or you can use pre-delivered templates to guide you to develop effective risk models for specific use cases. A built-in, user-guided interface structures your analytical activities and makes transparent data and variables used so you can retain IP control, even after model developers leave your organization. This interface includes specific functionality that facilitates the classification of characteristics into attributes, helps you develop regulatory-compliant risk models and addresses common challenges such as sample bias.

- **Deploy anywhere**

It's easy to build a homegrown system that allows you to build new models – for example, with open source software. The challenge is in operationalizing these models by deploying in the shortest possible time so you can derive actual business value from them (such as more informed decisions and decision automation). This is typically a painful process for banks, as it is usually necessary to recode the model logic so that it can be understood by whatever system(s) are using the model. In the process, they lose track of where the models are deployed.

With SAS, models are ready to be deployed anywhere, any time – no recoding needed. It's even possible to build and deploy a compliant model the same day. You can automate model deployment and redeployment (for example, after the model has been recalibrated) so there's no delay in deriving business value and results are always as accurate as possible. As models are deployed, they are centrally tracked so you can see where they are being used across the enterprise – in which decision flows, departments, systems and so on. And you have a single, trusted source of truth about the models you have deployed and managing decisions across the enterprise.

- **Monitor risk models**

Using the monitoring capabilities built into the platform, you can not only keep track of where models are deployed, but also monitor their usage, detect model degradation, trigger redevelopment or recalibration when needed, automate recalibration and more. Recalibrated models can be set to automatically redeploy using the platform. This vastly reduces manual effort and oversight so you can truly scale model utilization and ensure ongoing accuracy without excessive headcount or risk to your business. This is especially valuable for managing ML models, as they tend to degrade faster. The prebuilt solution content allows you to monitor the discriminatory power, accuracy and population stability of both traditional and machine learning models. Finally, you can drill down into a detailed view to detect the root cause of model degradation.

- **Automate decisions**

The platform enables you to deploy risk models and rule sets into decision flows across the enterprise to automate decisioning – no recoding or other manual interventions needed. A flexible, scalable decision engine makes transparent the deployment of rules, models, data and strategies across your enterprise. Because you can deploy them so effortlessly and with such transparency and governance, it's never been easier to build models and derive business value from them.

Proving the Value

As illustrated in Figure 3, when all these capabilities run on a single platform in a smooth and integrated way, risk modelers can quickly onboard new data, develop an innovative model based on SAS data mining and machine learning or open source algorithms, and validate its performance using back testing and benchmarking. Validation is essential to ensuring outcomes are accurate and everything is functioning in a way that both the business and regulators require. In addition, risk modelers can easily extend the platform to support the deployment of complex model logic within decision flows and realize immediate business value. All this can happen in one to two days, if necessary.

The push to quickly adopt new analytic methods (including AI and ML) when delivering models and gain tangible benefits places tremendous pressure on modeling and management teams to execute and deliver business value. For example, while a growing number of banks are exploring the use of machine learning in production for credit decisioning, many more are using these methods as benchmark comparisons or for auxiliary analytics. Enabling deployment of new innovative models in a timely manner to meet the individual business needs is the principal benefit of having a true, end-to-end risk modeling platform - because models that are stuck in a long development cycle can't deliver business value, no matter how innovative they are.

Let's take a look at how customers are already using the SAS Platform's capabilities to develop and deploy new risk models and achieve rapid business value.

Operationalizing Analytics: Smart Credit Risk Decisioning at a Medium-Sized Bank

One SAS customer – a medium-sized bank that provides financial services to people and businesses, including insurance, mortgages, loans and credit cards – is already using key SAS technologies as a proof of concept for operationalizing advanced analytics. They wanted a way to automate their credit risk decisioning process for home loans and make this process available online so customers can initiate a loan request from anywhere using a PC or mobile device. As shown in Figure 3, the customer defined its decision strategy using a flow of checkpoints that customers go through, starting with facial recognition and a PIN request to validate their identity. Customers interact with a chatbot, which asks them to provide specific information as they go through:

- An online credit check – during which an API brings in customer credit bureau data.
- An online property price estimation – at this stage an ML model estimates the property price by performing a comparison of prices of similar homes in the area that have sold recently and verifies that the price offered is legitimate.
- A risk decision process – which is executed by an ML model that analyzes all the data collected and makes a credit decision and offer to the customer, if appropriate.

