

Vendor Model Validation: Challenges and Proposed Solutions

By PSS Moorthy

Validation of vendor models has always been regarded as a complex task to accomplish due to firms' inability to access proprietary code and underlying data. Vendor models have also attracted increased attention from regulators in the recent times, providing further motivation for banks and financial services institutions to make progress in this area.

Despite the apparent challenges, a great deal of model risks can be recognized and mitigated by thoughtful and well-planned validation activities. Different types of models create different challenges for validation. Consequently, this whitepaper will address, through practical business case study, the validation of vendor models.

1. Objective

This whitepaper will provide insights on industry best practices for the following three groups of people who deal with vendor models:

- *First line of defense:* Vendor model users, who seek to gain a better understanding of vendor models and regulatory expectations around usage of vendor models.
- *Second line of defense:* Vendor model validators, who want to develop their practice (mitigating key risks) and gain opportunities in vendor model validation with a clear understanding of regulatory requirements.
- *Third line of defense:* Internal auditors, who want to clarify expectations of applicable validation and model risk governance practices related to vendor models.

2. Regulatory guidance

Based on the guidance provided in SR Letter 11-7^{*}, regulatory requirements of the banks and financial services institutions dealing with vendor models can be summarized into seven different challenges, as shown (below) in Table 2.1.

^{*} <http://www.federalreserve.gov/bankinfo/srletters/sr1107a1.pdf>

TABLE2.1: REGULATORY GUIDANCE ON VENDOR MODELS

Sl.No.	Challenge	Excerpt from SR Letter 11-7
1	Why vendor models?	<ul style="list-style-type: none"> • Banks should ensure that there are appropriate processes in place for selecting vendor models. Banks should require the vendor to provide developmental evidence explaining the product components, design, and intended use, to determine whether the model is appropriate for the bank's products, exposures, and risks. • Bank's policies should include a description of the processes used to select and retain vendor models, including the people who should be involved in such decisions.
2	Applicability testing	<ul style="list-style-type: none"> • Even if a bank relies on vendors for basic model development, the bank should still choose the particular models and variables that are appropriate to its size, scale, and lines of business and ensure the models are appropriate for the intended use. • Banks should obtain information regarding the data used to develop the model and assess the extent to which that data is representative of the bank's situation.
3	Knowledge of vendor model assumptions & limitations	<ul style="list-style-type: none"> • Vendors should clearly indicate the model's limitations and assumptions and where the product's use may be problematic. • If data and information are not representative of the bank's portfolio or other characteristics, or if assumptions are made to adjust the data and information, these factors should be properly tracked and analyzed so that users are aware of potential limitations. This is particularly important for external data and information (from a vendor or outside party), especially as they relate to new products, instruments, or activities.
4	Qualitative/Manual overlay	<ul style="list-style-type: none"> • Vendor models are often designed to provide a range of capabilities and so may need to be customized by a bank for its particular circumstances. A bank's customization choices should be documented and justified as part of validation. If vendors provide input data or assumptions, or use them to build models, their relevance for the bank's situation should be investigated.
5	Ongoing Monitoring	<ul style="list-style-type: none"> • Analysis of the integrity and applicability of internal and external information sources, including information provided by third-party vendors, should be performed regularly (i.e., Applicability should be monitored on an ongoing basis) • The bank should conduct ongoing monitoring and outcomes analysis of vendor model performance using the bank's own outcomes.
6	Implementation testing	<ul style="list-style-type: none"> • External models may not allow full access to computer coding and implementation details, so the bank may have to rely more on sensitivity analysis and benchmarking. • A bank's customization choices should be documented and justified as part of validation. • Banks should have contingency plans for instances when the vendor model is no longer available or cannot be supported by the vendor.
7	Vendor validation report	<ul style="list-style-type: none"> • Banks should require the vendor to provide developmental evidence explaining the product components, design, and intended use, to determine whether the model is appropriate for the bank's products, exposures, and risks. • Vendors should provide appropriate testing results that show their product works as expected.

Based on the regulatory requirements discussed in Table 2.1, from a validation perspective, for each of the seven challenges, specific validation activities are proposed in Table 2.2.

