

## **INCREASING OPERATIONAL EFFICIENCY BY USING SAS® IN AN AUTOMATED PROCESS FOR CREDIT SCORING MODELS**

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### **ABSTRACT**

Sicoob is the largest Credit Union System in Brazil. It has more than 4.2 million customers and almost US\$300 million in total assets. This case shows how we used SAS® Enterprise Miner, SAS Enterprise Guide, SAS Management Console, and SAS Stored Process to completely change the credit scoring process of the institution, exploiting integration with products databases, automation, and reporting. Previous models were based on customer registration data and qualitative information, captured from self-filled questionnaires. The customers probability of default had to be manually updated by employees, which took, on average, 15 minutes for each update. This process involved high operational risk. The automatic reclassification project is based on a more robust methodology and intensive use of data for decision-making. The new statistical models are now processed inside a SAS engine, which enabled the creation of behavior score models, integration with internal and external databases, and the automation of the entire process. These models can calculate more consistent and assertive probabilities of default. Another gain of centralizing the process inside SAS tools is the creation of dashboards, built through a SAS Stored Process, to monitor the performance of the models in near real time. In addition, there are gains in operational efficiency, an increase in competitiveness, and the reduction of image and legal risk, an estimated saving of almost US\$3 million for Sicoob.

### **INTRODUCTION**

Credit risk is the possibility of the counterpart not honoring its duties, that is, get in debt. Managing credit risk in a conservative and efficient way, making sure default probabilities are consistent with the economical and financial reality of the client, is a complex activity. Without automating this process there are negative effects from an operational efficiency and a cost and error possibility points of view.

The automation of this process aligned with efficient analysis and risk monitoring guarantee a more adequate alignment of the needs of the institutions, thus reduction of credit risk. With technology advancements and the help from robust software, it's possible to evaluate information from different sources, such as registered data, financial transactions history and habits of payment. This data guarantees solidity regarding the conditions of the client, which provides a safer concession of credit.

The software capable of executing high performance methodologies are being more sought after by companies in the financial industry with time, in order to provide agility and efficiency in their business. Therefore, the software seek more sophistication and algorithms capable of processing immense amounts of data in a shorter period of time.

This article aims to present how the use of the SAS software provided the automation of credit risk management at Sicoob, providing to the institution, besides assertive default probability and operational risk cost reduction, cost reduction equivalent to approximately U\$ 3 million for Sicoob.

## ABOUT SICOOB

Sicoob is the largest cooperative financial system in Brazil, with approximately 4,4 million members, 2,9 thousand service locations and 41 thousand employees. It includes 16 Central cooperatives, 451 singular cooperatives and one cooperative bank offer the members banking services such as checking accounts, providence, credit, investment, consortium, insurance, among others.

In 2018, Sicoob presented about:

- US\$ 27,6 billion in total assets;
- US\$ 17,1 billion in total deposits;
- US\$ 14,4 billion in credit operations.

In Brazilian 2018, Sicoob's participation in Brazilian cooperativism corresponded to:

- 44% of the net worth;
- 48% of total deposits;
- 49% of credit operations;
- 34% of total assets.

## MOTIVATION OF THE PROJECT

The project of periodic classification and reclassification of the counterparts involved in credit operations had as main motivation the intent of boosting the growth of Sicoob's credit portfolio in a prudent way, with operational efficiency.

