

DATA CULTURE: A STATISTICS APPROACH IN ADMINISTRATIVE DECISION-MAKING

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In Colombia, public higher education institutions show an organizational structure that allows them, under the concept of university autonomy, to make serious decisions at various administrative levels. This paper presents the results of an administrative-level pilot that consisted of training a group of officials from a public higher education institution (Industrial University of Santander) in statistical measurement techniques and data modeling to determine if it is possible to observe changes in collective behavior in the use of data and decision-making after intensive statistical training. Results show that it is possible to observe positive collective behaviors in the use of data in decision-making, and uninformed decisions are presented, in their entirety, in the group of officials who did not receive statistical training.

INTRODUCTION

In public entities, a lot of decisions are made based on information stored in their systems. However, sometimes this information is kept without any processing or statistical analysis. On other occasions, statistical analysis is a fundamental part of decision-making at the board of directors' level.

In Colombia, the organizational structure of the Public Higher Education Institutions (PHEI) allows them, under the concept of university autonomy, to make serious decisions at various administrative levels.

This paper presents the result of an administrative-level pilot that consisted of training a group of officials from the Industrial University of Santander (UIS) in statistical measurement techniques and data modeling to determine if it is possible to observe changes in the collective behaviors in data use and decision making after intensive statistical training.

PROBLEM

At administrative levels of a non-directive nature within the PHEI, some decisions are made without statistical treatment of the data (when the use of data is pertinent), largely because there is no "data culture" that allows officials to become aware of the importance of information assurance and quality. Officials at UIS were informally asked if they were aware of who was responsible for the information they handled and if they kept it properly; the answer in all cases was negative, which allowed justifying, at the level of the board of directors, the need for a statistical training pilot.

Sadiq Rababh, Mohamed Omar, and Yassin Alzyoud, (2019) highlight the importance of the use of quantitative methods in decision-making at the administrative level and the role of mathematical, statistical, and programming techniques in the analysis of information. On the other hand, Urahn et al. (2018) expose some strategies for the proper use of data in decision-making. These elements served as a basis to guide the training process of the officials.

SAMPLE COMPOSITION

The organizational structure of UIS has several levels and each level has two types of officials: executive (management nature) and non-executive (operational nature). Thirty-one volunteers participated in the process. Of these volunteers, 68% of them decided to take the training voluntarily and 32% decided not to take the training, although they were followed up with while the other group received training. The overall sample was made up of 19% executive-level officials and 81% non-executive-level officials (Figure 1).

The distribution of the training-group samples is displayed in Figure 2. Even when participation in the training was voluntary, the intervention group was made up of 19.05% executive-level officials and 80.95% non-executive-level officials; the non-intervention group was made up equivalently: 20% executive-level officials and 80% non-executive-level officials.

