

# Strategic Management to Model Profitability of the Primary Dairy Sector in Colombia

**Alejandra Berdugo, Gloria Ramírez and Carmen Patiño**

Department of Industrial Engineering

Universidad de Antioquia

Medellín, Antioquia, Colombia

[alejandra.berdugo@udea.edu.co](mailto:alejandra.berdugo@udea.edu.co), [glorial.ramirez@udea.edu.co](mailto:glorial.ramirez@udea.edu.co), [elena.patino@udea.edu.co](mailto:elena.patino@udea.edu.co)

**José Guarín**

Department of Agricultural Sciences

Universidad de Antioquia

Medellín, Antioquia, Colombia

[fernando.guarin@udea.edu.co](mailto:fernando.guarin@udea.edu.co)

## Abstract

In Colombia, the annual production of milk was 7,301 million liters in 2019. The dairy sector accounts for 1.6 percent of national GDP (gross domestic product) and 21.8 percent of agricultural GDP. However, the results for this sector have not been satisfactory as expected in the last decades as compared to the rest of Latin America. As we were able to identify, many problems have been reported in the primary productive sector such as: lack of policies to improve productivity, inefficiency in production, inadequate technical production processes, huge variability in production prices, competitive disadvantages generated by the massive inflow of imported goods, among others, which contributes greatly to the reductions on dairy farms profitability. The latter implies the need for research on decision-making tools that reduce uncertainty in the dairy industry. The use of technical indexes aimed to control in evaluate dairy farms in terms of productivity and profitability, which can be useful to monitor and track changes and requirements for the Colombian dairy industry. In Colombia, there are no studies addressed at the determinants of profitability of the dairy sector. This has motivated the current work to study profitability using predictive analytics, through an integrated approach considering costs, productivity, economic and technical indexes. This project proposes a management model that supports decision-making on dairy farms by calculating profitability and generating alerts based on the sensibility of selected input variables. The model focuses on the determination of the cause-effect relationships between the input and output variables (net annual income, profit margin, and return rates on the invested capital) to explain the determinant of profitability in the farm. First, we described the generalities of the primary link in the dairy sector in Colombia. Second, using a panel of experts we selected a set of variables related to feed, animals, human resources, fertilization, among others. We used principal component analysis (PCA) as a tool to reduce preselected inputs to those that explain better the variance and have the greatest impact on output variables. The results of this PCA worked as an initial model for multiple linear regression models as the primary methodology for establishing cause-effect relationships between input and output variables (a model for each output variable) that can explain the profitability of the production in the farm. We used R Studio to operate both methodologies. Our final goal is to calculate the profitability considering our output variables. Furthermore, generate alerts on input variables based on scenario analysis to support decision-making in dairy farms. Our work team had access to an experimental farm of the Center of Agricultural Practices and Development of the Universidad de Antioquia located in the municipality of San Pedro de los Milagros, Antioquia, where we used productive records of this farm, developing indexes and generating new determinants of profitability if these were not available. We propose to validate this model on farms in other regions in Colombia in order to verify the capacity to calculate profitability in real management situations in the Colombian dairy productive sector.

## Keywords

Competitiveness, dairy, productivity, profitability, model.

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## Biographies

**Alejandra Berdugo** is a Student of Master of Engineering at Universidad de Antioquia, Colombia. Alejandra holds a bachelor's degree in Industrial Engineering from Universidad del Atlántico, Colombia. She has three years of experience in logistics. Alejandra has published journal and conference papers in topics like optimization and simulation. Her research interests include profitability, optimization, model, and finances.

**Gloria Lucía Ramírez Córdoba** is a Professor of the Industrial Engineering Department at the Universidad de Antioquia in Colombia. She holds a Master and a Ph.D. in Accounting and Finance from the Universidad de Zaragoza, Spain. Her research interests are related to finance in supply chain management, economic indicators and circular economy.

**José Fernando Guarín Montoya**, Ph.D. in Dairy Science from the University of Wisconsin-Madison, MSci in Agronomy Universidade de São Paulo, and Animal Scientists from Universidad de Antioquia. Dairy Science professor at Universidad de Antioquia, Medellín, Colombia. Experience in Animal Sciences with an emphasis in milk quality, animal nutrition and reproduction. Main areas of expertise are Mastitis, Biotechnology of reproduction, Animal nutrition, and Agribusiness.

**Carmen Patiño R.** Received the B.S. Degree in Industrial engineering from the National university of Colombia. Subsequently she received her M.Sc. and Ph.D. From the Polytechnic School of University of Sao Paulo, Brazil. Since 2010 is associated professor at the University of Antioquia. Her area of interest belong to continuous improvement of productive systems by use of descriptive analytics tools. She has been leads projects related with the application of Industrial statistics in manufacturing and Oil & Gas industries and agroindustrial process.