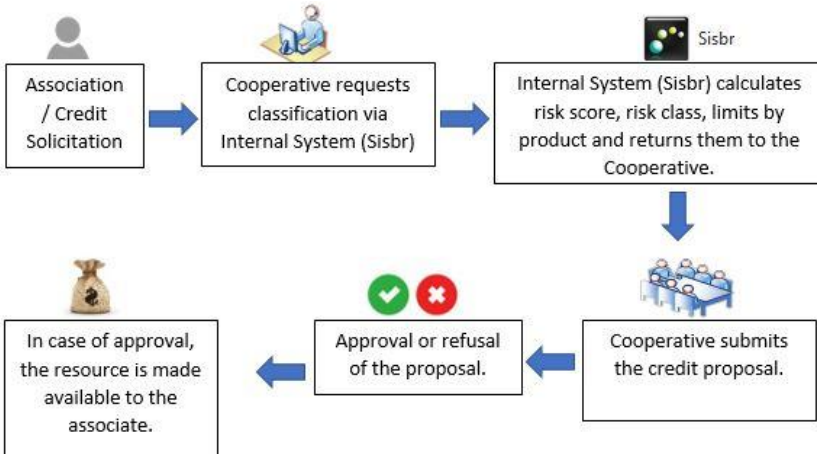
Additionally, in a conformity point of view, it guarantees the automatic revision of risk classification of borrowers every six or twelve months. Since the classification and reclassification processes demanded action from the users of the system in cooperative, it was linked to a relevant operational risk, besides analyzing every credit operation in the same tray, regardless of its worth. So, the need for automation was identified, to improve the process as a whole.

Another decisive factor for the creation of this project was the demand of the Brazilian financial system for:

- Better and faster decisions;
- Intensive usage of data for decision making;
- Utilization of more sophisticated statistical techniques;
- Competitive environment;
- Increase of operational efficiency.

## CREDIT PROCESS AT SICOOB

The credit process at Sicoob is demonstrated in Image 1. Credit Process Flow at Sicoob, as follows.



**Image 1. Credit Process Flow at Sicoob**

The SAS is utilized to calculate the risk score of the borrower to classify them in their risk zone. Besides utilizing this routine daily, the SAS was also utilized to help with studying the analysis of the limits that were made available in each product, according to the borrower's risk score.

## THE SOLUTION

### PREVIOUS PROCESS

The previous classification and reclassification credit risk system had some improvement opportunities, such as:

- Credit scoring statistical models strongly based on qualitative and registered information, obtained utilizing individual questionnaires, increasing the exposure to operational risk;
- Low level of awareness regarding external information and historic and behavioral data with the models produced until then.;
- For calculation reasons, new members were treated the same way that members with a known credit history were being treated.
- Limitations in the utilization of mathematical operators and functions in the calculation engine, a system developed by Sicoob. More sophisticated algorithms couldn't be implemented in the production for prediction;
- Possibility of choice, by the user of the system, of the statistical model to be utilized in the calculation of risks and limits. That gave room for an ill-intended analyst to choose models that returned smaller possibilities of default for a member, reducing the need of provision;
- Great effort in the following and monitoring of the performance of the models.
- From an efficiency and operation cost perspective, the classification and reclassification of risk process was manual, that is, depended on actions of users of the system. It was necessary that these users executed some of the tasks manually, which meant around 15 minutes per classification. That means that besides the operational risk, there was also a high opportunity cost, since cooperatives would stop focusing on creating business opportunities to classify borrowers.

## THE NEW PROCESS

The current process of classification and reclassification of borrower's risk at Sicoob is based on a robust methodology with more consistent and determined criteria as well as intensive use of data for decision making. Since the implementation of this process, a cost reduction of over US\$3 million is estimated. The new statistical models are processed in a SAS mechanism, which made the creation of behavior punctuation models, integration with internal and external databases, besides integration with Sicoob's internal system, where classifications occur automatically. This process made possible the revaluation of the probability of non-compliance of the borrowers in a periodic and automatic way, requiring minimal operational activity from the cooperatives.

The automatic classification and reclassification project began in March/2018 with the understanding of the problem and definition of the objectives. The necessary sources of data were identified and utilizing the SAS Enterprise Guide module it was possible to access several analytic information that was stored in different sources. Besides obtaining historic data, with this SAS module it was possible to cross information from internal and external databases and the construction of a matrix for moduling. Still utilizing SAS Enterprise Guide the data was treated, as in outlier analysis, missing and clustering of variables and the segregation of databases for training and tests of the models.

