# ESG aproach: a Model Comparison to predict the Controller Strategic-impact Performance

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## 1 Introduction

The processes of generating ESG (environmental, social and governance) initiatives are challenging companies (Bloomberg, 2022).

In this way, Managers and investors ask for higher and faster management information, not only accounting information. Technology, new regulations (i.e., Sarbanes Oxley), unique business model's irruptions, and organizational complexity increase decision-making difficulty (Byrne and Pierce 2006). The controller must support these demands and understand the company's whole business, process, and departments. Only with this knowledge can cooperate with other managers and distribute essential information at every organization level.

This new approach to the controller's role has added substantial duties and tasks (Morales & Lambert 2013). See (Ahrens 1996, Burns & Baldvinsdottir 2005, Friedman & Lyne 1997, Mourtisen 1996, Herzog 1999, Northcott and Scapens 2007,) for reviews. These studies frequently define two separate functions for controllers: the bean-counter; a controller focused on accounting where numbers are an end in themselves, and the business controller or business advisor, where the role is focused on helping and advising other areas, give an opinion in front of different kind of operational decisions, participate in strategic decisions and measuring ESG (environmental, social and governance) company impact (Järvenpää 2007, Zoni & Merchgant 2007, Vaivio Kokko 2006, Semenova N. 2021, Serafeim G. 2021).

Even the controller's professional organizations (ICV-IGC 2007) tend to see this role change positively. This progression means that the controller role plays a more significant function in management control, and generates more predictive management accounting methods, complements budgetary and power process, designs, more convenient control systems for organization, creates closer cooperation between accountants and managers, permits a broader administrative control, and becomes a facilitator of strategic decision making (Byrne and Pierce, 2007).

Therefore, it is important to ask ourselves which machine learning model best allows us to predict the behavior of a "new generation" Controller, with a more strategic than accounting vision. Next, I present some prediction model options and their associated performance. Just for preliminary analysis.