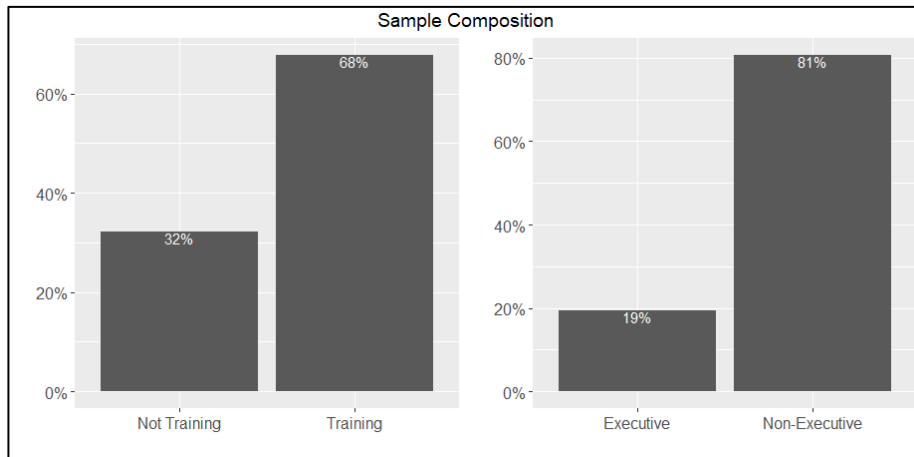


Figure 1. Sample composition

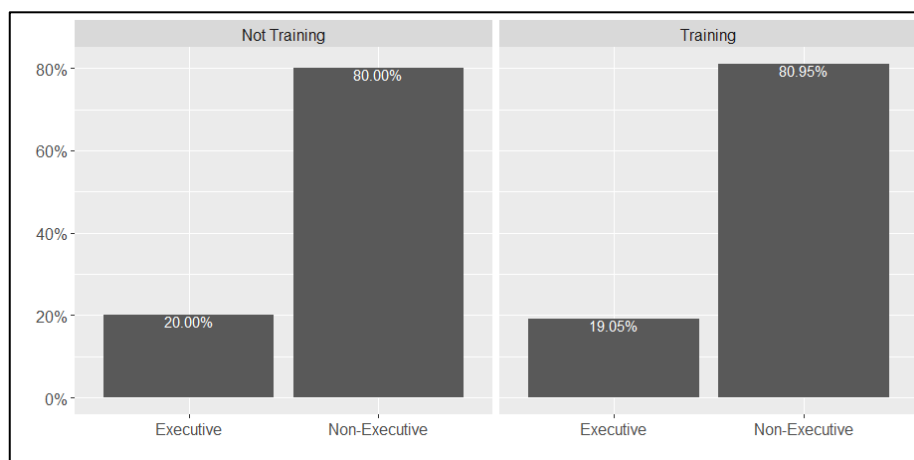


Figure 2. Sample distribution

TRAINING

The challenges posed by Urahn et al. (2018) guided the training process for officials: Staffing, Data Accessibility, Data Quality, and Data Sharing. Different teaching methodologies were implemented throughout the training, with particular attention paid to anticipated challenges: Project-Based Learning, Problem-Based Learning, Team-Based Learning, and Design Thinking. The specific topics selected for training were Information gathering, Data systemization, Data edition, Data modeling, Data visualization, Statistical measures, Programming language, Data storage, and Information assurance. The training lasted 20 hours.

METHODOLOGY

A quasi-experimental design was used for the study, defining the control group as those who did not participate in the training. An experiment could not be conducted because the allocation of the groups was determined by the will of the officials; random allocation was not possible.

Two stages were developed for the analysis of the results. In the first, open interviews were conducted through which, using textual mining, the categories for the subsequent quantitative analysis were identified. A survey was implemented to compare the groups (second stage) and their practices in relation to elements of the training.

To evaluate differences between training groups, a short survey was designed to establish whether there were differences in the collective behavior of officials in their use of data and decision-making. The survey was implemented 60 days after the training process to reduce the probability of induced responses.

Because the training sought to make officials aware of their collective behavior in the use of data and making informed decisions, in addition to the identification questions, three questions were raised with both training and control groups. The questions are displayed in Figure 3.

1. Do you normally clean your data?
 - Yes
 - No
2. How do you use statistics information?
 - Data Analysis
 - Decision Making
 - Evaluations
3. When you indicate that you use statistics for Data Analysis and/or Evaluation, do you make any type of subsequent decision?
 - Yes
 - No

Figure 3. Survey questions

RESULTS

Figure 4 shows the distribution of frequencies of responses for the control and intervention groups to the question: “Do you normally clean your data?” In the control group (no training), 60% of the officials stated that they clean their data, whereas in the training group, 95% stated that they clean their data. Seventy-five percent of the executive-level officials for the training group indicated that they usually clean their data whereas 100% of the non-executive-level officials in the training group indicated that they clean their data. The percentages of official from the training group who clean their data differs considerably with the percentages from the control group. In the control group, 60% of the officials said they clean their data whereas 95% of the officials in the training group said that they clean it.

