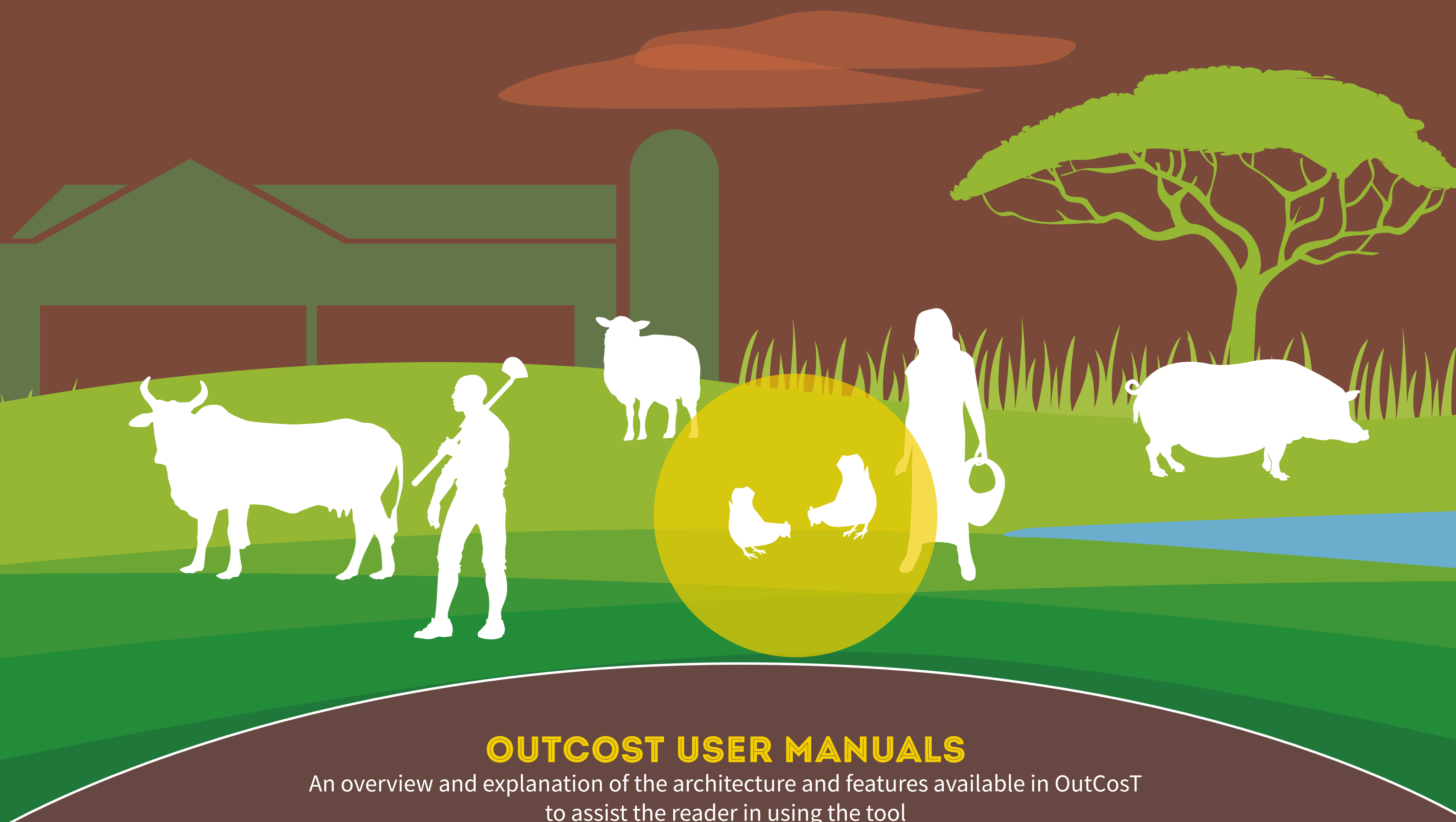
Food and Agriculture Organization of the United Nations

UAB Universitat Autònoma de Barcelona

OUTBreak COSting Tool for Poultry Diseases (OutCosT-Poultry) – Instructions for users

The cost of poultry diseases



OUTCOST USER MANUALS

An overview and explanation of the architecture and features available in OutCosT to assist the reader in using the tool

Contents

OUTbreak COSting Tool for Poultry Diseases (OutCosT-Poultry) – Instructions for users

A tool to calculate the cost of avian diseases in a territory.

Preface

Animal diseases affect not only animal productivity and welfare, but also human welfare and economy. Transboundary Animal Diseases (TADs) can have a significant economic impact at farm, regional and national levels. The costs of TADs are usually supported by government veterinary services, but there are also costs to industry and small producers. The economic impact of an epidemic varies considerably between regions and countries, depending on the disease, the number of affected premises when the disease is first diagnosed, the measures taken to control or eradicate the outbreak, and the structure of the poultry industry. Knowing the costs of disease outbreaks is essential to prioritize the allocation of resources, improve resource management and provide a basis for planning future interventions. It can also guide the evaluation of control strategies in terms of cost and impact and help to increase administrative transparency and public confidence.

This OutCosT version has been adapted to evaluate the cost of avian diseases. Nowadays, the more important TAD affecting poultry are avian influenza and Newcastle disease, but the tool can be used for any poultry diseases that affect a territory.

The objective of this manual is to help OutCosT users understand and use the tool to evaluate the direct costs of an epidemic (real or scenario) and the control measures applied in a country. OutCosT does not consider indirect costs related to global trade, long-term effects, or human health and welfare.

Introduction

The Outbreak COSting Tool (OutCosT) can be used to quantify the costs of a poultry disease and associated control measures in a real situation or a simulated scenario.

OutCosT estimates the losses caused by the disease and the costs associated with disease control, prevention, and treatment. The calculations are based on a deterministic model and the tool has been implemented on Excel spreadsheets. The model outputs calculate the costs of more than one hundred items:

- Direct costs of the disease (11 items).
- Costs due to detection, control, and eradication measures in the affected farms (28 items).
- Costs of the measures in farms at risk (neighbouring and contact farms) (28 items).
- Costs of prevention and surveillance activities in unaffected farms (general population) (14 items) and in wildlife (7 items) and/or vectors (3 items).
- Costs due to coordination and other centralized activities (9 items).
- Costs due to awareness and training campaigns (7 items).

Each item is calculated for the whole country, by type of farm and by stakeholder (veterinary services, farmers, and others).

The tool also has a section for the qualitative assessment of indirect and non-monetary costs, which provides a framework to assess the impact of the disease on human and animal welfare, the socio-political context, and the environment. For each item, the model provides the level of concern (i.e. low, moderate, high, and extreme) by combining the likelihood of occurrence and the importance of the consequences as indicated by the user, through a semi-quantitative scoring method.

OutCosT consists of the following spreadsheets:

- About: a short description of the tool and information about the other spreadsheets.
- Input: where the user enters data (model inputs) on the poultry population, the characteristics of the outbreak, the measures applied, and their costs.
- Breakdown of the costs: Detailed cost of the different items.
- Overall cost: a summary of the cost of the disease to the country.
- More costs: a summary of costs per farm.
- Qualitative evaluation: a framework for qualitative assessment of indirect and non-monetary costs.
- Two other sheets are for internal use only: Internal data for the calculation of some intermediate data used to calculate the results included in the previous sheets and Dic, a dictionary with different languages (and languages can easily be added by the users).