This bank shared that not only did this ML-enabled process make the home loan application and credit decision process much more efficient for the bank and its customers, but it opened up new ways to interact with customers and capture valuable information needed to identify new needs and engagement opportunities. For example, customers often shared information that the bank could use to determine the next best offers, understand gaps in customer knowledge about home loans and credit, and educate customers to help mitigate the risk of defaults in the future, and more.

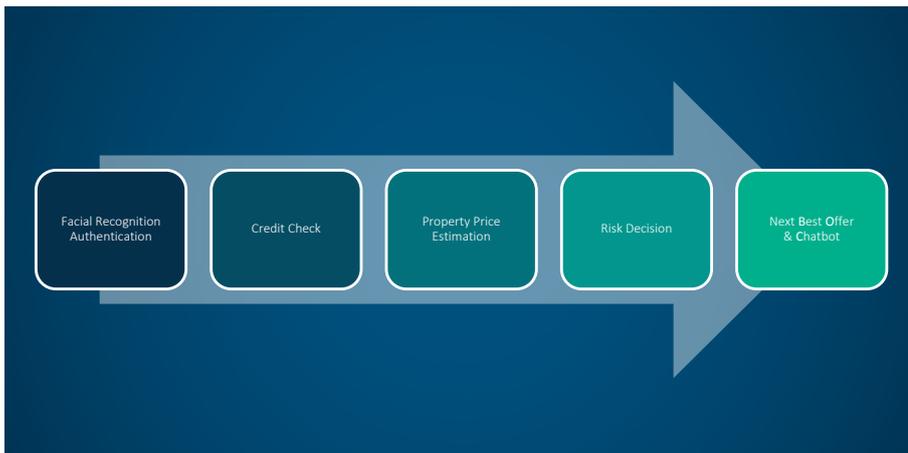


Figure 3: An ML-enabled home loan credit application and decisioning process.

Accelerating the Model Development and Deployment Life Cycle at a Large Bank

A large Brazilian bank with over 400 billion in total assets has used the SAS Platform to vastly accelerate its model development and deployment life cycle – and scale its use of ML and other models easily and cost-effectively. Before deploying the platform, it took the bank more than a year to develop, approve and deploy a single model. By that time, the models were often out of date and not useful.

Now, they use the SAS Platform to select predictive variables from hundreds of thousands of features, auto-build new models, select the champion model and deploy it, and retrain existing models for new purposes. Modelers can build and deploy models in one day – and with full confidence that the new models are compliant and properly governed in the context of other models. Moreover, the model development process is automated, as the models actually self-learn by selecting the most predictive variables and then modeling algorithms through a champion-challenger system.

The SAS Platform has transformed the bank's use of models – even advanced ML models – by eliminating speed, cost and compliance barriers. Already, it has scaled up its use of models from 100 in 2016 to nearly 500 and counting in 2018.

5X scale-out of model library in 2 years

Making Neural Networks Interpretable for Regulatory Approval and Use

A large credit-scoring organization that provides data and services to banks in the United States wanted to improve the accuracy of its income models and risk scores. The root cause was the firm's traditional credit scoring methodology, which was no longer providing enough statistical lift. Using deep neural networks has the potential to dramatically improve the accuracy of results, but they are notoriously difficult to interpret, making them inappropriate for most regulated activities.

Using tools and technologies from SAS, the business was able to make the neural networks completely interpretable for regulatory purposes – something no one had ever done before. After gaining approval to apply them to credit scoring by regulators, the company has improved the predictive ability of its models by up to 15%. They found that by analyzing larger data sets and using innovative algorithms, they can greatly improve credit scoring accuracy. In addition, modelers can build and test more accurate models faster using automation delivered through SAS technologies. And finally, after analyzing the last two years of data on declined borrowers, they have proven that many could have, in fact, been loaned to safely. This means that going forward, the banks working with this credit service will see considerable expansion of loans they can approve and generate income from.

Learn More

Are you ready to reap the benefits of a truly end-to-end risk modeling process – one that operates like an efficient and integrated platform that provides choice, governance, scalability and control? For more information, go to sas.com/ai.

To contact your local SAS office, please visit: sas.com/office

