

The Contribution of Data Analysis in Bank Branch Classification. Case Study:« Société Générale Algeria »

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Abstract:

This study employs Principal Component Analysis (PCA) and Hierarchical Cluster Analysis (HCA) to evaluate bank branch performance within Société Générale Algeria's network. Conducted at the bank's headquarters in Algiers, this research aims to provide marketing managers with a scientifically rigorous framework for assessing and categorizing branch performance across Algeria's national territory. The methodology combines PCA to identify key performance dimensions among variables, followed by HCA to segment 81 surveyed branches into homogeneous clusters. The findings reveal two primary performance dimensions, profitability and market orientation and establish three distinct branch categories ranked according to their overall performance levels.

Keywords: Quantitative methods, PCA, HCA, performance, bank branches.

JEL Classification Codes: M31, M39

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1. INTRODUCTION

In today's globalized economy, marked by rapid innovation and sectoral transformation, the banking industry faces increasingly intense competition. This competition is driven not only by profitability and profit generation but also by the ability to deliver high-quality customer service. Consequently, banks must adopt modern management techniques and analytical tools to maintain efficiency and meet stakeholder expectations.

Strategic choices and competitive advantages have become decisive factors for long-term success (Berger, 2009). It is therefore essential to base these decisions on relevant and reliable performance measures (Berger & Humphrey, 1997).

The Algerian banking sector has undergone significant development since the 1990s, following the transition from a centrally planned to a market-oriented economy. The entry of foreign banks has further intensified competition, making performance measurement a critical element for achieving objectives, ensuring growth, and maintaining sustainability.

To ensure effective management, banks need robust performance measurement tools to monitor branch operations accurately. Bank branches constitute the core of retail banking, as they are the primary point of contact with customers and the hub for most banking activities.

Considering this strategic importance, the present study proposes an objective method to classify bank branches according to their performance levels. The central research question is:

Can Société Générale Algeria's retail branches be classified according to performance levels using data analysis methods?

To address this question, we adopt a quantitative approach combining Principal Component Analysis (PCA) and Hierarchical

Ascending Classification (HAC) to provide a structured and evidence-based classification of Société Générale Algeria's branch network.

2. Performance: Between Classical and Recent Criteria

According to Philippe Lorino (1998), *“Performance in an organization is everything that, and only what, contributes to improving the value–cost relationship. Conversely, actions that merely reduce costs or increase value in isolation do not necessarily constitute performance. Performance is also everything that, and only what, contributes to achieving strategic objectives.”*

To define performance, three key criteria are traditionally considered: **effectiveness**, **efficiency**, and **relevance**.

Effectiveness refers to the relationship between the objectives set and the results achieved. An organization is considered effective when it attains its goals, even if this requires additional resources. This dimension is closely linked to a company's strategic priorities (Barabé & Meller, 2006).

Efficiency relates to optimization in achieving objectives. It involves meeting targets while minimizing resource consumption. According to Malo and Mathé (2000), efficiency *“maximizes the quantity obtained from a given amount of resources or minimizes the quantity of resources consumed for a given output.”* Therefore, a company's overall performance depends on both effectiveness and efficiency in a given context.

Relevance emphasizes the rationalization of resources and the costs incurred to achieve objectives. For performance to be sustainable, organizations must secure necessary resources at the lowest possible cost.

Recent research, however, highlights that performance is not limited to these traditional criteria; it also incorporates elements such as customer requirements and satisfaction. In recent decades, **quality** has become a fundamental factor, enabling companies to differentiate themselves in

competitive markets. Deming defined quality management as a systematic approach to continuously improving organizational processes, products, and services.

According to Pinto et al. (2003), performance should be understood as a sustainable concept, focusing on long-term growth and profitability rather than short-term gains. Similarly, Keramidas (2012) defines equity as “the sure and spontaneous sense of what is just and unjust, particularly as it manifests in the evaluation of specific cases.” Equity has emerged as a vital dimension of organizational performance, as it fosters strong social relationships, employee loyalty, and fairness in management practices.

3. Banking Performance

Through a meticulous and rigorous analysis of various factors, it becomes evident that performance measurement does not rely solely on a single parameter but rather results from the combination of multiple performance indicators, each relevant to the specific field of application.

3.1 Banking Profitability Indicators

Profitability can be defined as a very important performance indicator in the banking sector. From a strategic perspective, it is considered as the bank's accounting evaluation. According to Hadjelaoui and Mouhoun (2017), profitability can be defined as "an indicator of a bank's ability to bear risks and/or increase its equity."