## 2 Data

For the present analysis, a survey developed in Chile, between the years 2020 and 2021, to different companies was used. The sample size covered 151 companies. Through a process of descriptive analysis and cleaning of the data set, we ended up working with 72 Controllers, where 156 explanatory variables or regressors were created.

```
##      vars  n  mean   sd median trimmed   mad min max range  skew kurtosis   se
## V1      1 72 12.86 9.34   16.0   12.88 11.86   1  25    24 -0.16    -1.76 1.10
## V2      2 72  5.17 1.94    5.0    5.26  1.48   1   8     7 -0.31    -0.69 0.23
## V3      3 72  6.06 4.67    6.0    5.28  2.97   1  21    20  1.69     3.00 0.55
## V4      4 72  1.82 0.81    2.0    1.78  1.48   1   3     2  0.33    -1.42 0.10
## V5      5 72  5.28 1.27    5.0    5.36  1.48   2   7     5 -0.36    -0.66 0.15
## V6      6 72  5.44 1.40    6.0    5.60  1.48   2   7     5 -0.75    -0.13 0.17
## V7      7 72  1.00 0.00    1.0    1.00  0.00   1   1     0   NaN      NaN 0.00
## V8      8 72  6.21 0.98    6.0    6.38  1.48   3   7     4 -1.58     2.62 0.12
## V9      9 72  4.00 1.81    4.0    4.07  2.97   1   7     6 -0.21    -1.25 0.21
## V10    10 72  5.56 1.59    6.0    5.78  1.48   2   7     5 -0.85    -0.44 0.19
## V11    11 72  5.56 1.54    6.0    5.78  1.48   2   7     5 -0.96    -0.19 0.18
## V12    12 72  4.72 1.78    5.0    4.84  1.48   1   7     6 -0.40    -0.86 0.21
## V13    13 72  4.90 1.94    6.0    5.12  1.48   1   7     6 -0.78    -0.56 0.23
## V14    14 72  3.86 1.80    4.0    3.88  1.48   1   7     6 -0.05    -1.17 0.21
## V15    15 72  4.72 1.22    5.0    4.78  1.48   1   7     6 -0.51     0.26 0.14
## V16    16 72  2.88 1.56    2.0    2.78  1.48   1   6     5  0.47    -1.05 0.18
## V17    17 72  4.94 1.62    5.0    5.07  1.48   1   7     6 -0.54    -0.66 0.19
## V18    18 72  3.82 1.91    4.0    3.79  2.97   1   7     6  0.10    -1.27 0.22
## V19    19 72  3.31 1.62    3.0    3.24  1.48   1   7     6  0.24    -0.87 0.19
## V20    20 72  3.97 1.77    4.0    4.03  1.48   1   7     6 -0.17    -1.16 0.21
## V21    21 72  4.19 1.55    4.0    4.16  1.48   2   7     5  0.08    -1.11 0.18
## V22    22 72  3.42 2.13    3.0    3.28  2.97   1   7     6  0.41    -1.23 0.25
## V23    23 72  1.74 0.71    2.0    1.71  0.00   1   6     5  2.73    15.40 0.08
## V24    24 72  4.32 2.02    5.0    4.40  2.97   1   7     6 -0.24    -1.28 0.24
## V25    25 72  5.32 1.74    6.0    5.59  1.48   1   7     6 -1.10     0.35 0.21
## V26    26 72  4.32 1.81    4.5    4.40  2.22   1   7     6 -0.39    -0.79 0.21
## V27    27 72  4.42 1.68    5.0    4.50  1.48   1   7     6 -0.42    -0.64 0.20
## V28    28 72  5.21 1.91    6.0    5.50  1.48   1   7     6 -1.14     0.05 0.23
## V29    29 72  4.07 1.79    4.0    4.09  2.97   1   7     6 -0.02    -1.09 0.21
## V30    30 72  4.24 1.80    4.0    4.29  1.48   1   7     6 -0.12    -0.93 0.21
## V31    31 72  4.03 1.88    4.0    4.09  2.97   1   7     6 -0.28    -1.21 0.22
## V32    32 72  4.11 1.88    4.0    4.14  2.97   1   7     6 -0.17    -1.14 0.22
## V33    33 72  4.25 1.81    4.0    4.38  2.97   1   7     6 -0.40    -1.11 0.21
## V34    34 72  3.75 2.09    4.0    3.69  2.97   1   7     6  0.05    -1.39 0.25
## V35    35 72  2.08 1.07    2.0    1.98  1.48   1   4     3  0.51    -1.07 0.13
## V36    36 72  3.40 0.88    