TABLE2.2: VENDOR MODEL CHALLENGES – PROPOSED VALIDATION ACTIVITIES

Sl.No.	Challenge	Proposed validation activity
1	Why vendor models?	<ul style="list-style-type: none"> • Look for the following from model owners: <ul style="list-style-type: none"> ○ Look for justification for using vendor models vs. in-house models and alternative options ○ Benchmarking reports, in which various industry equivalents are compared
2	Applicability testing	<ul style="list-style-type: none"> • Evaluate the significance of the difference between the model development data (used by the vendor for developing the model) and the business portfolio data (in which the vendor model will be used) – if there is a significant gap between the data (especially in specific business segments) the model may not perform well on the given business portfolio.
3	Knowledge of vendor model assumptions & limitations	<ul style="list-style-type: none"> • Check if the model development team thoroughly understood and considered the model assumptions, limitations and restrictions of the vendor model.
4	Qualitative/Manual overlay	<ul style="list-style-type: none"> • Identify and look for justification of any qualitative overlays or judgment-based-adjustments in the model done by the vendor.
5	Ongoing Monitoring	<ul style="list-style-type: none"> • If the model cannot be fully validated, the ongoing monitoring plans must be held to even higher standards.
6	Implementation testing	<ul style="list-style-type: none"> • Independently assess if the implementation of the vendor model was properly done at the business end.
7	Vendor validation report	<ul style="list-style-type: none"> • Collect and review vendor’s model validation report.

3. Case Study: XYZ Vendor Model Validation

Let us look at validating a PD (Probability of default) model used on commercial equipment loan portfolio of ABC business. This model makes use of the PD scores generated by a model developed by external vendor XYZ. PD scores generated by the model will be utilized in portfolio management, Allowance for Loan and Lease Losses (ALLL) calculations, stress testing and calculation of expected loss.

The vendor model is a logistic regression based model that uses financial ratios as model inputs for small and medium enterprises. It consists of seven models classified by the industries – construction; wholesale; real estate; retail and restaurants; other services; manufacturing; and other industries.

The model owner submitted the model development document, ongoing monitoring plan and implementation plan to the validation team, with all the information he could gather from the vendor about the model.

Now, let us see how the validation team validated the above model against each of the seven challenges discussed in Table 2.

3.1 Why Vendor Models?

When validation team questioned the model owner on why the model from XYZ vendor was chosen, the following justification was provided:

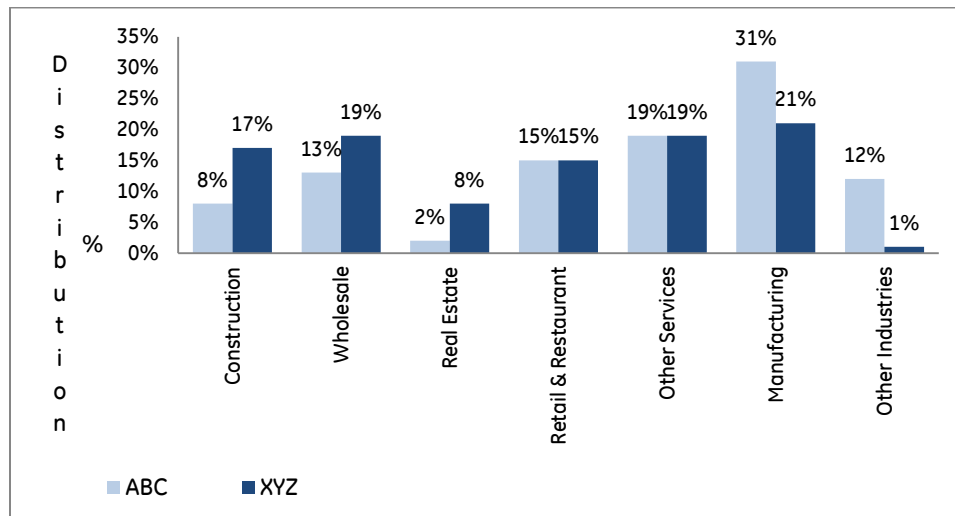
- ABC business does not have a long term credit history of its customers due to successive acquisitions.
- Accuracy of model developed only on ABC customer data may create potential selection bias because ABC portfolio will not capture the behavior of prospective customers that are rejected during ABC's underwriting process.
- XYZ model is developed mostly on small and medium enterprises which are core to ABC customer base.

The validation team found the above justification to be satisfactory.

3.2 Applicability Testing

The model owner performed XYZ vendor model applicability testing on ABC data. Figure 3.2.1 represents the portfolio distribution between XYZ data and ABC portfolio.