Utilizing the SAS Enterprise Miner module, statistical techniques were utilized to select the predictor variables of the models of risk classification. That is, within a group of available explanatory variables, it was possible to find a subset of variables that had a greater power of discrimination of non-compliance risk. After the selection of variables, different algorithms were tested such as Decision Trees, Random Forest and Logistic Regression. The selection of the "best" model was made as a result of the calculation of performance metrics, such as confusion matrix, KS, Gini and AUC. At last, the models were applied in the test database to verify the quality of the adjustments.

Differently from the previous process, currently there is a differentiation between new and old borrowers and there is also a smaller quantity of models capable of distinguishing different profiles within the Sicoob System, making the management and monitoring of the models in production easier. These models capture and analyze information on:

1. Registration
2. Habits and payment history
3. Product usage;
4. Market information;
5. Qualitative assessment on analysts / specialists / credit managers.

Besides providing the creation of more robust statistical models, based on more sophisticated techniques, SAS tools provided the automatic capture of the variables and the elaboration of hybrid models. That is, the new models are a combination of behavior score models with external modules. The external component is made of market variables e data bureaus.

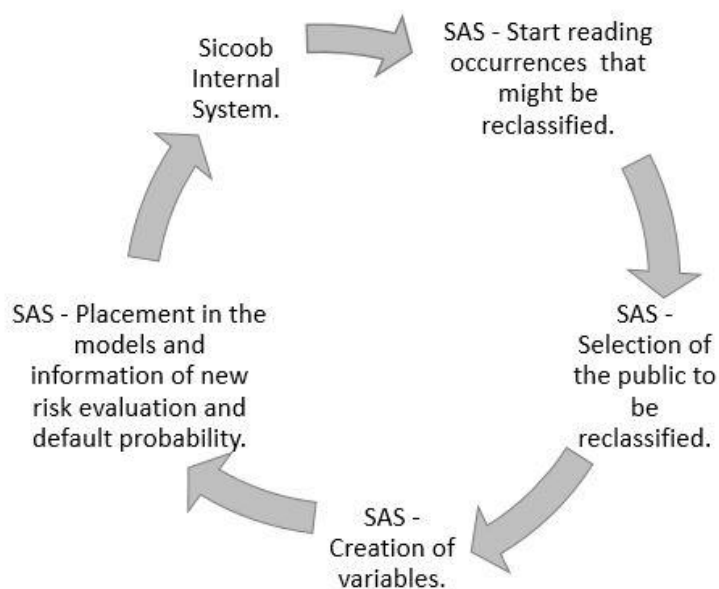
The automation and implementation of the process of automatic reclassification was made possible by integrating the SAS tool with the internal Sicoob System (CRL Module by Sisbr2.0). Starting with the integration, the following process is executed:

1. At 10 pm the CRL creates a file with all the occurrences that might be subject to

reclassification;

2. At 10:45 pm the SAS starts the process of reading the file;
3. The SAS selects and segregates the public that will be reclassified;
4. The SAS creates the input variables of the models;
5. The SAS directs each person to the corresponding model to their profile;
6. The SAS finalizes the process of reclassification, generates a file containing the reclassified profiles and returns the information of the new risk grades and new default probabilities to the CRL. In the following morning, the cooperatives are able to visualize the new risk classifications.

Following, in Image 2. Internal System Integration Flow at Sicoob (Sisbr) with SAS this flow is illustrated.



**Image 2. Internal System Integration Flow at Sicoob (Sisbr) with SAS**

Another SAS module utilized in this process of automatic classification and reclassification is the SAS Management Console. There is a team responsible for the administration of the SAS tools that, among other responsibilities, utilizes the SAS Management Console to schedule the daily execution of the mentioned flows.

Besides the automation, another advantage in centralizing the process within the SAS tools was the possibility of the creation of panels via SAS stored Process. Through these panels it's possible to follow and monitor the performance of the models almost in real time.

In these panels, descriptive statistics are presented summarizing the process of reclassification as a whole and by member profile, the number of not-reclassified borrowers, as well as performance indicators and quality of adjustment of the models in production.