4.0    3.57  0.00   1   4     3 -1.34     0.81 0.10
## V37    37 72  5.56 1.43    6.0    5.78  1.48   1   7     6 -1.36     1.59 0.17
## V38    38 72  4.29 1.80    5.0    4.31  1.48   1   7     6 -0.18    -1.12 0.21
## V39    39 72  5.36 1.39    6.0    5.50  1.48   2   7     5 -0.78    -0.25 0.16
## V40    40 72  4.88 1.63    5.0    5.02  1.48   1   7     6 -0.65    -0.34 0.19
## V41    41 72  4.40 1.54    5.0    4.45  1.48   1   7     6 -0.29    -0.77 0.18
## V42    42 72  4.54 1.79    5.0    4.62  2.22   1   7     6 -0.22    -1.07 0.21
## V43    43 72  4.83 1.52    5.0    4.93  1.48   1   7     6 -0.53    -0.31 0.18
## V44    44 72  5.46 1.54    6.0    5.67  1.48   1   7     6 -1.10     0.26 0.18
## V45    45 72  4.64 1.72    5.0    4.74  1.48   1   7     6 -0.42    -0.65 0.20
## V46    46 72  5.15 1.70    5.5    5.36  0.74   1   7     6 -0.90    -0.13 0.20
## V47    47 72  4.82 1.71    5.0    4.98  1.48   1   7     6 -0.67    -0.44 0.20
## V48    48 72  3.99 2.03    4.5    3.98  2.22   1   7     6 -0.17    -1.31 0.24
## V49    49 72  4.53 1.81    5.0    4.66  1.48   1   7     6 -0.56    -0.95 0.21
## V50    50 72  5.10 1.83    6.0    5.33  1.48   1   7     6 -0.94    -0.38 0.22
## V51    51 72  6.03 1.23    6.0    6.24  1.48   1   7     6 -2.10     5.62 0.15
## V52    52 72  4.93 1.61    5.0    5.03  1.48   1   7     6 -0.43    -0.66 0.19
## V53    53 72  5.07 1.66    5.0    5.26  1.48   1   7     6 -0.87    -0.03 0.20
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## V54    54 72  4.28 1.85    4.0    4.34  1.48   1   7     6 -0.17    -0.97 0.22
## V55    55 72  5.12 1.28    5.0    5.21  1.48   1   7     6 -0.67     0.26 0.15
## V56    56 72  4.61 1.76    5.0    4.72  1.48   1   7     6 -0.35    -0.76 0.21
## V57    57 72  5.46 1.45    6.0    5.62  1.48   2   7     5 -0.71    -0.55 0.17
## V58    58 72  5.57 1.33    6.0    5.71  1.48   1   7     6 -0.89     0.41 0.16
## V59    59 72  4.74 1.58    5.0    4.83  1.48   1   7     6 -0.43    -0.21 0.19
## V60    60 72  5.78 1.39    6.0    5.98  1.48   1   7     6 -1.29     1.33 0.16
## V61    61 72  5.40 1.46    6.0    5.55  1.48   1   7     6 -0.71    -0.20 0.17
## V62    62 72  4.81 1.92    5.0    5.00  1.48   1   7     6 -0.66    -0.66 0.23
## V63    63 72  5.12 1.77    5.0    5.34  1.48   1   7     6 -0.73    -0.32 0.21
## V64    64 72  5.74 1.54    6.0    6.03  1.48   1   7     6 -1.46     1.52 0.18
## V65    65 72  5.60 2.69    6.0    5.66  2.97   1  10     9 -0.20    -1.03 0.32
## V66    66 72  3.88 1.88    4.0    3.88  2.22   1   7     6 -0.11    -1.15 0.22
## V67    67 72  4.96 1.81    6.0    5.17  1.48   1   7     6 -1.01    -0.22 0.21
## V68    68 72  3.99 1.83    4.0    4.03  1.48   1   7     6 -0.28    -1.10 0.22
## V69    69 72  3.97 1.81    4.0    4.00  1.48   1   7     6 -0.20    -1.01 0.21
## V70    70 72  4.06 1.74    4.0    4.07  1.48   1   7     6 -0.05    -0.83 0.20
## V71    71 72  3.74 1.85    4.0    3.69  2.97   1   7     6  0.11    -1.09 0.22
## V72    72 72  4.08 1.76    4.0    4.14  1.48   1   7     6 -0.23    -0.92 0.21
## V73    73 72  4.25 1.89    4.5    4.31  2.22   1   7     6 -0.23    -1.05 0.22
## V74    74 72  4.33 1.75    5.0    4.41  1.48   1   7     6 -0.40    -0.76 0.21
## V75    75 72  3.89 1.70    4.0    3.93  1.48   1   7     6 -0.13    -1.00 0.20
## V76    76 72  4.36 1.80    