- ***Economic Profitability*** : Economic profitability allows measuring whether an operation generates a cost or, conversely, whether it would allow achieving a surplus.
- ***Financial Profitability*** : Financial profitability is profitability calculated after taking financing into account, that is, after considering debt costs. It is the ratio between net result and equity capital used to obtain it.

3.2 Profitability Indicators

Intermediate management balances are considered essential indicators in the banking sector. They highlight the key components contributing to the net result. Four primary indicators can be distinguished:

- Net Banking Income "NBI"
- Gross Operating Result "GOR"
- Operating Result "OR"
- Net Result "NR"

3.3 Productivity Indicators

Banking performance is measured not only through profitability indicators but also through productivity indicators. Productivity indicators reflect the bank's resources and uses, which correspond to the elements that make up its balance sheet.

✓ Resources

Banking resources represent the liabilities on the balance sheet and consist of the following:

- Different types of customer deposits
- Interbank borrowings
- Equity capital
- Bonds

✓ Uses

Uses refer to the allocation of banking resources and correspond to the assets on the balance sheet. These include:

- Customer loans
- Interbank loans
- Portfolio securities

Additionally, the analysis considers customer activity indicators, such as:

- Number of bank accounts
- Number of granted credit files
- Number of current operations
- Number of foreign trade operations

4. Presentation of “ Société Générale Algeria”

Société Générale Algeria, a subsidiary of the Société Générale group, is one of the first private banks established in Algeria. As a retail bank, it offers a diversified and innovative range of banking services to more than 450,000 individual, professional, and corporate clients. Its network spans the entire national territory with 91 branches distributed across 31 provinces, including 13 Business Centers. Its workforce consists of more than 1,500 employees. Here are some key milestones in the company's evolution: 1987: Opening of a representative office

- 1998/1999: Obtaining banking license and creating Société Générale Algeria subsidiary
- 2000: Opening to customers of the 1st El Biar Branch in March 2000
- 2004: Société Générale Algeria becomes 100% subsidiary of Société Générale Group after buying out minority shareholders
- 2010: Creation of four Business Centers in Algiers (Chéraga-Amara, Dar El-Beïda, Rouïba-Hassiba and Constantine-Palma) to better serve SMEs
- 2015: Celebration of the bank's 15th anniversary and visit to Algeria by the Group's first executive Frédéric Oudéa
- 2020: Celebration of the bank's 20th anniversary and opening of the Lions branch in Oran.

5. Research Methodology

To achieve our objective, we must determine our database while defining individuals and variables. We then apply Principal Component Analysis for representing branches according to chosen variables and use the Hierarchical Ascending Classification method to obtain homogeneous groups. The method implementation is done using SAS software (Statistical Analysis Software).

5.1 Rationale for Methods

- **Principal Component Analysis (PCA):** Reduces dimensionality while preserving key variance, simplifying data interpretation. PCA identifies latent performance dimensions, reducing subjectivity in branch evaluation.
- **Hierarchical Ascending Classification (HAC):** Groups branches into performance-based clusters using Euclidean distances. HAC is ideal for visualizing branch proximity and performance similarities.

5.2. Variables and Coding

Code	Variable	Description	Type
NBI	Net Banking Income	Total revenue from banking operations	Quantitative
GE	General Expenses	Operating costs	Quantitative
NR	Net Result	Profit after expenses	Quantitative
CC	Corporate Commitments	Corporate loan portfolio	Quantitative
RC	Retail Commitments	Retail loan portfolio	Quantitative
CD	Corporate Deposits	Corporate client deposits	Quantitative
RD	Retail Deposits	Retail client deposits	Quantitative
AC	Active Corporate Clients	Number of active corporate clients	Quantitative
AP	Active Professional Clients	Number of active professional clients	Quantitative
AI	Active Individual Clients	Number of active retail clients	Quantitative
CC_C	Corporate Commitment Clients	Number of corporate loan clients	Quantitative

RC_C	Retail Commitment Clients	Number of retail loan clients	Quantitative
PC_I	Irregular Professional Clients	Number of irregular professional clients	Quantitative

Source: Authors' compilation

5.2 Data Analysis Presentation

Data analysis comprises a set of techniques designed to uncover and interpret the underlying structure of complex, multi-dimensional datasets, simplifying them into a more interpretable form. According to J.-P. Fénelon (1981), these structures can often be effectively represented using graphical methods.

