**SUPPLEMENTARY MATERIAL -** Artificial neural networks for the management of poultry industry: a simulation based on the broiler production chain

**Table S1 –** Descriptive analysis of the main numerical variables of the database bank.

| Variable | Minimum | Maximum | Mean ± standard deviation | Mean error | Total number of flocks |
|---|---|---|---|---|---|
| Age of breeder flocks (weeks) | 27 | 72 | 47.06 ±11.26 | 0.24 | 2,188 |
| Egg weight (g) | 67 | 69.60 | 67.96 ±0.5 | 0.01 | 2,189 |
| Egg storage period (h) | 0 | 312 | 113.29 ±38.82 | 0.83 | 2,191 |
| Cracked eggs (%) | 0 | 11.43 | 0.15 ±0.68 | 0.01 | 2,190 |
| Fertility (%) | 74.11 | 98.96 | 94.43 ±4.03 | 0.10 | 1,540 |
| Hatching eggs (%) | 19 | 20,160 | 4,224.4 ±4,276.8 | 91.39 | 2,190 |
| Incubation time (min) | 0 | 30,930 | 30,262 ±861.53 | 18.41 | 2,191 |
| Egg weight loss (g) | 11.2 | 14.10 | 12.95 ±0.59 | 0.01 | 2,190 |
| Total hatch (%) | 47.12 | 92.71 | 81.70 ±7.44 | 0.16 | 2,190 |
| Saleable eggs (%) | 46.67 | 92.45 | 81.16 ±7.53 | 0.16 | 2,190 |
| Total number of flocks in each hatch basket | 1 | 28 | 8.64 ±7.71 | 0.16 | 2,190 |
| Time at hatch basket (min) | 4,320 | 30,240 | 7,407.7 ±8,398.3 | 179.4 | 2,191 |
| Hatches contamination - *Aspergillus* spp. ($\log_{10}$ CFU/10cm$^2$) | 0 | 21 | 19.24 ±20.12 | 18.45 | 2,191 |
| Hatches contamination - *Escherichia coli* ($\log_{10}$ CFU/10cm$^2$) | 0 | 21 | 20.31 ±20.6 | 18.93 | 2,191 |
| Hatches contamination - *Pseudomonas* spp. ($\log_{10}$ CFU/10cm$^2$) | 0 | 21 | 19.84 ±20.4 | 18.73 | 2,191 |
| Chicks weight (g) | 6.32 | 50 | 45.81 ±3.45 | 0.07 | 2,189 |
| Use of chicks (%) | 94.48 | 100 | 99.33 ±0.47 | 0.01 | 2,191 |
| Broiler weight at the end of week 1 (g) | 128 | 246 | 176.5 ±19.41 | 0.43 | 2,026 |
| Broiler weight at the end of week 2 (g) | 313 | 558 | 441.7 ±51.01 | 1.14 | 2,008 |
| Broiler weight at the end of week 3 (g) | 588 | 1,081 | 856.7 ±105.2 | 2.36 | 1,991 |
| Broiler weight at the end of week 4 (g) | 1,052 | 1,772 | 1374.2 ±154.75 | 3.83 | 1,636 |
| Broiler weight at the end of week 5 (g) | 1,650 | 2,390 | 2123.4 ±116.09 | 4.07 | 815 |
| Mortality at the end of week 1 (%) | 0.22 | 4.69 | 0.96 ±0.57 | 0.01 | 2,002 |
| Mortality at the end of week 2 (%) | 0.38 | 5.38 | 1.50 ±0.75 | 0.02 | 1,955 |
| Mortality at the end of week 3 (%) | 0.38 | 6.41 | 2.08 ±0.93 | 0.02 | 1,848 |
| Mortality at the end of week 4 (%) | 0.95 | 7.31 | 2.78 ±1.11 | 0.03 | 1,474 |
| Mortality at the end of week 5 (%) | 1.87 | 7.87 | 3.55 ±1.25 | 0.04 | 788 |
| Partial condemnation (%) | 0.49 | 6.59 | 2.79 ±1.01 | 0.02 | 2,089 |
| Total condemnation (%) | 0.08 | 2.81 | 0.52 ±0.33 | 0.01 | 2,104 |

**Table S2 –** Relative importance (%) of each input variable in the generated models for each output variable.

| Input variable | | Output variable | | | |
|---|---|---|---|---|---|
| | | saleable hatching | weight at the end of the week 5 | partial condemnation | total condemnation |
| **Birds lineage** | Lineage A | 9.6 | 2.4 | 1.2 | 1.2 |
| | Lineage B | 4.1 | 5.8 | 1.8 | 1.3 |
| | Mixed flocks (A + B) | 2.0 | 0.9 | 0.1 | 0.2 |
| **Average age of breeder flocks** | - | 14.7 | 2.1 | 1.8 | 2.3 |
| **Egg type** | Clean nest egg | 10.7 | 9.0 | 0.6 | 1.6 |
| | Dirty nest egg | 11.8 | 1.3 | 0.9 | 2.8 |
| | Litter egg | 6.9 | 5.0 | 0.7 | 3.6 |
| **Egg weight** | - | 1.7 | - | - | - |
| **Egg storage period** | - | 3.1 | - | - | - |
| **Cracked eggs** | - | 0.1 | - | - | - |
| **Incubator equipment** | Incubator A | 13.5 | - | - | - |
| | Incubator B | 13.6 | - | - | - |
| **Incubation time** | - | 6.3 | - | - | - |
| **Total number of flocks in each hatch basket** | - | 1.0 | - | - | - |
| **Time at hatch basket** | - | 0.1 | - | - | - |
| **Hatches contamination (*Aspergillus* spp.)** | - | 0.1 | 0.6 | 0.1 | 0.3 |
| **Hatches contamination (*Escherichia coli*)** | - | 0.7 | 0.2 | 2.4 | 1.1 |
| **Hatches contamination (*Pseudomonas* spp.)** | - | 0.2 | 1.3 | 0.5 | 2.2 |
| **Chick weight** | - | - | 3.1 | 0.6 | 0 |
| **Type of chick** | breeder < 37 weeks old | - | 0.9 | 0 | 0 |
| | breeder 38 to 49 weeks old | - | 0.9 | 0.1 | 0.1 |
| | breeder >49 weeks old | - | 4.4 | 0.4 | 0.4 |
| **Flock sex** | Male | - | 7.5 | 8.8 | 0.6 |
| | Female | - | 9.3 | 7.0 | 1.0 |
| | Mixed flocks | - | - | 8.1 | 1.6 |