5.0    4.43  1.48   1   7     6 -0.34    -0.98 0.21
## V77    77 72  4.69 1.93    5.0    4.84  1.48   1   7     6 -0.59    -0.96 0.23
## V78    78 72  3.22 0.98    3.0    3.09  0.00   2   6     4  1.40     2.06 0.12
## V79    79 72  2.81 0.78    3.0    2.76  0.00   1   5     4  0.34     1.38 0.09
## V80    80 72  3.79 2.01    4.0    3.71  1.48   1   8     7  0.23    -0.89 0.24
## V81    81 72  5.75 1.51    6.0    6.05  1.48   1   7     6 -1.59     1.93 0.18
## V82    82 72  5.78 1.55    6.0    6.09  1.48   1   7     6 -1.47     1.54 0.18
## V83    83 72  5.78 1.64    6.0    6.10  1.48   1   7     6 -1.43     1.31 0.19
## V84    84 72  5.22 1.87    6.0    5.45  1.48   1   7     6 -0.85    -0.54 0.22
## V85    85 72  6.03 1.35    6.0    6.28  1.48   1   7     6 -2.07     4.67 0.16
## V86    86 72  5.78 1.58    6.0    6.12  1.48   1   7     6 -1.68     2.22 0.19
## V87    87 72  4.43 1.75    5.0    4.53  1.48   1   7     6 -0.52    -0.68 0.21
## V88    88 72  5.06 1.63    5.0    5.26  1.48   1   7     6 -0.92     0.33 0.19
## V89    89 72  4.99 1.66    5.0    5.19  1.48   1   7     6 -0.95     0.27 0.20
## V90    90 72  5.25 1.54    6.0    5.45  1.48   1   7     6 -0.97     0.60 0.18
## V91    91 72  4.60 1.80    5.0    4.74  1.48   1   7     6 -0.59    -0.58 0.21
## V92    92 72  5.19 1.51    5.0    5.36  1.48   1   7     6 -0.77     0.19 0.18
## V93    93 72  5.28 1.47    5.5    5.47  0.74   1   7     6 -0.98     0.72 0.17
## V94    94 72  5.28 1.47    6.0    5.43  1.48   1   7     6 -0.88     0.35 0.17
## V95    95 72  4.61 1.70    5.0    4.71  1.48   1   7     6 -0.51    -0.62 0.20
## V96    96 72  4.57 1.72    5.0    4.69  1.48   1   7     6 -0.63    -0.53 0.20
## V97    97 72  5.92 1.24    6.0    6.14  1.48   1   7     6 -1.85     3.99 0.15
## V98    98 72  5.58 1.55    6.0    5.86  1.48   1   7     6 -1.36     1.46 0.18
## V99    99 72  4.86 1.75    5.0    5.02  1.48   1   7     6 -0.59    -0.55 0.21
## V100  100 72  5.53 1.33    6.0    5.69  1.48   1   7     6 -1.12     1.16 0.16
## V101  101 72  5.67 1.42    6.0    5.91  1.48   1   7     6 -1.34     1.32 0.17
## V102  102 72  5.60 1.52    6.0    5.84  1.48   1   7     6 -1.34     1.12 0.18
## V103  103 72  4.11 1.85    4.0    4.14  2.97   1   7     6 -0.16    -1.10 0.22
## V104  104 72  2.72 1.58    2.0    2.53  1.48   1   7     6  0.77    -0.26 0.19
## V105  105 72  3.08 1.73    3.0    2.95  1.48   1   7     6  0.52    -0.83 0.20
## V106  106 72  3.65 1.85    3.5    3.60  2.22   1   7     6  0.18    -1.16 0.22
## V107  107 72  4.65 1.87    5.0    4.79  1.48   1   7     6 -0.54    -0.86 0.22
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## V108  108 72  2.96 1.80    2.5    2.78  2.22   1   7     6  0.62    -0.74 0.21
## V109  109 72  6.07 1.17    6.0    6.26  1.48   1   7     6 -2.34     7.44 0.14
## V110  110 72  5.50 1.30    6.0    5.66  1.48   1   7     6 -1.04     1.06 0.15
## V111  111 72  6.12 1.03    6.0    6.28  1.48   1   7     6 -1.98     6.54 0.12
## V112  112 72  6.07 1.20    6.0    6.29  1.48   1   7     6 -2.00     4.74 0.14
## V113  113 72  5.36 1.69    6.0    5.60  1.48   1   7     6 -1.10     0.14 0.20
## V114  114 72  4.90 1.77    5.0    5.09  1.48   1   7     6 -0.74    -0.37 0.21
## V115  115 72  5.33 1.37    6.0    5.50  1.48   1   7     6 -0.96     0.70 0.16
## V116  116 72  5.49 1.49    