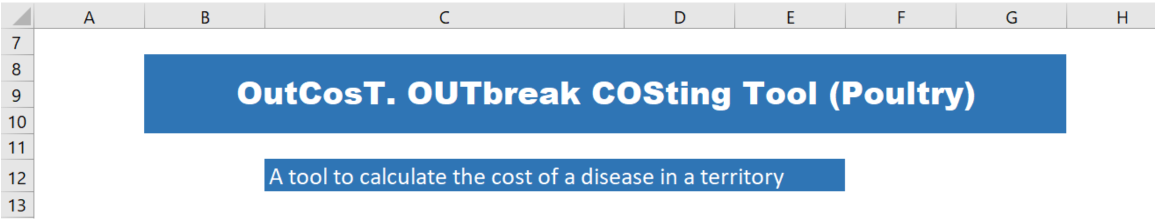
The aim of this user manual is to provide an overview of the architecture and features available in OutCosT and to assist the reader in using the tool through various sections. The manual is divided into two parts:

- Part I is a set of instructions for entering the model inputs in the highlighted cells of the "Input" spreadsheet.
- Part II focuses on the results provided by the model and the qualitative evaluation of the indirect and non-monetary costs of the disease.

Part I

About spreadsheet

Under this tab the user will find a brief description of the contents of each spreadsheet included in the Excel file. A schematic explanation of the structure of the deterministic model (i.e. activities and sub-activities considered) is also available here



Language option: Select the language from the drop-down list in cell C13.

Input spreadsheet

1. Inputs spreadsheet

This spreadsheet allows the input of data on the poultry population (i.e. census and types of farms), the disease, and the control measures implemented which are used by the model as parameters to calculate the costs of outbreaks.

In the spreadsheet, some data need to be entered manually, while others are calculated by the tool. **Only cells with a light background and numbers in bold should be filled in.** Cells with a dark background contain formulae and the values are automatically calculated by the tool. To prevent the formulae from being accidentally deleted, the spreadsheets are protected. **If required, the protection can be removed by using the "Review" tab in the Excel menu and selecting the "Unprotect Sheet" option.**

The "INPUT" spreadsheet presents five main blocks (with colour code) which contain different sections, as described below. All input parameters are numbered and described below.

1. General setting and data on poultry population and production (**light green**)

General data setting and information about the country, poultry population, production parameters (excluding diseases), poultry production costs and salaries.

2. **Data on Outbreaks and Control measures applied in affected farms (orange)**

2.1. Detection of Outbreaks

Time spent on outbreak detection, suspected, and confirmed outbreaks, number of clinical cases, production losses and costs due to the disease, costs of sampling and testing and extra work needed due to the presence of the disease.

2.2. *Control measures in affected farms and its cost*

Stamping-out (including culling and disposal of carcasses), insect control, cleaning and disinfection, treatments, extra work due to the application of treatments and/or other control activities, movement ban, period without birds and restocking, and travel time spend by veterinarians to visit farms.

3. Control measures applied in neighbouring and/or at-risk farms (grey)

Time spent visiting neighbouring or at-risk farms to check if they are positive and the control measures applied

4. Control measures and surveillance applied to (part of) the general population (light blue)

Vaccination in poultry, costs of vaccination (including time spent), side effects of vaccination, control measures and surveillance in poultry, wildlife and vectors (including time spent), prices of tests used for surveillance and time spent on coordination tasks.

5. Training, communication and other centralized activities (brown)

Coordination and bureaucratic tasks, checkpoints (movement control), border control (in addition to normal control measures), training and awareness materials and communication.

Module 1. General data (light green)

This block is dedicated to general information on the outbreak area, data on poultry population and production parameters in the absence of disease. Moreover, it covers the description of costs and prices in avian production (including salaries).

General setting

The first rows of the "Inputs" spreadsheet allow the user to enter general information about the setting of the outbreak.

Parameter (reflects text in the spreadsheet)	Description
1. Disease	The disease being studied.
2. Country/Region	The territory considered for the study, identified as the whole country or a specific region. All other inputs should apply to this study area.
3. Year	The tool will calculate the cost for a specific period (i.e. an outbreak lasting several months) or for a period of one year. The tool can also be applied to longer periods (i.e. epidemics lasting more than one year or endemic diseases), in which case, the user must create one OutCosT file per year and ensure the activities carried out each year are included. If prices have changed significantly; appropriate annual values should be used.
4. Classification of farms	One of the challenges of evaluating the cost of a disease in a region or country is the categorization of farms. The characteristics of poultry production vary greatly depending on the type of farms. The model allows up to **eight farm** types to be specified in the table. The types of farms can be defined by their species, census and/or production system (i.e. layers in production, rearing layers, broiler breeders rearing, turkeys, backyard…). These categories may also be defined according to country-specific definitions, the species affected, and the characteristics of the disease under study. Throughout the "Input" spreadsheet, data on poultry are collected separately in a column for each type of farm. If more than eight types of farms are identified, they should be reclassified into a maximum of eight types. Note that the data must be available in a disaggregated format that reflects these farm classifications.
5. Currency used for inputs	The tool allows the user to choose a currency for the input parameters. This should be the local currency in which the costs of the input parameters are incurred.
6. Other currency and exchange rate	A second currency to be used for the output parameters can be selected, if necessary. This should be specified in two cells; the first specifying the currency name and the second

	indicating the exchange rate against the currency used for the inputs specified above (item 5).
7. Currency for the outputs	A drop-down menu allows the selection of the currency to be used for visualizing outputs.

Population

The following information is collected for each type of farm.

Parameter (reflects text in spreadsheet)	Description
8. Number of farms	Total number of farms in the study area (of each type).
9. Number of birds	Total population in **thousands of birds** in the country/region under study.
The "Average birds per farm" is automatically calculated by the spreadsheet from the entered data.	

Production parameters and prices

This part includes some of the bird production parameters and prices necessary for the calculation of costs and benefits of bird production when the disease is not present.

Parameter (reflects text in spreadsheet)	Description
10. Age at start of placement (in days)	Normal age when birds enter the group.
11. Age at the end of placement (in days)	Normal age at which birds leave the group (to be sent to slaughter or moved to another farm).
12. Days empty between batches	Time (in days) that the facilities remain empty between batches.
13. Price of birds at entry	Normal price of birds (or eggs) when they enter the farm (expressed in the currency of inputs, item 5).
14. Price when birds are sold	Normal price of birds when they leave the farm (expressed in the currency of inputs, item 5).
15. Number of workers	Equivalent to full-time farm labour.
16. Select data to enter	To evaluate the cost of the disease, some basic information is needed. The user should choose between entering a) Cost and percentage of the benefits achieved, b) Cost and income, or c) Multiple production parameters. The last one is the least recommended option. Depending on the selection, only some of the next items to be filled in appear in bold.
17. Costs (whole live)	Cost of production for each bird during the whole batch period (to be filled in if you select b) in item 16).
18. Proportion of profit (regarding the cost)	Proportion that represents the profit relative to the cost (to be filled in if you select a) in 16).