These techniques are primarily descriptive, aiming to describe, reduce, classify, and clarify data. They consider multiple perspectives of analysis to reveal relationships, similarities, and differences between variables or groups of variables. From this perspective, data analysis is a branch of descriptive statistics divided into two main approaches:

1. **Factorial analysis** – Based on Euclidean geometry, it focuses on extracting eigenvalues and eigenvectors to summarize the dataset's dimensions.
2. **Classification** – Relies on proximity indices and aggregation or disaggregation algorithms to create partitions or classification trees.

In this study, both methods are applied: **Principal Component Analysis (PCA)** to reduce the dimensionality of the dataset and identify key factors of bank branch performance, and **Hierarchical Ascending Classification (HAC)** to classify branches into homogeneous groups based on these factors.

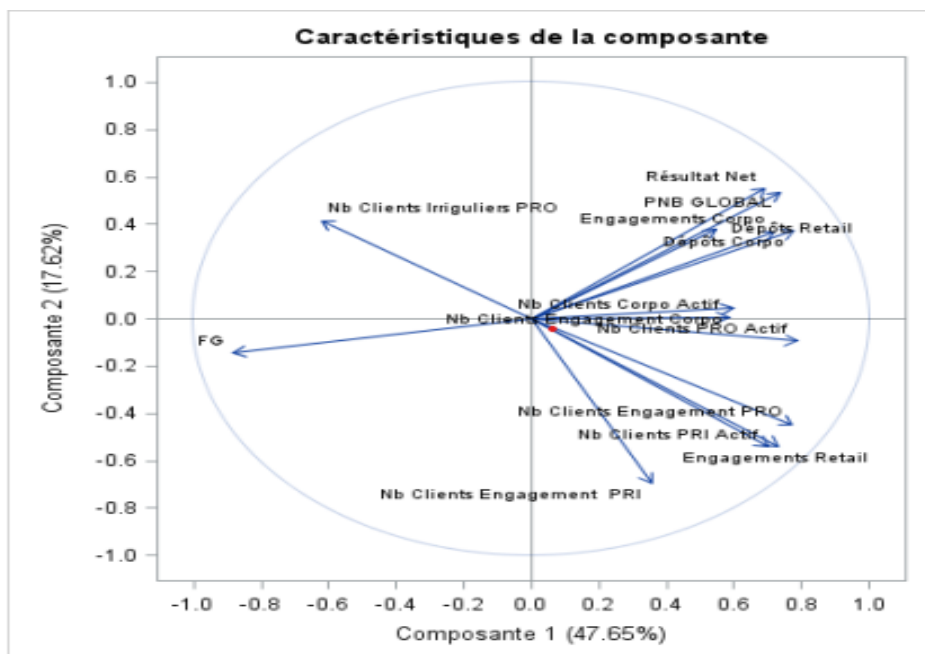
5. Results and Discussion

5.1 Principal Component Analysis (PCA)

a. Interpretation of Factorial Axes

After determining our principal components from eigenvalues, we represent variable correlations relative to two axes to examine the relationship between axis 1 and axis 2 with all variables. The correlation circle is presented below:

Fig.1. Interpretation of Factorial Axes



Source: Results from SAS 9.4 software

The first axis accounts for **47.65%** of the total variance. Most variables are positioned on the right side of this component. Variables such as **Net Banking Income (NBI)** and **Net Result (NR)** are strongly and positively correlated and closely aligned, indicating that Axis 1 reflects their influence. Conversely, **General Expenses (GE)** is strongly and negatively correlated with this axis, illustrating an inverse relationship between GE