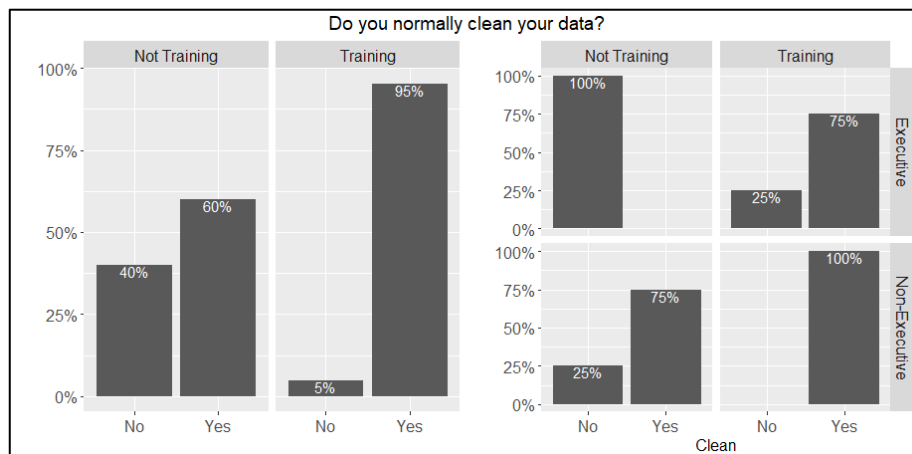


Figure 4. Frequency distribution of responses to the question: Do you normally clean your data?

Figure 5 shows the distribution of frequencies in the training and control groups in response to the question: “How do you use statistics information?” In the control group, 70% of the officials stated that they used statistics information (e.g., academic dropout rate, academic absorption rate) for data analysis; 20% used statistics in their decision-making; and 10% used statistics for evaluations. In the training group, 76.2% exclusively use statistical information in decision-making and 23.8% for data analysis.

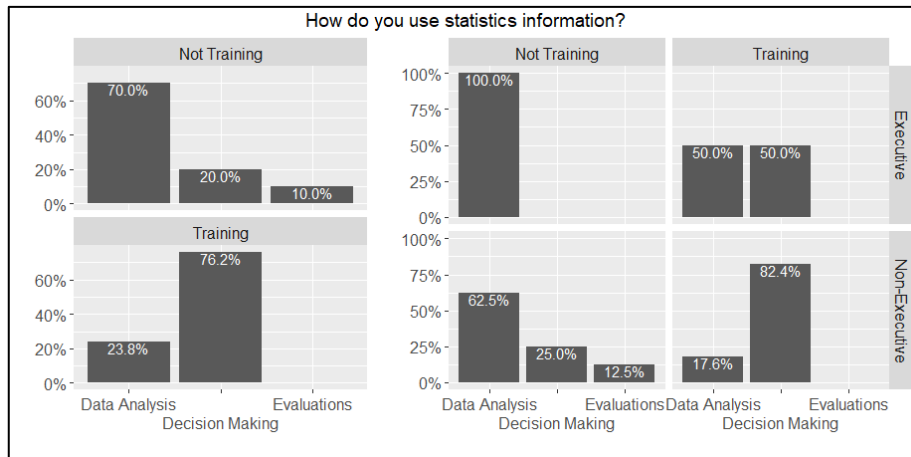


Figure 5. Frequency distribution of responses to the question: How do you use statistics information?

Executive-level officials who used statistical information for decision-making were in the training group and represented 50% of this group; the other 50% used statistical information for data analysis. All executive-level officials who were in the control group said that they used statistical information for data analysis. In the case of non-executive level officials, 82.4% of the training group stated that they use statistical information in decision-making, and the other 17.6% said they use statistical information for data analysis. For the non-executive officials in the control group, 25% stated that they use statistical information in decision-making, 12.5% in evaluations, and 62.5% for data analysis.

Regarding the options found in the use of statistical information, those who indicated using statistics for Data Analysis or Evaluations were asked if they made any subsequent decisions based on this use. In the training group, 100% indicated that they “make a decision” after using the statistical information in data analysis and/or evaluations. In the control group, 88% of the officials indicated the same answer. Officials who indicated not making decisions after what they consider data analysis and evaluations correspond to 14% of executive-level officials who did not receive training (Figure 6).