6.0    5.71  1.48   1   7     6 -1.10     0.51 0.18
## V117  117 72  4.93 1.70    5.0    5.09  1.48   1   7     6 -0.71    -0.42 0.20
## V118  118 72  4.71 1.83    5.0    4.86  1.48   1   7     6 -0.63    -0.63 0.22
## V119  119 72  4.90 1.65    5.0    5.05  1.48   1   7     6 -0.68    -0.30 0.19
## V120  120 72  4.79 1.81    5.0    4.97  1.48   1   7     6 -0.64    -0.52 0.21
## V121  121 72  4.99 1.62    5.0    5.14  1.48   1   7     6 -0.58    -0.41 0.19
## V122  122 72  5.89 1.49    6.0    6.19  1.48   1   7     6 -1.66     2.26 0.18
## V123  123 72  4.57 1.84    5.0    4.67  1.48   1   7     6 -0.28    -0.91 0.22
## V124  124 72  4.97 1.63    5.0    5.14  1.48   1   7     6 -0.75    -0.23 0.19
## V125  125 72  4.93 1.57    5.0    5.05  1.48   1   7     6 -0.62     0.03 0.18
## V126  126 72  5.11 1.43    5.0    5.21  1.48   1   7     6 -0.59    -0.29 0.17
## V127  127 72  5.92 1.41    6.0    6.17  1.48   1   7     6 -1.34     1.02 0.17
## V128  128 72  4.61 1.79    5.0    4.74  1.48   1   7     6 -0.42    -0.57 0.21
## V129  129 72  4.78 1.88    5.0    4.95  2.97   1   7     6 -0.44    -0.78 0.22
## V130  130 72  5.47 1.77    6.0    5.78  1.48   1   7     6 -1.19     0.45 0.21
## V131  131 72  4.62 1.80    5.0    4.74  1.48   1   7     6 -0.50    -0.83 0.21
## V132  132 72  4.71 1.75    5.0    4.83  1.48   1   7     6 -0.41    -0.73 0.21
## V133  133 72  4.94 1.69    5.0    5.09  1.48   1   7     6 -0.45    -0.64 0.20
## V134  134 72  5.44 1.63    6.0    5.69  1.48   1   7     6 -0.97     0.18 0.19
## V135  135 72  5.51 1.61    6.0    5.72  1.48   1   7     6 -0.95     0.03 0.19
## V136  136 72  6.11 1.38    7.0    6.41  0.00   1   7     6 -2.29     5.49 0.16
## V137  137 72  6.49 0.73    7.0    6.62  0.00   4   7     3 -1.44     1.86 0.09
## V138  138 72  6.10 1.27    7.0    6.33  0.00   1   7     6 -1.97     4.87 0.15
## V139  139 72  6.25 1.15    7.0    6.47  0.00   1   7     6 -1.87     4.42 0.14
## V140  140 72  6.56 0.99    7.0    6.81  0.00   2   7     5 -2.63     7.10 0.12
## V141  141 72  5.40 1.53    6.0    5.62  1.48   1   7     6 -1.06     0.92 0.18
## V142  142 72  5.24 1.59    5.0    5.41  1.48   1   7     6 -0.76     0.08 0.19
## V143  143 72  5.47 1.48    6.0    5.64  1.48   1   7     6 -0.65    -0.32 0.17
## V144  144 72  5.88 1.23    6.0    6.07  1.48   1   7     6 -1.37     2.24 0.15
## V145  145 72  6.43 1.11    7.0    6.67  0.00   1   7     6 -2.35     6.56 0.13
## V146  146 72  5.28 1.61    5.5    5.52  2.22   1   7     6 -1.05     0.70 0.19
## V147  147 72  5.92 1.17    6.0    6.07  1.48   1   7     6 -1.29     2.45 0.14
## V148  148 72  6.54 0.89    7.0    6.71  0.00   1   7     6 -3.65    18.74 0.10
## V149  149 72  5.86 1.20    6.0    6.03  1.48   1   7     6 -1.32     2.35 0.14
## V150  150 72  5.86 1.37    6.0    6.09  1.48   1   7     6 -1.52     2.49 0.16
## V151  151 72  5.89 1.22    6.0    6.07  1.48   1   7     6 -1.36     2.30 0.14
## V152  152 72  6.72 0.65    7.0    6.86  0.00   3   7     4 -3.22    13.10 0.08
## V153  153 72  6.65 0.70    7.0    6.79  0.00   3   7     4 -2.65     9.12 0.08
## V154  154 72  3.64 1.59    4.0    3.67  1.48   1   6     5 -0.09    -1.06 0.19
## V155  155 72  2.43 1.24    2.0    2.31  1.48   1   5     4  0.63    -0.67 0.15
## V156  156 72  3.22 0.88    3.0    3.21  1.48   1   5     4  0.06    -0.38 0.10
```