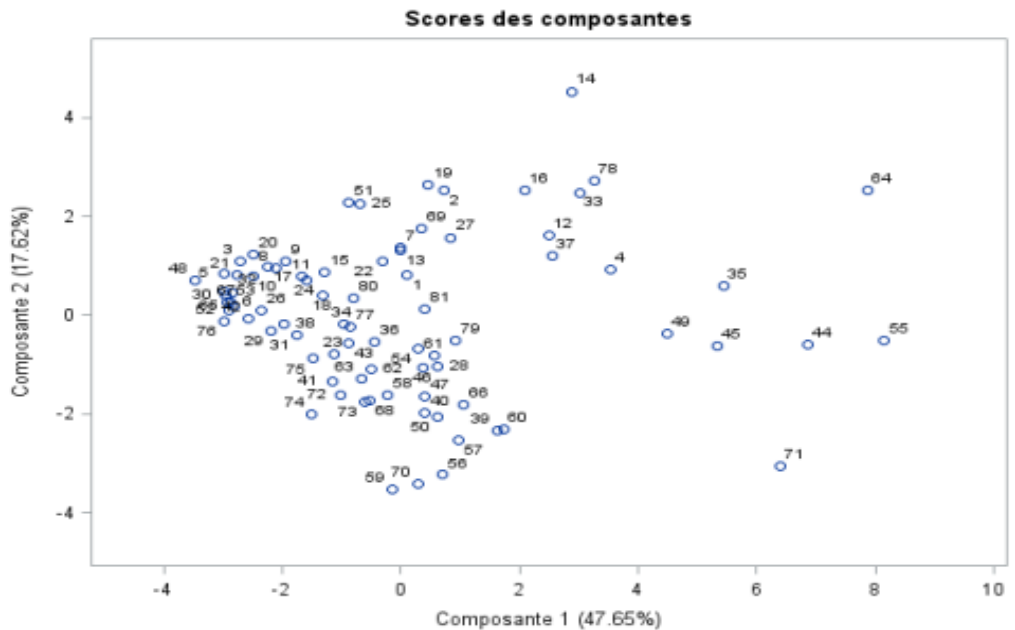
and NBI. This opposition suggests that Axis 1 represents a **profitability dimension**.

The second axis explains **17.62%** of the total variance and is less significant than the first. It reveals two opposing variable clusters: one group, positively correlated, is associated with the **corporate market** (e.g., corporate commitments, corporate deposits), while the other, negatively correlated, reflects the **retail market** (e.g., retail commitments). Thus, Axis 2 can be interpreted as a **market-type dimension** distinguishing corporate-oriented from retail-oriented branches.

b. Point Cloud Interpretation

In space, each individual (branch) is represented by a point characterized by chosen factorial axes and according to performance (profitability and market type). The obtained point cloud is shown below:

Fig.2.Point Cloud Interpretation



Source: Results from SAS 9.4 software

From the point cloud obtained through Principal Component Analysis (PCA), interpretation is somewhat challenging due to the wide dispersion of individual branches. However, the visualization highlights a clear concentration of branches in the center and on the right side of the factorial plane. The analysis reveals the following key findings:

Axis 1 (Profitability): This axis serves as an opposition dimension that classifies branches based on profitability, ranking them from the most to the least profitable.

Axis 2 (Market Type): This axis also represents an opposition dimension, separating branches according to their market orientation: branches at the top of the axis are primarily focused on the corporate market, while those at the bottom are more retail-oriented.

Based on these axes, the main performance dimensions retained for classification are profitability and market orientation. The corporate market appears to hold greater strategic significance, given the higher value and impact of corporate clients.

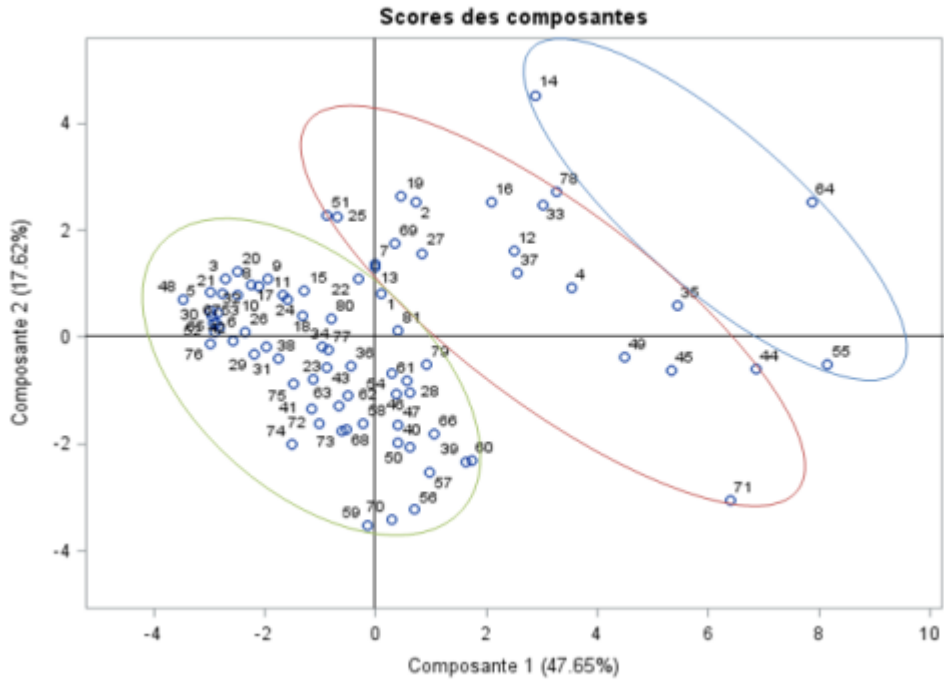
However, the PCA results alone do not allow for a precise identification of the highest- and lowest-performing branches. To refine this classification and provide a clearer segmentation, Hierarchical Ascending Classification (HAC) is applied.