FIGURE 3.2.1: PORTFOLIO DISTRIBUTION BY INDUSTRY

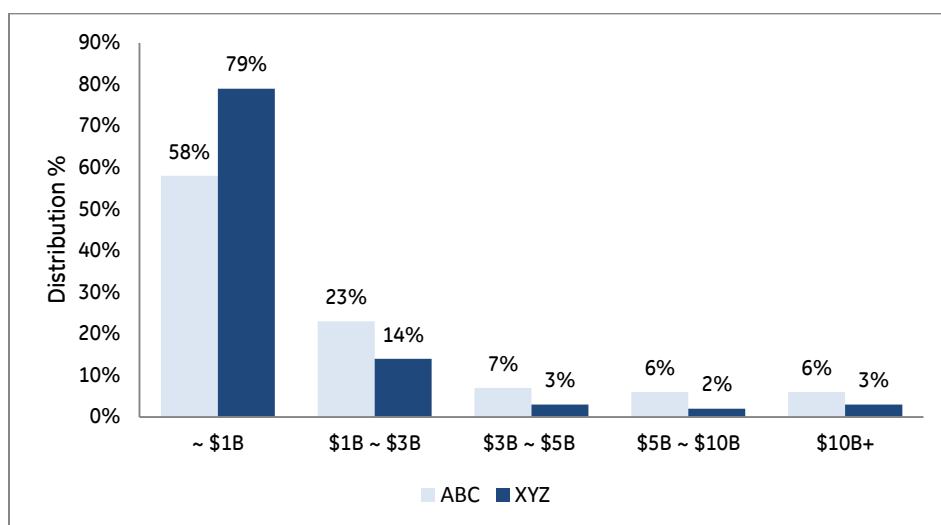


Model owner made following inference based on the above Figure 3.2.1:

- Although the distribution by industry is slightly different between ABC and XYZ, it does not have negative effect on the model performance on ABC portfolio as the model is different by industry.

Additionally, model owner compared ABC portfolio and XYZ data by sales size (\$), as illustrated in Figure 3.2.2 and inferred that there is no material difference between them.

FIGURE 3.2.2: PORTFOLIO DISTRIBUTION BY SALES SIZE (\$)



However, default rate by sales size of XYZ data was not provided by XYZ. The validation team observed that more analysis could have been conducted to strengthen the supporting evidence on the applicability of vendor model to ABC portfolio.

The validation team agreed to the above analyses and inferences made by model owner from applicability testing perspective. However, the validation team made the following recommendation to model owner:

- ABC needs to expand the applicability testing around most sensitive risk drivers to further support the vendor model's applicability to ABC's portfolio.
- ABC needs to compare default rate by sales size between XYZ data and ABC data.

3.3 Knowledge of Vendor Model Assumptions and Limitations

ABC provided limited information on the model assumptions and limitations based on its knowledge about the XYZ model and its applicability to ABC portfolio. However, the following information was not provided on the vendor model: (1) model assumptions, as well as any areas where data may deviate from the assumptions; and (2) circumstances or scope under which the model may not work effectively.

The validation team believed that lack of sufficient information on assumptions and limitations of model might increase the vulnerability into the credit decision process and potentially weaken the ability to monitor ABC's portfolio credit quality on a timely basis. Lack of transparency in explaining the situations where the model should not be used tends to increase the model risk.

The validation team made following recommendation to ABC from understanding assumptions & limitations standpoint:

- ABC needs to negotiate with vendor to gain as much insight as possible on the model's limitations and assumptions, as well as the areas that the model use may not be appropriate or more risky.

3.4 Qualitative/Manual Overlay

The model owner confirmed after checking with the vendor that no qualitative overlay or manual adjustment was done to the vendor model output.

3.5 Ongoing Monitoring

After reviewing the ongoing monitoring plans submitted by the model owner, validation team recommended tracking the following on an ongoing basis:

- Identify and closely monitor the key risk driver values of obligors that significantly deviate from their normal ranges.
- Identify potential reasons or patterns of model's under prediction in specific years (2011 and 2012), and establish monitoring plan accordingly.
- Evaluate the rank ordering ability and key model performance metrics (AR, Gini, KS etc.) at business segment and industry level.