# 3 Model Development

Understanding that the process of developing ESG policies in the company is a strategic decision, we will try to understand, and therefore predict, the strategic behavior of the Controller. To do this, we will use the variable *V30 = Controller Function: Help/advice to align the control with the company's strategy* as an independent variable. This behavior of the Controller implies a more strategic vision of the role of control and monitoring.

## 3.1 Train and Test data

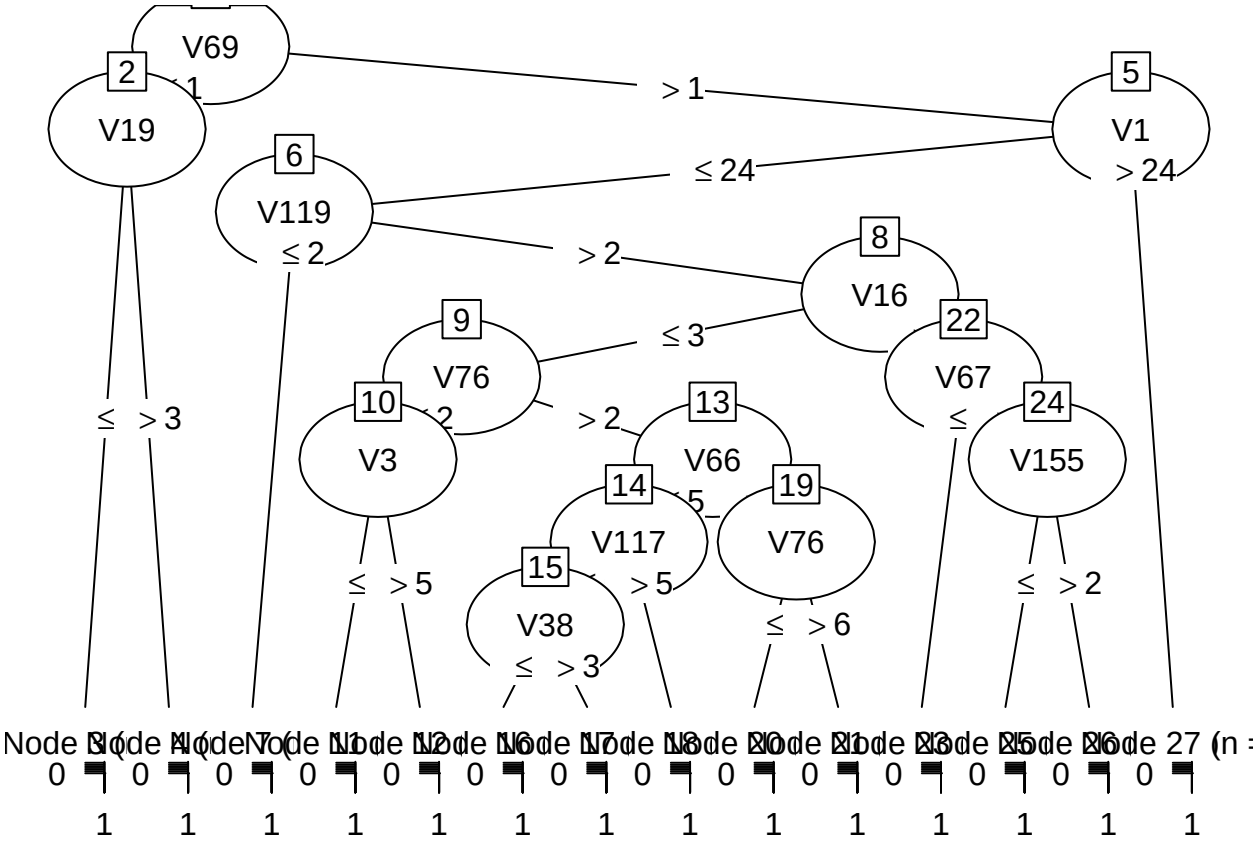
In this section we will only do an ETL process, to later be able to separate the data groups in training and in test.