19. Income (whole life)	Amount of income obtained for each bird during the whole batch period (to be filled in if you select a) or b) in item 16).
20. Mortality during the placement	Proportion of mortality due to causes other than the one investigated. Items 20 to 25 should be filled in if you select c) in item 16.
21. Mean egg production (per hen)	Average number of eggs produced by laying hens during their whole life.
22. Price of an egg or a one-day-old chick	Normal price of an egg produced by a laying hen, or price of a one-day-old chick obtained in hatcheries (expressed in the currency of inputs, item 5).
23. Concentrated feed consumed (kg/bird)	Average quantity of concentrates (in kilograms) consumed by a bird during its whole life.
24. Cost of concentrate feed (*currency*/kg)	Cost per kilogram of concentrates provided to poultry (expressed in the currency of inputs, item 5).
25. Other cost (energy, amortization of equipment...)	Cost of energy, water, gas, or other local utilities (all costs except birds, feed and labour) per bird during its whole life. In the case of broilers and eggs, usually expressed in kg produced: convert to cost per bird or per egg.
The "Total Benefit/bird" is automatically calculated by the spreadsheet from the entered data.	

Cost of salaries

Items 26–29 focus on salaries (including Social Security contributions, unemployment, and other taxes). Average hourly wages are specified along with the standard number of yearly working hours in the country. Up to five employee profiles can be provided.

Parameter (reflects text in spreadsheet)	**Description**
26. Veterinarians	Hourly rate for veterinary salaries (expressed in the currency of inputs, item 5). The monthly value is calculated automatically.
27. Farmers	Hourly rate for farmers employed on the farm (expressed in the currency of the inputs, item 5). Note that this is the category used to calculate the costs of labour for the total annual costs at farm level.
28. Other salaries (*currency*/ hour)	Up to three additional employee profiles with their respective hourly rates can be entered here (column J). By default, the model indicates an additional technical profile (i.e. Technician) and two other professional profiles (i.e. "Salary 4" and "Salary 5") which can be specified by the user (the profiles can be changed, and hourly rates are expressed in the currency of the inputs, item 5).
29. Hours worked per year	Number of hours worked per year. In the example, 1,920 hours were obtained by multiplying the number of working weeks per year (i.e. 48) by the number of working days per week (i.e. 5) by the number of working hours per day (i.e. 8). The user should

	amend the values in this formula (cell G33) or include directly the total number worked usually in the studied region/country.

Module 2. Data on outbreaks and control measures applied in affected farms (orange)

This thematic block collects information on the outbreak detection activities and other outbreak-related interventions, the characteristics of the epidemic and the control measures applied on the affected farms.

Detection of outbreaks

The first part, named "Outbreaks", focuses on the detection of the outbreaks, the impact of the disease on poultry production, and the diagnostic tests used. This information is provided for each type of farm identified in the first section (item 4). The total number of outbreaks detected is automatically calculated by the model, and it is shown in column L.

Parameter (reflects text in spreadsheet)	**Description**
30. Hours spent visiting a suspected case	Average number of hours spent by a veterinarian inspecting farms with a suspected outbreak. The model assumes that veterinarians spend the same amount of time regardless of the type or size of the farm.
31. Number of farms with suspected disease	Number of farms reported as possibly infected (i.e. active and passive surveillance), regardless of whether the test results are positive or negative.
32. Mean number of birds tested in suspected farms	Average number of birds tested on each suspected farm.
33. Number of confirmed outbreaks	Number of farms in each category reporting at least one positive test result.
34. Birds in all confirmed farms	Total number of birds in all farms where disease has been officially confirmed.
35. Diseased birds (including mortality)	Number of birds showing clinical signs, including those which died because of the disease, in farms where the disease has been officially confirmed. Note that birds culled to control/eradicate the disease are not included here.
36. Dead birds (total)	Number of birds which died because of the disease. Note that birds culled to control/eradicate the disease are not included here.

Production losses and cost of diseases

This section considers the production losses due to the infectious disease in the affected farms (i.e. eggs not produced, increased number of days to reach weight, etc.), and reduced production. In case of stamping-out, items 37 to 39 should be omitted.

Parameter (reflects text in spreadsheet)	**Description**
37. Eggs not produced (per affected layer)	Number of eggs not produced due to the disease (expressed in number of eggs per clinically affected layer).
38. Eggs not viable (per affected layer)	Number of non-viable eggs due to the disease (expressed in the average number of eggs per clinically affected layer).
39. Increase in days to achieve the weight (broilers)	Additional days needed for poultry to reach market weight (i.e. the reference weight at which a bird is slaughtered) due to the disease.
40. Increase of management (hours of extra work)	Average number of working hours spent by farmers on additional management activities on the farm due to the presence of diseased birds. Note that any additional time spent treating birds is described in item 89, and it should therefore not be included here.
41.Cost of one dead bird (*currency*)	By default, the value is the average between initial and final value of the bird, but since farms apply the all-in/all-out procedure and the age can be low or high, the value can be modified by the user (expressed in the currency of inputs, item 5).
42.Cost of an extra-day (*currency* per bird)	Additional days needed for fatteners to reach market weight (i.e. the reference weight at which a fattener is slaughtered) due to the disease.
43. Cost of other losses (bulk cost per farm in *currency*)	Average cost per farm of other aspects related to the disease and not specifically included.

Diagnostics

This section focuses on outbreak diagnosis and detection (i.e. sampling and laboratory diagnosis). Two different tests can be included in the model. The second of these diagnostic tests is assumed to be applied only on a certain percentage of the original samples.

Parameter (reflects text in spreadsheet)	**Description**
44. Transport of samples to the lab (per farm)	Average cost of sending the samples from a farm to the laboratory (expressed in the currency of the inputs, item 5).
45. Sampling (cost per sample)	Average cost of materials needed to sample a bird, e.g. vacutainers, needles, etc.

46. Pools (# of samples per Test 1)	Mean number of samples included in each analysed pool. If samples are not pooled, use mean number of samples analysed.
47. Cost of Test 1 (*currency* per sample)	Cost of each sample to be tested with Test 1 (in case of pools of samples, the cost of each sample should be considered).
48. Proportion of birds retested with Test 2	Proportion of birds tested with Test 1 that are retested with Test 2.
49. Pools (# of samples per Test 2)	Mean number of samples included in each analysed pool. If samples are not pooled, use mean number of samples analysed.
50. Cost of Test 2 (*currency* per sample)	Cost of each sample to be tested with Test 2 (in case of pools of samples, the cost of each sample should be considered).

Control measures applied in affected farms:

Items 51–97 are devoted to the description of the number of birds and farms of confirmed outbreaks where control measures are applied and the costs of these measures. The costs of the measures are also applied to the farms at risk (items 99–112).