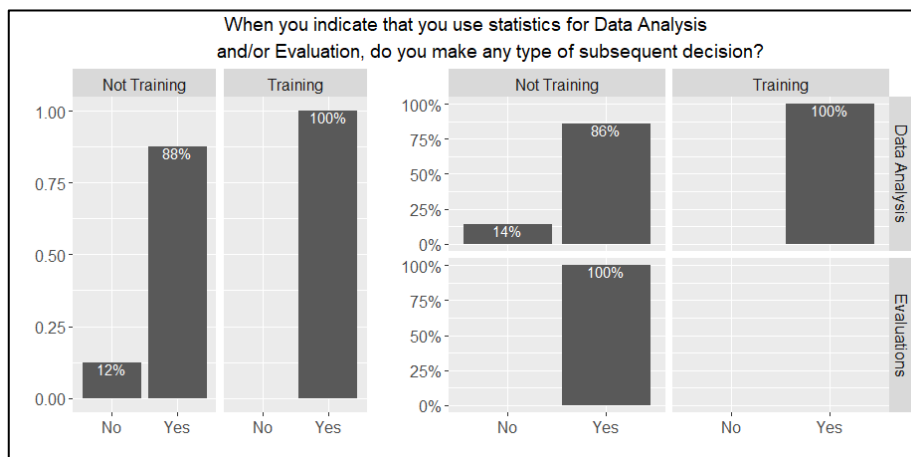


Figure 6. Frequency distribution of responses to the question: When you indicated that you use statistics for data analysis and/or evaluation, do you make any type of subsequent decision?

DISCUSSION

It is possible to observe positive collective behaviors in the use of data in decision-making. A low percentage of officials (3%) make decisions without the use of statistical information. However, if the answer selected by the officials in the corresponding question is considered, 58% make conscious use of statistics in their decision-making.

Uninformed decisions are presented, in their entirety, in the group of officials who did not receive statistical training and correspond to 10% of this group; however, this percentage corresponds to non-executive level officials, which suggests that it is in relation to operational and non-administrative decisions (Figure 7).

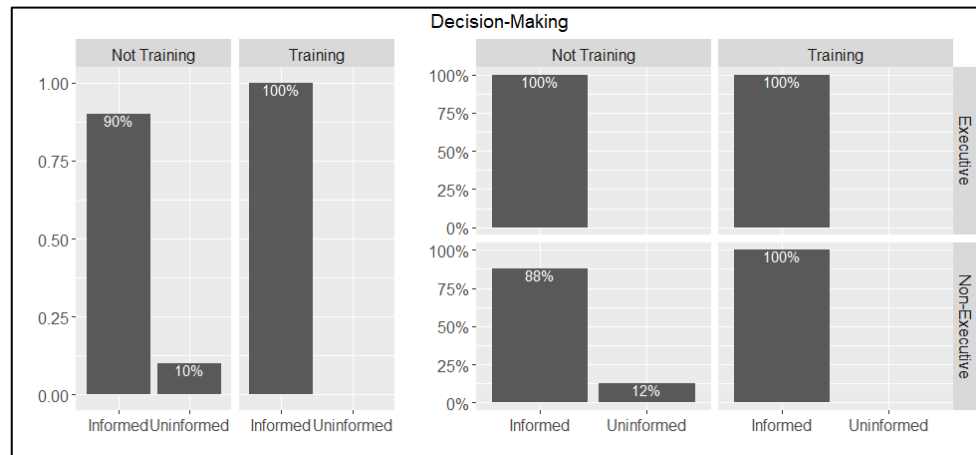


Figure 7. Frequency distribution about making informed decisions

The sample may be reflecting a bias due to a possible Hawthorne effect (McCambridge et al., 2014) and, although it is a pilot test, it is necessary to review the methodological adjustments for the selection of a larger sample and to reduce the possible influence of the knowledge of the participants who are being studied.

LIMITATIONS AND FUTURE ACTIONS

The sample, corresponding to a pilot test, is too small to present conclusive results. However, the development of the exercise is projected to conduct statistical training for all the administrative officials and the teaching staff commissioned in administrative functions. This implementation requires methodological adjustments such as the *ex ante* and *ex post* evaluation of the participants, as well as the construction of a more precise and complete measurement instrument that more efficiently evaluates the changes in the collective behavior of officials in the use of data and decision-making.

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