# 4 Model Comparison

## 4.1 Tree Model

```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction 1 2 3 4 5 6 7
##          1 3 0 0 0 0 0 0
##          2 0 1 0 0 0 0 0
##          3 0 0 3 0 0 0 0
##          4 0 0 1 2 1 0 0
##          5 0 0 0 0 4 0 0
##          6 0 0 0 0 0 2 1
##          7 0 0 0 0 1 0 3
##
## Overall Statistics
##
##                Accuracy : 0.8182
##                  95% CI : (0.5972, 0.9481)
##     No Information Rate : 0.2727
##     P-Value [Acc > NIR] : 1.545e-07
##
##                   Kappa : 0.7843
##
##  Mcnemar's Test P-Value : NA
##
## Statistics by Class:
##
##                      Class: 1 Class: 2 Class: 3 Class: 4 Class: 5 Class: 6
## Sensitivity            1.0000  1.00000   0.7500  1.00000   0.6667  1.00000
## Specificity            1.0000  1.00000   1.0000  0.90000   1.0000  0.95000
## Pos Pred Value         1.0000  1.00000   1.0000  0.50000   1.0000  0.66667
## Neg Pred Value         1.0000  1.00000   0.9474  1.00000   0.8889  1.00000
## Prevalence             0.1364  0.04545   0.1818  0.09091   0.2727  0.09091
## Detection Rate         0.1364  0.04545   0.1364  0.09091   0.1818  0.09091
## Detection Prevalence   0.1364  0.04545   0.1364  0.18182   0.1818  0.13636
## Balanced Accuracy      1.0000  1.00000   0.8750  0.95000   0.8333  0.97500
```

```
##                      Class: 7
## Sensitivity            0.7500
## Specificity            0.9444
## Pos Pred Value         0.7500
## Neg Pred Value         0.9444
## Prevalence             0.1818
## Detection Rate         0.1364
## Detection Prevalence   0.1818
## Balanced Accuracy      0.8472
```




### 4.2 Random Forest Model

```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction 1 2 3 4 5 6 7
##          1 3 0 0 0 0 0 0
##          2 0 1 0 0 0 0 0
##          3 0 0 3 0 0 0 0
##          4 0 0 1 2 1 0 0
##          5 0 0 0 0 4 0 0
##          6 0 0 0 0 0 2 0
##          7 0 0 0 0 1 0 4
##
## Overall Statistics
```

```
##
##                Accuracy : 0.8636
##                  95% CI : (0.6509, 0.9709)
##     No Information Rate : 0.2727
##     P-Value [Acc > NIR] : 1.191e-08
##
##                   Kappa : 0.8374
##
##  Mcnemar's Test P-Value : NA
##
## Statistics by Class:
##
##                      Class: 1 Class: 2 Class: 3 Class: 4 Class: 5 Class: 6
## Sensitivity            1.0000  1.00000   0.7500  1.00000   0.6667  1.00000
## Specificity            1.0000  1.00000   1.0000  0.90000   1.0000  1.00000
## Pos Pred Value         1.0000  1.00000   1.0000  0.50000   1.0000  1.00000
## Neg Pred Value         1.0000  1.00000   0.9474  1.00000   0.8889  1.00000
## Prevalence             0.1364  0.04545   0.1818  0.09091   0.2727  0.09091
## Detection Rate         0.1364  0.04545   0.1364  0.09091   0.1818  0.09091
## Detection Prevalence   0.1364  0.04545   0.1364  0.18182   0.1818  0.09091
## Balanced Accuracy      1.0000  1.00000   0.8750  0.95000   0.8333  1.00000
##                      Class: 7
## Sensitivity            1.0000
## Specificity            0.9444
## Pos Pred Value         0.8000
## Neg Pred Value         1.0000
## Prevalence             0.1818
## Detection Rate         0.1818
## Detection Prevalence   0.2273
## Balanced Accuracy      0.9722
```