Stamping-out

Parameter (reflects text in spreadsheet)	**Description**
51: Number of farms	Number of farms affected by the outbreaks (item 33) that are stamped-out.
52: Culled birds in these farms (total)	Number of culled birds in all farms with confirmed outbreaks. In case of hatcheries, use the number of incubating eggs.
53. Cost of compensation (per bird)	Amount of compensation paid for each bird that has been stamped out.
54. Cost of disposal (per farm)	Mean cost associated with disposing all carcass after culling.
55. Cost of destroyed eggs (*currency* per farm)	Value of eggs stored on the farm that cannot be commercialized and must be destroyed.
56. Cost of destroyed feed/goods (*currency* per farm)	Cost associated with the disposal of feed or products.
57. Hours spent by vet/s on culling and carcass disposal	Average number of hours spent by veterinarians on culling and carcass disposal on a farm.

58. Hours spent by farmer/s on culling and carcass disposal	Average number of hours spent on culling and carcass disposal on the farm. The salary profile is selected at the end of the row (see item 61 below).
Parameter (reflects text in spreadsheet)	**Description**
59 and 60. Hours spent by others on culling and carcass disposal	If other professional profiles are involved in culling and carcass disposal, users should specify the average number of hours spent. The professional profiles are selected to the right of the row, see item 61.
61. Salary type (right side of the table)	At the end of the row for items 58- 60: Select an employee profile (from those defined in items 26–28) involved in the task (use the drop-down menu to select the profile).
62. Days that the farms remain empty	Average number of days that farms remain empty after depopulation.
63. Months of salary not paid (unemployment):	Number of months during which no salary is paid while the farm is being depopulated.. The salary profile is selected at the end of the row (item 61).
64. Fuel and other goods saved during depopulation (*currency*):	Average amount of money saved in each farm as a result of fuel, or other goods not being consumed/used when there are no birds on the farm.

Disinfection and insect control (on stamped-out farms)

Parameter (reflects text in spreadsheet)	Description
65: Cleaning/disinfection (Y/N)	Either “Y” (Yes) or “N” (No) is selected depending on whether the facilities are cleaned and disinfected. If “N” is selected, items 66–69 are not filled in.
66. Detergents/ disinfectants (*currency* per farm):	Average cost of products (detergents and disinfectants) used for cleaning and disinfection on one farm. Only to be filled in if “Y” is selected for item 65 and/or item 117.
67. Hours spent by vet/s	Average number of hours spent on cleaning and disinfection by veterinarians. The salary profile is selected at the end of the row. Only to be filled in if “Y” is selected for item 65 and/or item 117.
68. Hours spent by the farmer	Average number of hours spent on cleaning and disinfection by farmers.
69. Hours spent by others	If other professional profiles are involved in cleaning and disinfection, users should indicate the average number of hours spent and the salary profile at the end of the row (item 61).
70: Insect control (Y/N)	Select either “Y” (Yes) or “N” (No) depending on whether insect control is used. If “N” is selected, items 71–72 are not filled in.
71. Cost of insecticides (*currency* per farm)	Cost of insecticides used on one farm. Only filled in if “Y” is selected for item 70 and/or item 118.
72. Hours spent on insect control activities	Average number of hours spent by farmer/s or others on insect control activities. Only to be filled in if “Y” is selected for item 70 and/or item 118.

Immobilization/Quarantine

Parameter (reflects text in spreadsheet)	Description
73: Duration (average in days)	Average duration of the movement restrictions (in days). As the length of this period may vary as the epidemic progresses, the average number of days the measure is in place should be indicated. This value also applies the time during which stamped-out farms remain empty.
74. Can birds be sent to the slaughterhouse?	If birds can be sent to the slaughterhouse during the lockdown period, select "Yes" from the drop-down menu, otherwise select "No".
75. Proportion of the slaughter price paid by the slaughterhouse /veterinary services	If "Yes" is selected in item 74 (birds can be sent to the slaughterhouse), indicate the proportion of the normal market price paid by the slaughterhouse to farmers. If "No" is selected (birds remain on the farm or are culled), indicate the proportion of the market price paid as compensation by the veterinary services.
76. Number of farms	Number of farms with movement restrictions.
77. Birds on these farms	Total number of birds on farms with movement restrictions.
78. Lockdown time after which birds are sacrificed	Time (in days) after which birds should be culled due to welfare concerns, e.g. lack of food and overstocking.
79. Immobilization of eggs. Can they be marketed?	The user can select through a drop-down menu if eggs present on the farm when it is immobilized can be marketed. The three options are "Yes", "For industry only" and "No".
80. Proportion of egg price paid by the industry	If in the previous question the answer is "Yes" or "For industry only", enter the percentage of the normal price paid by the industry.
81. Proportion of egg price paid by veterinary services	If in the question 79 the answer is "No" or "For industry only", enter the percentage of the normal price paid by the veterinary services as compensation.
82. Eggs on these farms (total)	Total number of eggs stored on farms with movement restrictions.

Sentinels

After culling and disinfection (and before restocking), authorities may decide to introduce only a few birds to a farm to check that it has been properly decontaminated.

83. Time visiting each farm (hours)	Time spent visiting each farm (in hours).
84. Average number of farms visited per trip	Number of farms visited in a single trip.

61. Salary type	At the end of the row for items 83 and 84: Select an employee profile (from those defined in items 26–28) responsible for this additional work.
85. Number of tested birds per farm	Average number of sentinel birds introduced to each farm and tested for negative results.
86. Duration of the process (average in days)	Average number of days the sentinel birds are maintained and monitored on the farm.

Treatments

If a treatment is applied before culling or if birds are not culled, the user can specify up to two treatments (e.g. two different drugs).

87: Treatment: farms treated	Number of farms applying Treatment 1 or Treatment 2.
88. Cost of treatment (1 or 2)	Cost of the treatment per farm.
89. Treatment 1 or 2: (hours of extra work per farm)	Additional working hours required on the farm to treat birds for disease using these treatments.
61. Salary type:	At the end of the row for items 108 and 111: Select an employee profile (from those defined in items 26–28) responsible for these treatments (use the drop-down menu).

Other control measures

90. Other control measures (Yes/No)	Select either “Y” (Yes) or “N” (No) depending on whether additional control measures are used.
91.Other control measures (cost in *currency* per farm)	Only filled in if “Yes” is selected in the previous item. Total cost of additional control measures per farm.
92.Other control measures (hours spend by vet)	Only filled in if “Yes” is selected in item 90. Average number of hours spent by the veterinarian(s) to implement additional control measures.

Travel costs

This section provides information on the cost of veterinarians’ travel to and from farms. The cost of these trips may vary depending on a number of factors. The model allows up to three different types of trips to be identified (items 94–96). These trips are defined by distance, travel time and the proportion of journeys they represent.

Parameter (reflects text in spreadsheet)	**Description**

93. Distance (km)	Round trip distance (in kilometres) of each type of trip.
94. Time	Round trip time (in hours) of each type of trip.
95. Proportion	Proportion (in percent) of trips with each time and distance combination (e.g. trip type profile).
96. Mean values per trip	Average distance and time travelled are calculated automatically by the tool. The background of the cell turns red if the sum of the proportions given does not equal 100%.
97. Cost per km	Travel costs per kilometre, including fuel, depreciation, and maintenance of the vehicle.