In conclusion, currently the risk classification and reclassification of borrowers at Sicoob

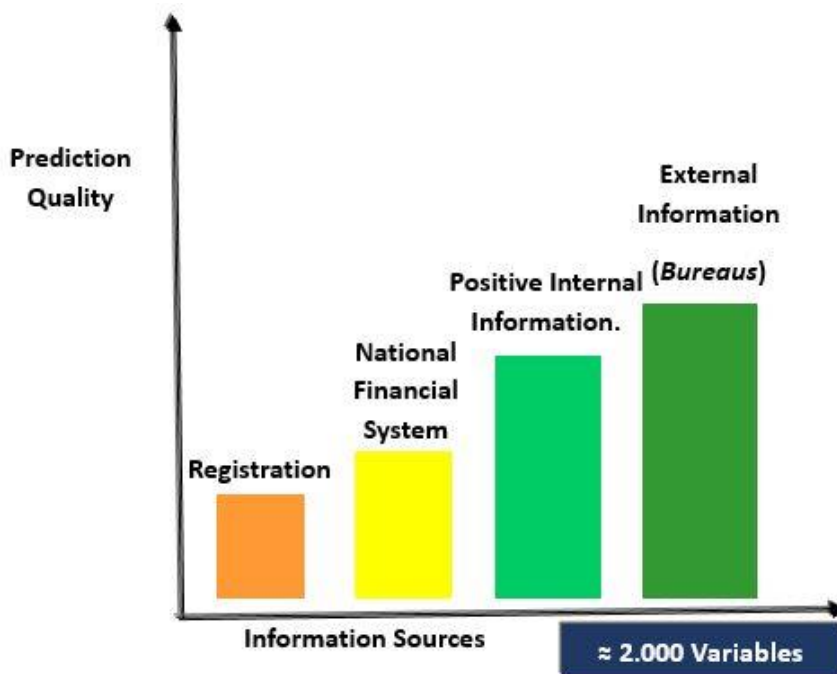
include:

- Automatic classification and reclassification;
- Automatic and consistent risk and limit attribution by product;
- Behavior scoring statistical models;
- Analysis of external information and historic and behavior data;
- Specific and distinct models for new member and member with known credit history;
- More sophisticated algorithms;
- Clusters of tracking and monitoring the performance of the models.

## MAIN RESULTS

The automatic process of classification and reclassification, with the support of SAS tools alongside the improvements in Sicoob's internal system provided the following results:

1. Utilization of more assertive and robust statistical models, behavior and historic information analysis;
2. Integration of internal sources (registration and payment habits) with external sources (Bureaus and National Financial System) - Image 3;



**Image 3. Improvement of prediction quality x information sources.**

3. Possibility of developing more sophisticated models, with more complex machine learning algorithms;
4. Autonomy in the updates of the models by the area responsible for their development;
5. Improvement on the credit risk management of the cooperatives:
  - More adequate provisions;

- Predictability related to the loss of capability of payment;
  - Possibility of anticipation of charging actions.
6. Increase of operational efficiency and maximization of the business via:
- Cost reduction – Estimated US\$3 million in savings;
  - Increase in competitiveness;
  - Reduction of operation risk;
  - Reduction of legal risk;
  - Reduction of image risk;
  - Guarantee of updated default probability according to the profile and current situation of the borrower.

## **CONCLUSION**

The competitive and prudential environment provoked the need of more efficient and assertive implementation processes at Sicoob. With the intensive utilization of data, the integration of external sources and the implementation of more robust methodologies it was possible to completely change the credit cycle in the institution utilizing the SAS solutions. The measurement of non-compliance risk automation provides, besides cost reduction, a more adequate management, mainly from a credit and operational risk point of view, the system seeks automation of operational processes via the intensive use of data and analytic intelligence, supported by cutting edge technological solutions.

## **CONTACT INFORMATION**

Your comments and questions are valued and encouraged. Contact the author at:

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