### 4.3 Naive Bayes Model

```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction 1 2 3 4 5 6 7
##          1 2 0 0 0 0 0 0
##          2 1 1 0 0 0 0 0
##          3 0 0 2 0 0 0 0
##          4 0 0 1 2 1 0 1
##          5 0 0 1 0 5 0 0
##          6 0 0 0 0 0 2 0
##          7 0 0 0 0 0 0 3
##
## Overall Statistics
##
##                Accuracy : 0.7727
##                  95% CI : (0.5463, 0.9218)
##     No Information Rate : 0.2727
##     P-Value [Acc > NIR] : 1.523e-06
##
##                   Kappa : 0.7291
```

```
##
##  Mcnemar's Test P-Value : NA
##
## Statistics by Class:
##
##                      Class: 1 Class: 2 Class: 3 Class: 4 Class: 5 Class: 6
## Sensitivity           0.66667  1.00000  0.50000  1.00000   0.8333  1.00000
## Specificity           1.00000  0.95238  1.00000  0.85000   0.9375  1.00000
## Pos Pred Value        1.00000  0.50000  1.00000  0.40000   0.8333  1.00000
## Neg Pred Value        0.95000  1.00000  0.90000  1.00000   0.9375  1.00000
## Prevalence            0.13636  0.04545  0.18182  0.09091   0.2727  0.09091
## Detection Rate        0.09091  0.04545  0.09091  0.09091   0.2273  0.09091
## Detection Prevalence  0.09091  0.09091  0.09091  0.22727   0.2727  0.09091
## Balanced Accuracy     0.83333  0.97619  0.75000  0.92500   0.8854  1.00000
##                      Class: 7
## Sensitivity            0.7500
## Specificity            1.0000
## Pos Pred Value         1.0000
## Neg Pred Value         0.9474
## Prevalence             0.1818
## Detection Rate         0.1364
## Detection Prevalence   0.1364
## Balanced Accuracy      0.8750
```

### 4.4 SVA Model

```
## Support Vector Machine object of class "ksvm"
##
## SV type: C-svc  (classification)
##  parameter : cost C = 1
##
## Gaussian Radial Basis kernel function.
##  Hyperparameter : sigma =  0.00114786804737896
##
## Number of Support Vectors : 50
##
## Objective Function Value : -6.0635 -8.9034 -6.8235 -6.0536 -7.9432 -4.7253 -6.3101 -5.5766 -5.0469 -5
## Training error : 0.3

## Confusion Matrix and Statistics
##
##           Reference
## Prediction 1 2 3 4 5 6 7
##          1 2 0 0 0 0 0 0
##          2 0 0 0 0 0 0 0
##          3 1 1 2 0 0 0 0
##          4 0 0 2 2 4 0 2
##          5 0 0 0 0 1 0 0
##          6 0 0 0 0 1 2 2
##          7 0 0 0 0 0 0 0
##
## Overall Statistics
##
```

```
##                Accuracy : 0.4091
##                  95% CI : (0.2071, 0.6365)
##     No Information Rate : 0.2727
##     P-Value [Acc > NIR] : 0.1178
##
##                   Kappa : 0.3286
##
##  Mcnemar's Test P-Value : NA
##
## Statistics by Class:
##
##                      Class: 1 Class: 2 Class: 3 Class: 4 Class: 5 Class: 6
## Sensitivity           0.66667  0.00000  0.50000  1.00000  0.16667  1.00000
## Specificity           1.00000  1.00000  0.88889  0.60000  1.00000  0.85000
## Pos Pred Value        1.00000      NaN  0.50000  0.20000  1.00000  0.40000
## Neg Pred Value        0.95000  0.95455  0.88889  1.00000  0.76190  1.00000
## Prevalence            0.13636  0.04545  0.18182  0.09091  0.27273  0.09091
## Detection Rate        0.09091  0.00000  0.09091  0.09091  0.04545  0.09091
## Detection Prevalence  0.09091  0.00000  0.18182  0.45455  0.04545  0.22727
## Balanced Accuracy     0.83333  0.50000  0.69444  0.80000  0.58333  0.92500
##                      Class: 7
## Sensitivity            0.0000
## Specificity            1.0000
## Pos Pred Value            NaN
## Neg Pred Value         0.8182
## Prevalence             0.1818
## Detection Rate         0.0000
## Detection Prevalence   0.0000
## Balanced Accuracy      0.5000
```

# 5 Conclution

Based on the evidence presented, we can affirm that for this specific case, there is evidence that the **Random Forest model** is the one with the best Accuracy. All those companies that want to predict the strategic behavior of the Controller, with a focus on the implementation of ESG policies and initiatives, should use the model mentioned above.