Using PCA prior to HAC offers two key advantages: it identifies the overall structure of the dataset and highlights proximities between branches, while HAC builds on this information to generate the optimal segmentation of branches into homogeneous performance-based groups.

5.2 Hierarchical Ascending Classification Application

The application of Hierarchical Ascending Classification (HAC) enables the identification of three distinct groups of bank branches, determined by comparing the distribution patterns observed in the PCA point cloud with the structure of the HAC dendrogram. The results of this classification are presented as follows:

Fig.3.Hierarchical Ascending Classification Application



Source: Results from SAS 9.4 software

From the dendrogram and PCA visualization, three distinct groups of branches can be identified:

1. First category (Blue circle)

This category includes 3 branches out of 81, representing approximately 4% of Société Générale Algeria’s retail network. These branches stand out as the top performers, characterized by high profitability and strong activity levels.

- Branch A64 emerges as the most profitable branch, with particularly high Net Banking Income (NBI) and Net Result (NR).

- This branch demonstrates strong engagement in both the corporate and retail markets, confirming its superior performance across all criteria.

2. Second category (Red circle)

This group accounts for 24% of the branches studied. Branches in this category are positioned on the positive side of Axis 1 and along Axis 2, indicating moderate profitability and performance levels. While these branches are performing well, they do not reach the exceptional standards of the first group.

3. Third category (Green circle)

The third group represents 72% of the total network. Branches in this group are highly homogeneous, with similar operational profiles. They are mainly concentrated in the center-right of the factorial plane and are characterized by lower profitability and performance compared to the other two categories.

5.3 Comparative Study of Internal (Traditional) Method and Data Analysis Method (ADD) Results

The following table presents a comparative state of internal method and ADD results:

Table. 2 : internal method and ADD results

	Internal Classification	ADD Classification
1st category branches	12	03
2nd category branches	21	19
3rd category branches	49	59
Total	81	81

Source: Results from SAS 9.4 software

According to the comparative table, the results obtained from internal

analysis and data analysis are broadly consistent, with notable differences observed in the first and third categories. Specifically, nine branches initially classified in the first category were downgraded.

These findings indicate that Société Générale Algeria (SGA) primarily classifies its branches based on profitability and market orientation (corporate versus retail activities). This outcome validates both the relevance of the selected variables and the robustness of the analytical methods employed in this study.

The classification provides branches with a clear view of their performance and operational dynamics. Branches in Category A are encouraged to maintain their high performance, while branches in lower categories can use this classification as a benchmark for improvement.

From a managerial perspective, SGA's strategy should involve:

Allocating additional resources to high-performing branches (Category A), including increased staffing, human resource support, digital tools, and logistical infrastructure, in order to sustain their growth trajectory.

Reinforcing the visibility of these branches, which are considered strategic assets given their large client portfolios.

Relocating or restructuring underperforming branches (Category C) where necessary, to optimize their operations and align them with overall bank performance objectives.

6. CONCLUSION

The study conducted and presented in this article demonstrates that performance is a key factor not only in the economic sector but also in the banking industry, where it plays a crucial role in driving competitiveness and sustainability.

Since the branch represents the fundamental operational unit of a bank, branch performance serves as a direct reflection of the bank's overall effectiveness and market positioning. Our analysis identified two key dimensions of performance:

✓ Profitability

✓ **Market orientation (corporate versus retail)**

Using these criteria, branches were classified into three categories:

- Category 1: 4% of all retail branches, representing top performers.
- Category 2: 24% of branches, demonstrating moderate performance.
- Category 3: 72% of branches, characterized by lower performance levels.

This classification confirms our research question: data analysis methods, particularly PCA and HAC, are effective tools for objectively classifying bank branches based on performance levels. To further enhance this research, we recommend:

Conducting a qualitative study to complement the quantitative findings by incorporating additional indicators such as customer satisfaction, service quality, and employee engagement.

Exploring alternative statistical methods for classification, as they may provide complementary insights and a more holistic view of bank branch performance.

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