As an example: the user defines two types of travel: 90% of visits are located near the offices (an average of 15 km away) and they need 30 minutes to go. The other 10% are farms located 60 km away and one hour of travel. The values in the first row should be: 30 km in column D, 1 hour in column E (both values include round trip) and the proportion of 0.9 in column F. In the second row, values should be 120 km, 2 hours and 0.1 respectively (and the third row should remain empty).

Module 3. Control measures in at-risk farms (grey)

For some diseases, measures may be applied to unaffected farms at high risk of infection, e.g. neighbouring farms, or farms within a certain distance from an outbreak, or farms with epidemiological links to outbreaks.

Items 98–118 collect information on at-risk farms that have been investigated and control measures that have been applied (i.e. investigation and testing, preventive culling, or movement controls). The time spent visiting neighbouring and/or at-risk farms (i.e. clinical inspection, investigation, and testing) is also considered in this section. However, other input parameters for costs and time are assumed to be the same as for the outbreaks, which were defined in the previous section (e.g. travel costs, costs of sampling/testing, or the time spent on certain activities).

Note that those at-risk farms that turn out to be actual outbreaks should be counted as confirmed outbreaks in the previous section "Outbreaks and control measures in affected farms" and should be excluded from this section.

Time invested by the veterinarian

Parameter (reflects text in spreadsheet)	Description
98. Hours visiting each neighbouring or at-risk farm	Number of hours spent visiting an at-risk neighbouring or contact farm. This should be an average considering visits to different types of farms. If more than one person is involved, this should be the total number of hours spent by all personnel.
99. Average number of farms visited per trip	Average number of at-risk farms visited per trip.

60. Salary type	For item 98, in column G: Select an employee profile (from those defined in items 26–28) responsible for visiting at-risk farms using the drop-down menu.

Farms investigated

Parameter (reflects text in spreadsheet)	Description
101. Number of farms	Number of at-risk farms investigated.
102. Birds TESTED in these farms (average)	Average number of birds tested for disease in each farm investigated. Include laboratory tests only. Clinical inspection costs are included in item 98.

Stamping-out and disinfection

Parameter (reflects text in spreadsheet)	Description
102. Number of farms	Number of farms using preventive culling.
103. Total number of birds in these farms (culled)	Total number of birds culled in all farms.
104. Vaccination prior to stamping-out	If birds were vaccinated prior to culling, this is indicated by selecting the appropriate option from the drop-down menu.
105. Days between vaccine & sacrifice	This item only appears if the birds are vaccinated before culling ("Yes" in item 105). In this case, the mean time between the two actions should be given. Data about vaccination cost should be entered in rows 127–130.

Immobilization/Quarantine

Parameter (reflects text in spreadsheet)	Description
106. Duration (average in days)	Average duration (in days) of movement restrictions applied to farms at risk. The model applies the average duration of lockdown after which birds are slaughtered for welfare reasons as indicated in the section on control measures in the affected farm (item 78).
107. Can birds be sent to the slaughterhouse? (Y/N)	If birds can be sent to the slaughterhouse during the lockdown period, select "Yes" from the drop-down menu, otherwise select "No".
108. Proportion of slaughter price paid by the slaughterhouse/veterinary services	If "Yes" is selected in item 107, indicate the proportion of the normal market price paid by the slaughterhouse. If "No" is selected, indicate the proportion of the market price paid as compensation by the veterinary services.

109. Number of farms	Number of farms subject to movement controls or quarantine. If farms are restricted for a short period of time (i.e. less than or equal to five days), they should not be included.
110. Birds on these farms (total)	Total number of birds subject to movement restrictions in the at-risk farms.
111. Immobilization of eggs. Can they be marketed?	The user can select through a drop-down menu if eggs present on the farm when it is immobilized can be marketed. The three options are “Yes”, “For industry only” and “No”.
112. Proportion of the egg price paid by the industry	If in the previous question the answer is “Yes” or “For industry only”, enter the percentage of the normal price paid by the industry.
113. Proportion of the egg price paid by veterinary services	Proportion of the price paid by veterinary services as compensation (if eggs can be used for industry only or must be destroyed).
114. Eggs on these farms (total)	Total number of eggs on at-risk farms with movement restrictions.

Tests before lifting measures

Increased surveillance may occur when authorities decide to test farms before lifting movement restrictions. The protocols and prices of tests are assumed to be the same as those used for the diagnostic of the outbreaks.

Parameter (reflects text in spreadsheet)	**Description**
115. Number of farms	Number of farms tested before quarantine or movement controls were lifted.
116. Number of birds tested (total)	Total number of birds tested before quarantine or movement controls were lifted in the study area, for each type of farm.

Disinfection and vector control

Cleaning, disinfection and insect control procedures are the same as those applied on the outbreak farms. The following items collect information about measures that are applied on at-risk farms that are stamped-out.

Parameter (reflects text in spreadsheet)	**Description**
117. Cleaning/disinfection (Y/N)	For each type of farm, indicate whether cleaning and disinfection is carried out by selecting “Yes” (Y) or “No” (N).
118. Insect control (Y/N)	For each type of farm, indicate whether vector control is carried out by selecting “Yes” (Y) or “No” (N).

Module 4. Measures applied to (part of) the general population (light blue)

If measures are applied beyond the affected or at-risk/neighbouring farms, either in the whole population or only in a sub-section (e.g. a buffer zone, specific production systems or region), the information can be recorded in this part of the spreadsheet.

Vaccination

Parameter (reflects text in spreadsheet)	Description
119: Vaccination	Data on the vaccinated population by type of farm can be reported as absolute numbers or percentages by selecting the appropriate option from the drop-down menu.
120: Vaccination: Number of farms	*Only to be filled in if "Number" is selected for item 119.* Number of farms in which vaccination is carried out.
121: Vaccination: Total number of birds	*Only to be filled in if "Number" is selected for item 119.* Total number of birds vaccinated in the study area for each type of farm.
122: Vaccination (% farms)	*Only to be filled in if "Percentage" is selected for item 119.* Percentage of farms vaccinated.
123: Vaccination (% all birds)	*Only to be filled in if "Percentage" is selected for item 119.* Percentage of the bird population vaccinated in each type of farm.

Vaccine application

Parameter (reflects text in spreadsheet)	Description
124. Hours spent by vet/s	Average additional time (in hours) spent on the farm due to vaccination activities. The salary profile used is given in item 61.
125. Average number of farms visited per trip	Average number of farms visited and vaccinated during each trip.
126. Hours spent by farmer/s	Average additional time (in hours) spent by farmers on vaccination related activities.
61. Salary type	At the end of the row for item 124: Select an employee profile (from those defined in items 26–28) responsible for the vaccination using the drop-down menu.

Cost of vaccination

Parameter (reflects text in spreadsheet)	Description
127. Vaccination costing	Vaccination costs can be indicated as either "Fixed cost per dose" (i.e. the country pays a fixed amount to administer each

	dose of a vaccine) or "Cost per visit" (i.e. it pays according to the real cost) by selecting the appropriate option from the drop-down menu.
128. Cost of 1 dose of vaccine (*currency*)	Price paid for a vaccine dose, *only to be filled in if "Cost per visit" was selected in the previous item*.
129. Application of 1 dose of vaccine (*currency*)	*Complete only if "Fixed cost per dose" is selected.* The fixed price paid for the delivery of each vaccine dose, which should include all costs except the vaccine.
130. Mortality	Probability of poultry mortality as a side effect of vaccination (proportion of deaths resulting from vaccination).