Additionally, the following recommendations were made to the model owner:

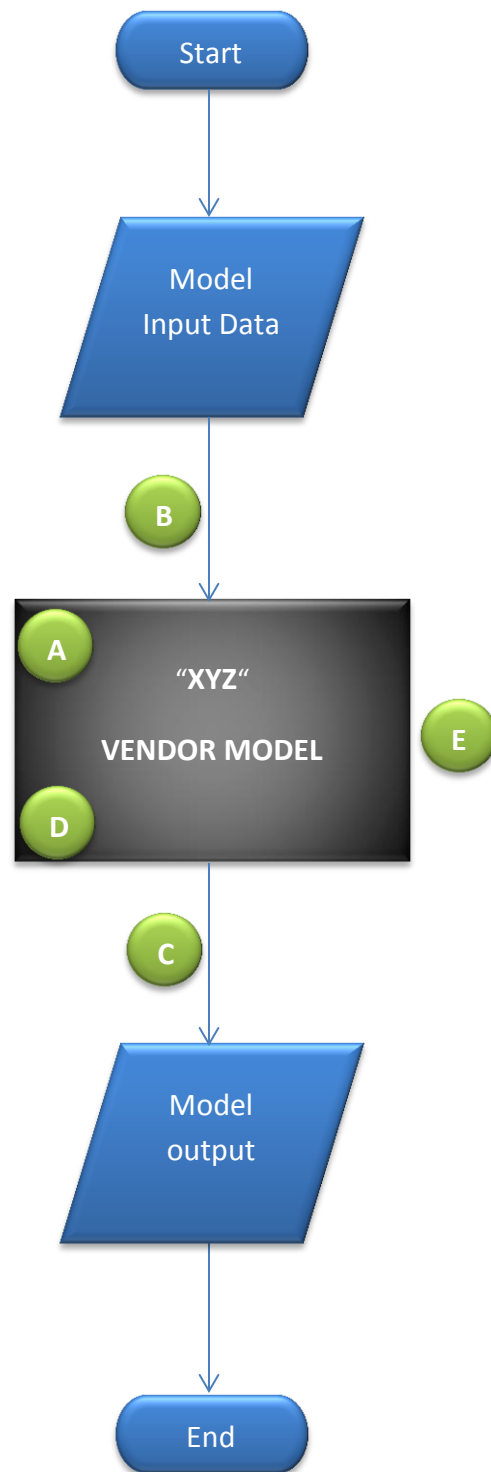
- Add clear indication for how monitoring of the appropriate scope/population is will be performed, including method of assessment, thresholds and escalation criteria.
- Enhance ongoing monitoring plan documentation on the following:
 - Process verification
 - Testing and change controls
 - Quality assurance processes
 - Output verification

3.6 Implementation Testing

Independent validation of implementation of XYZ model on ABC portfolio was a big challenge. However, the validation team did the following as depicted in Figure 3.6.1:

- A.** Designed specific tests (Ex: back testing, sensitivity analysis etc.) for the vendor to run for ABC.
- B.** Checked if the input data from ABC complies with the original data input instruction provided by the vendor.
- C.** Understood model output characteristics and checked if the model calibration is consistent.
- D.** Reviewed vendor's error logs (Ex: code running errors etc.) to check if there are any exceptions.
- E.** Reviewed vendor provided model implementation document including description of each implementation step.

FIGURE 3.6.1: VENDOR MODEL PROCESS WORKFLOW



Based on the above review, the validation team recommended the following enhancements to the implementation testing plan:

- Clear documentation regarding the architecture, implementation process and testing of the systems and supporting infrastructures involved in the model.
- Complete architecture diagram including the upstream and downstream process along with details on hardware, software, operating system and disaster recovery plan.
- Detailed data collection process, including details on the input data quality checks and data movement methods and checks.
- Details on user acceptance testing (UAT) /sample reports and the monitoring checks that are conducted on output.
- Adequate standard operating procedure around the process flow explaining each component in the process (data entry, data extraction, transformation, scoring, application of calibration, and push to downstream systems) and controls in place.
- Details on the security around backups, whether the implementation team is trained on latest IT information security and data protection and the data protection procedure that is applied throughout the process.

3.7 Vendor Validation Report

Upon validation team's request, ABC business was able to get vendor's validation report on its model. After reviewing that report, the validation team came up with the following finding:

- XYZ vendor used data between 2002 and 2006 to build the model in 2008. The model is unchanged since then, although model's performance is 'satisfactory'.

Validation team made the following recommendation to model owner from 'model development data' perspective:

- Given the observed rapid changes in economic environment in the recent years, the limitation and potential impact of using outdated development dataset by vendor should be analyzed by ABC business.

4. Conclusion

Overall, banks and financial services institutions can try the validation activities proposed in this whitepaper to overcome their challenges while validating vendor models. Thorough understanding of regulatory guidance coupled with targeted validation activities based on industry best practices will enhance the ability to identify and mitigate risk in vendor models.

PSS Moorthy works as Assistant Vice President – Financial Services Analytics at GENPACT. He is a subject matter expert in risk and regulatory space and currently manages the Model Risk Management team for one of Genpact's US- based financial services clients.