| | | | | | |
|---|---|---|---|---|---|
| **Broiler weight at the end of week 1** | - | - | 12.2 | 6.3 | 3.0 |
| **Broiler weight at the end of week 2** | - | - | 10.6 | 6.4 | 10.3 |
| **Broiler weight at the end of week 3** | - | - | 12.4 | 7.9 | 10.1 |
| **Broiler weight at the end of week 4** | - | - | 10.1 | 5.7 | 9.7 |
| **Broiler weight at the end of week 5** | - | - | - | 8.8 | 9.5 |
| **Mortality at the end of week 1** | - | - | - | 4.7 | 9.7 |
| **Mortality at the end of week 2** | - | - | - | 8.4 | 5.9 |
| **Mortality at the end of week 3** | - | - | - | 7.1 | 10.4 |
| **Mortality at the end of week 4** | - | - | - | 0.1 | 5.8 |
| **Mortality at the end of week 5** | - | - | - | 9.1 | 5.5 |

**Table S3** – Main simulated scenarios and their economic impact.

| Saleable hatching | | | |
|---|---|---|---|
| **Scenario** | Variables | Difference (%)[1] | Financial impact (R$) |
| **1*** | Lineage A x clean nest egg x Incubator A | 4,9 | 147.000,00 |
| **2** | Lineage A x clean nest egg x Incubator B | | |
| **5*** | Lineage B x clean nest egg x Incubator A | 1,91 | 57.300,00 |
| **6** | Lineage B x clean nest egg x Incubator B | | |
| **7*** | Lineage B x dirty nest egg x Incubator A | 20,45 | 613.500,00 |
| **8** | Lineage B x dirty nest egg x Incubator B | | |
| **9** | Egg storage period (average) – 113 h | 0,9 | 27.000,00 |
| **10*** | Egg storage period (reduced) – 74 h | | |
| | | | |
| **Broiler weight at the end of week 5** | | | |
| **Scenario** | Variables | Difference (g)[1] | Financial impact (R$) |
| **12*** | Lineage A x male flocks | 98 | 310.000,00 |
| **14** | Lineage B x male flocks | | |
| **16** | Broiler weight at the end of the week 1 (mean) x male flocks | 50 | 159.090,00 |
| **17*** | Broiler weight at the end of the week 1 (increased) x male flocks | | |
| | Broiler weight at the end of the week 3 (mean) x male flocks | -154 | -490.000,00 |
| **20*** | Broiler weight at the end of the week 3 (decreased) x male flocks | | |
| | Broiler weight at the end of the week 4 (mean) x male flocks | -195 | -620.454,00 |
| **21*** | Broiler weight at the end of the week 4 (decreased) x male flocks | | |
| | | | |
| **partial condemnation** | | | |
| **Scenario** | Variables | Difference (%)[1] | Financial impact (R$) |
| **23** | Lineage A or Lineage B x male flocks | 0,25 | -5.125,00 |
| **24*** | Lineage A or Lineage B x female flocks | | |
| **33** | Broiler weight at the end of the week 2 (mean) x male flocks | -0,7 | 14.480,00 |

| Scenario | Variables | Difference (%)[1] | Financial impact (R$) |
|---|---|---|---|
| 34* | Broiler weight at the end of the week 2 (increased) x male flocks | | |
| 36 | Broiler weight at the end of the week 3 (mean) x male flocks | -0,71 | 14.687,00 |
| 37* | Broiler weight at the end of the week 3 (increased) x male flocks | | |
| | Broiler weight at the end of the weeks 2 and 3 (mean) x male flocks | -1,11 | 22.755,00 |
| 39* | Broiler weight at the end of the week 2 and 3 (decreased) x male flocks | | |
| | | | |
| **total condemnation** | | | |
| **Scenario** | Variables | Difference (%)[1] | Financial impact (R$) |
| | Mortality at the end of weeks 1, 2, and 3 (average) x female flocks | -0,0795 | 8.347,00 |
| 48* | Mortality at the end of weeks 1, 2, and 3 (low) x female flocks | | |
| | Mortality at the end of weeks 1, 2, and 3 (average) x female flocks | 0,9405 | -98.752,50 |
| 50* | Mortality at the end of weeks 1, 2, and 3 (maximum) x female flocks | | |
| 51 | Broiler weight at the end of the week 2 (mean) x male flocks | -0,0636 | 6.677,60 |
| 52* | Broiler weight at the end of the week 2 (increased) x male flocks | | |

* Scenario associated with the estimated financial impact.

[1]Difference observed between the compared scenarios in relation to the values obtained for saleable hatching, chicken weight at the end of week 5, partial condemnation, or total condemnation.