Movement ban

Items 131–136 provide information on movement restrictions that can be applied on farms (beyond the farms at risk) at a county, regional or national level. The model allows the consideration of two different movement restrictions, which can be applied as complementary or alternative strategies.

Parameter (reflects text in spreadsheet)	**Description**
131. Duration (average in days)	Duration (in days) of the movement ban. As the length of this period may vary during the epidemic, the average number of days the measure is in place should be given. The model will use the average length of lockdown after which birds are slaughtered for welfare reasons, as indicated in the section on control measures in the outbreaks (item 78).
132. Can birds be sent to the slaughterhouse?	If birds can be sent to the slaughterhouse during the lockdown period, select "Yes" from the drop-down menu, otherwise select "No".
133. Proportion of the slaughter price paid by the slaughterhouse/veterinary services	If "Yes" is selected in item 74, indicate the proportion of the normal market price paid by the slaughterhouse. If "No" is selected, indicate the proportion of the market price paid as compensation by the veterinary services.
134. Number of farms	Number of farms subject to a movement ban.
135. Birds in these farms (total)	Total number of birds subject to the movement ban.
136. Other posterior or complementary measures	It is possible to indicate whether other movement restriction strategies are applied by using the drop-drown menu. These measures can be complementary (applied in the same farms after the previous measures, usually with less strict measures) or alternative (applied in other zones).

Other control measures

Additional measures to control the disease not previously considered are included in this section (e.g. use of parasiticides or repellents).

Parameter (reflects text in spreadsheet)	Description
137. Select either number of birds or percentage	Information on the number of farms involved in other control measures can be given either as number or as a percentage, which is selected from the drop-down menu.
138. Measure 1 (total number of birds)	*To be filled in if "Number" is selected for item 137.* The total number of birds subject to control Measure 1.
139. Measure 1 (% birds)	*To be filled in if "Percentage" is selected for item 137.* The percentage of birds subject to control Measure 1.
140. Cost of Measure 1 (currency/per bird)	The average cost of Measure 1 for each bird.
141. Measure 2 (number of farms)	*To be filled in if "Number" is selected for item 137.* The number of farms subject to control Measure 2.
142. Measure 2 (% farms)	*To be filled in if "Percentage" is selected for item 137*. The percentage of farms subject to control Measure 2.
143. Cost of Measure 2 (currency/farm)	Average cost of Measure 2 for each farm.

Active surveillance

This section contains information on active surveillance. The model allows for the inclusion of two different active surveillance strategies. Please note that passive surveillance is not included in this section because suspected farms and their investigation have already been considered in the outbreak session (item 30).

Parameter (reflects text in spreadsheet)	Description
144. Farms tested (Strategy 1)	Number of farms investigated in active surveillance Strategy 1.
145. Birds tested per farm (Strategy 1)	Average number of birds sampled in active surveillance Strategy 1.
146. Cost of Test 1 (per bird in *currency*)	Cost of a test used in active surveillance Strategy 1.
147. Farms tested (Strategy 2)	Number of farms investigated in active surveillance Strategy 2.
148. Birds tested per farm (Strategy 2)	Average number of birds sampled in active surveillance Strategy 2.
149. Cost of Test 2 (per bird in *currency*)	Cost of a test used in active surveillance Strategy 2.
150. Hours spent by the veterinarian (both strategies)	Average number of hours spent by a veterinarian on surveillance activities in each type of farm (for both strategies).
151. Hours spent by the farmer	Average number of hours spent by farmers on surveillance activities in each type of farm (for both strategies).
152. Average number of farms visited per trip	Average number of at-risk farms visited per trip.

61. Salary type	For item 150: Select an employee profile (from those defined in items 26–28).

Control and surveillance in wildlife and vectors

This section contains information on activities related to the surveillance and control of the disease in wildlife and vectors.

Control in wildlife

Parameter (reflects text in spreadsheet)	Description
153. Carcass detection campaigns	Total number of wildlife carcass detection campaigns and average cost per campaign.
154. Compensation for each wild bird carcass	Total number of wildlife carcasses handed over to the authorities and compensation paid per carcass.
155. Cost of wild bird disposal	Total number of carcasses disposed of and the cost of disposing of a carcass.
156. Other costs (bulk cost in *currency*)	Other costs related to wildlife control activities may be included as a bulk sum.

Surveillance in wildlife

Parameter (reflects text in spreadsheet)	Description
157. Hours spent in each operation	Average time in hours spent on sampling (first column), laboratory analysis (second column) and other activities (third column).
158. Number of operations	Number of wildlife surveillance exercises.
159: Samples per operation & cost per sample (in *currency*)	Number of samples obtained in each exercise (column D) and cost of analysis for each wildlife sample (column F).
160: Wildlife surveillance (bulk cost in *currency*)	Any other costs associated with wildlife surveillance as a bulk sum.

Surveillance in vectors

Items 161–164 on the right side of the inputs are related to arthropod-borne diseases and focus on surveillance activities in insect vectors.

Parameter (reflects text in spreadsheet)	Description
161. Number of traps	Number of traps used.
162. Tests for vectors per trap (in *currency*)	Cost of tests performed per trap (during the whole campaign).
163. Hours spent taking samples (per trap)	Average number of hours spent sampling a trap (during the whole campaign).
164. Hours spent in the lab (per trap)	Average number of hours spent analysing samples from one trap in the laboratory.

61. Salary type	For items 153, 163 and 164: Select an employee profile (from those defined in items 26–28) in charge of activities related to field and laboratory activities using the drop-down menu.

Module 5. Other centralized activities (brown)

The last part of the spreadsheet is dedicated to activities outside the field. These include centralized activities such as coordination activities, checkpoints, borders controls, and training or awareness campaigns, which are carried out to control the spread of the disease.

Coordination and bureaucratic tasks

Time spent on coordination and administrative/ bureaucratic tasks can be indicated in items 165–167

Parameter (reflects text in spreadsheet)	**Description**
165. Coordinator: days of work	Average number of working days spent on coordination activities.
166 and 167. Other tasks: days of work	Average number of working days spent by other employee profiles (indicated in item 61) on bureaucratic and other related tasks.
61. Salary type	At the end of the row for items 165 to 167: Select an employee profile (from those defined in items 26–28) for time spent on coordination and bureaucratic tasks using the drop-down menu.

Checkpoints and Border control (movement control)

Items 168–183 collect information on measures taken in zones with different animal health status (items 168–175) and at border crossing points (items 176–183) to reinforce the control of bird movement and reduce the spread of the disease.

Checkpoints (Control of movements in affected area)

Parameter (reflects text in spreadsheet)	**Description**
168. Number of checkpoints	Number of checkpoints set up to control the movement of poultry in affected area.
169. Duration of checkpoints (average in days)	Average or estimated number of days that checkpoints are operational.
170. Detergents/disinfectants (*currency* per point & day)	Daily cost of detergents and disinfectants per checkpoint.
171. Kilometres travelled daily by a patrol (average)	Average or estimated distance (in kilometres) travelled per day by a patrol vehicle.
172. Hours per day (employee)	Time (in hours) spent on checkpoint inspections. Type of salary indicated in item 61.
173. Hours per day (employee)	Additional employee time (in hours) spent on checkpoint inspections. Type of salary indicated in item 61.

174. Other materials (*currency* per point & day)	All other costs incurred on a daily basis.
175. Other materials (*currency*)	Additional costs as a bulk sum.
61. Salary type	At the end of the row for items 172 and 173: Select an employee profile (from those defined in items 26–28) for time spent on checkpoints (these profiles are applied automatically to border control as well).

Border control

Items 176–183 refer to border control activities carried out in addition to those normally in place.

Parameter (reflects text in spreadsheet)	**Description**
176. Number of border control posts	Number of additional to normal border control posts.
177. Duration of border control posts (average in days)	Average or estimated number of days each additional border post is operational.
178. Detergents and disinfectants (*currency* per point and day)	Daily cost of detergents and disinfectants per border control post.
179. Kilometres travelled daily by a patrol (average)	Average (or estimated) distance (in kilometres) travelled per day by a patrol vehicle.
180. Hours per day (employee)	Time (in hours) spent by veterinarians carrying out inspections at border posts. Type of salary indicated in item 60.
181. Hours per day (employee)	Additional time (in hours) spent by employee carrying out inspections at border posts. Type of salary indicated in item 60.
182. Other materials (*currency* per point and day)	All other costs incurred on a daily basis.
183. Other materials (currency)	Additional costs as a bulk sum.

Training and communication

Three training interventions can be described in items 184–188, indicating the number of participants, the number of days and the various costs. The materials and communications used for the awareness campaigns are described in items 189–194.

Training

Parameter (reflects text in spreadsheet)	**Description**
184. Training costs	The three training activities can be renamed by the user. The professional profiles of the participants in each activity can be specified in item 61.
185. Number of participants	Number of participants enrolled in each training activity.
186. Number of days (activity)	Length of the course/activity (in days or fractions of days).
187. Travelling cost per participant	Average travel costs per participant.

188. Other (*currency*)	Other costs associated with the organization of training events (e.g. venue, catering, printing, accommodation, instructors).

Awareness

Cost of awareness-raising materials produced (e.g. leaflets, posters, factsheets, videos, press releases, and publications). Each row refers to a different material. For each item in the table, the users can indicate the number produced and the cost of production.

Parameter (reflects text in spreadsheet)	**Description**
189. Brochures, leaflets, etc.	Number of units produced and unit cost of printed leaflets and brochures.
190. Posters	Number and unit cost of printed posters.
191. Other media (TV commercials)	Number and unit cost of TV spots.
192. Other media (Radio commercials)	Number and unit cost of radio spots.
193. Newspaper publications, infographics	Number and unit cost of these materials
194. Other	Number and unit cost of other materials not included in the previous items.

The definition of who bears the cost of each item is defined in column D of the Breakdown of costs sheet.

Part II

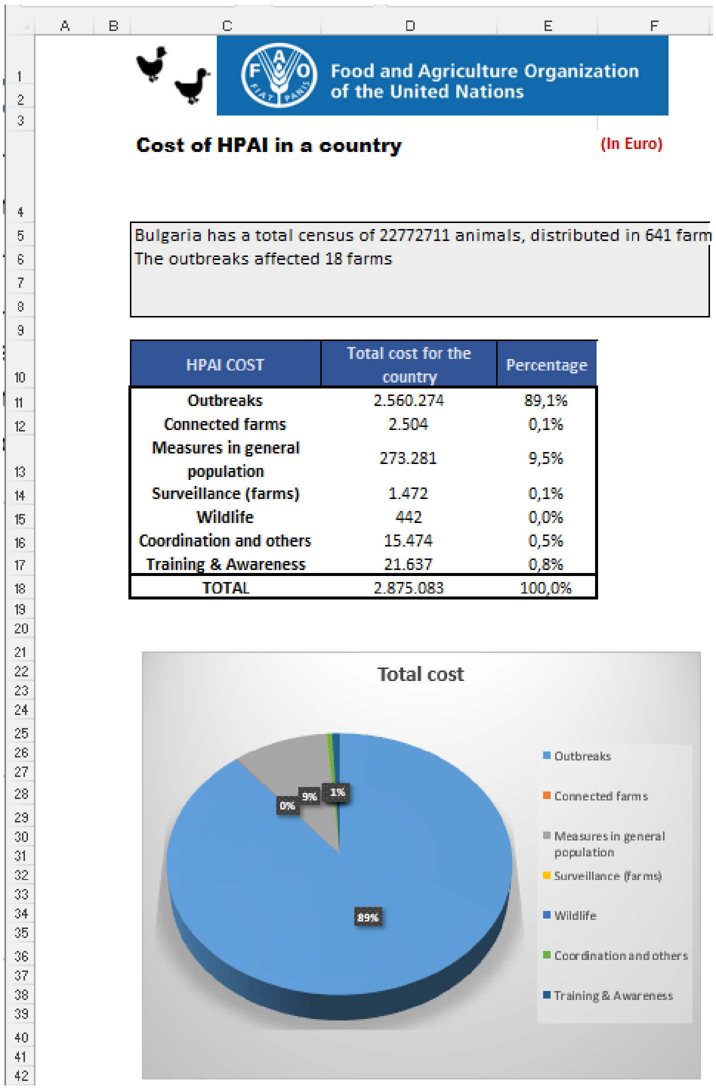
The results provided by the model and the qualitative evaluation of the non-monetary costs of the disease are described in the following spreadsheets:

- Overall cost: Summary of the cost of the disease to the country.
- More costs: Summary of the costs per farm and per sector.
- Breakdown of the costs of the disease: A set of detailed tables showing the final costs of all items included in the study (for technical use).
- Qualitative evaluation: Framework for qualitative assessment of indirect and non-monetary costs with a set of instructions for filling in the model.

Overall cost spreadsheet

The spreadsheet "Overall cost" shows the cost per farm (in the currency indicated in item 7 in "INPUT"), per sector and for the whole country or region through a selection of tables and charts.

The first table (in cells C10 to F18) gives a summary of the total country cost (i.e. the overall cost for the whole country/region) which is broken down into seven cost categories, including the percentage amount of each category. The following items are shown:



HPAI COST	Total cost for the country	Percentage
Outbreaks	2.560.274	89,1%
Connected farms	2.504	0,1%
Measures in general population	273.281	9,5%
Surveillance (farms)	1.472	0,1%
Wildlife	442	0,0%
Coordination and others	15.474	0,5%
Training & Awareness	21.637	0,8%
TOTAL	2.875.083	100,0%

1. "Outbreaks" present the total costs of the disease in the affected farms, including the costs of outbreak investigations, control measures (e.g., stamping-out), and direct and indirect costs at farm level.
2. "Connected farms" shows the costs resulting from measures taken in at-risk farms (neighbouring and other epidemiologically linked farms).
3. "Measures in the general population" includes the costs of measures applied in other farms beyond affected and at-risk (i.e. vaccination and other measures).
4. "Surveillance" summarizes the costs of active surveillance in farms.
5. "Wildlife and vectors" summarizes the costs of active surveillance and control in wildlife and vectors.
6. "Coordination and others" includes the cost of centralized activities such as coordination of activities and checkpoints and border posts.
7. "Training and awareness" includes the costs of training and awareness campaigns.

The proportions of the cost categories are also shown in a pie chart below the table.

On the right-hand side of the spreadsheet (cells H3 to X58), a table gives more detailed costs of the different items included in the evaluation of the costs, considering the type of farms and sector (veterinary services, farmers, and others). The table below gives a brief explanation of the different sections in the table and lists the rows in the "Breakdown of costs" sheet used to calculate the corresponding costs.

Outbreaks	Concept	Explanation	Rows in Breakdown Cost Sheet
Outbreak investigation	Visit to the farm	Includes the veterinarian's salary (considering the visit and the trip) and the cost of displacement	20 and 21

	Analysis (lab)	Includes kits, reagents, and salaries of the laboratory personnel	24 and 25
	Sampling material and transport	Containers, needles, and other possible materials, and transport of samples to the laboratory	23 and 23
Stamping-out			
Destroyed birds	Compensation to farmers	Compensation to farmers for birds sacrificed	35
	Cost paid by the farmers	Costs paid by farmers beyond the compensation paid by the government	36
Culling and carcass disposal		Hours spent by farmers, veterinarians, and others to sacrifice the birds	40 to 42
Other		Eggs and goods destroyed, carcass disposal	37, 38 and 43
Immobilization of farms			
	Farm level	Costs of maintaining non-productive birds after reaching the required weight. Cost of eggs destroyed and birds sacrificed for welfare reasons.	29 to 33
Cleaning/disinfection/insect control			
	Personnel	Salaries of veterinarians, farmers, and others for cleaning and disinfecting premises	45 to 47
	Materials used	Disinfectants and other materials and products for cleaning and disinfecting premises	48
	Insect control	Salaries and insect control products	49 and 50
	Sentinels	Activities related to inspection and analysis of sentinels	53 to 55
	Other control measures	Other, not included in previous sections	51
Direct disease costs			
	Dead birds	Value of birds and disposal costs	5 to 6
	Loss of production and others	Reduction in production parameters and other direct costs	7 to 9
	Treatments	Cost of the treatments applied, including drugs, their application, and the extra work due to the increase in management	12 to 16
Indirect disease costs			
	Farm level	Includes the opportunity cost due to the lack of production after the sacrifice, as well as the savings in salaries, fuel, and other costs that result from the absence of birds	57 to 59

Epidemiologically connected farms			
	Visits and Analysis	Includes the veterinarian's salary and travelling costs to visit farms at risk during the outbreak and before leaving the measures to confirm that the farms are free of diseases	63 and 64 and 88 to 90
	Stamping-out	Value of birds sacrificed, and cost of destruction of carcasses and salaries	72 to 78
	Vaccination prior to stamping-out	Costs of vaccination and maintenance of birds until sacrifice	80 to 82

	Immobilisation	Costs of maintaining non-productive birds after their productive period. Cost of birds sacrificed for welfare reasons.	66 to 68 and 69 to 70
	Cleaning, disinfection and insect control	Salaries and products used for disinfection and insect control	84 to 86
	Indirect costs at farm level	Opportunity costs of non-productive birds after the sacrifice, and savings due to the absence of birds	92 to 94

Measures in general population			
Immobilization		Costs of maintaining non-productive birds after their productive period. Cost of birds sacrificed for bird welfare reasons	98 to 103
Vaccination	Application of vaccine	Salaries of farmers and veterinarians	106 to 109
	Vaccine		105
Other measures	Insecticides / repellents.	Other measures applied to the general population	111 and 112

Farms Surveillance	Active surveillance only	Costs of farm visits, sampling, and laboratory tests	115 to 118

Wildlife and vectors	Control measures in Wildlife	Campaigns to find carcasses: Salaries and disposal costs, compensation for hunters, and other costs	132 to 135
	Wildlife surveillance	Wildlife sampling and laboratory tests	137 to 139
	Vector surveillance	Trap maintenance, vector identification, and analysis	141 to 143

Other centralized activities	Coordination	Time spent on coordination and bureaucracy	147 to 149
	Control of movements	Cost of checkpoints: salaries, disinfectants and other materials, and displacements	121 to 123
	Control of borders	Cost of checkpoints: salaries, disinfectants and other materials, and displacements	126 to 128
	Training	Courses	152
	Awareness	Brochures, posters, leaflets, advertisements, and other media	153 to 158

In addition to the description of the different approaches, the table in the “Overall cost” sheet includes the following values:

- Columns J and K show the number of farms and the total costs, respectively,
- Columns from M to T show the costs for each type of farm, and
- Columns from V to X show the costs by sector.

The allocation of costs to the sector is defined in column D of the cost “Breakdown of costs” sheet. The three possible sectors are Veterinary services (VS), Farmers (F) and Others (O).

More Costs spreadsheet

The first part of the spreadsheet focuses on the costs of the outbreaks in the affected farms, which are described in three tables.

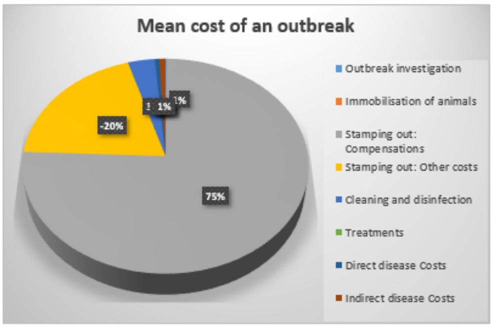
- Total costs in the affected farms are shown in the first table (cells B8 to D17).
- Total costs per type of farm are shown in the table in cells B22 to J32
- Mean costs for each type of farm in the next table in cells B36 to J46.

Cost of HPAI in example (In Euro)

Cost of outbreaks:

The cost per outbreak is:

Cost of the outbreaks of HPAI		89,1% of the total cost
Outbreak investigation	5.448	0,2%
Immobilisation of animals	0	0,0%
Stamping out: Compensations	3.190.102	124,6%
Stamping out: Other costs	-831.881	-32,5%
Cleaning and disinfection	140.687	5,5%
Treatments	0	0,0%
Direct disease Costs	23.598	0,9%
Indirect disease Costs	32.320	1,3%
TOTAL	2.560.274	



Cost of the outbreaks of HPAI (by type of farms)	breeder broilers	earing laying her	adult laying hens	broilers	lard duck (Foie gr	ck (fattening ; An	attening ; Americ	heries for laying hens
Outbreak investigation	243	243	1.213	152	1.599	400	1.599	0
Immobilisation of animals	0	0	0	0	0	0	0	0
Stamping out: Compensations	553.424	0	519.108	157.619	796.140	193.416	970.395	0
Stamping out: Other costs	-406.195	52	104.090	-13.029	-178.926	64.523	-402.396	0
Cleaning and disinfection	7.858	7.858	39.054	15.622	31.243	7.811	31.243	0
Treatments	0	0	0	0	0	0	0	0
Direct disease Costs	3.617	0	5.520	652	78	240	13.492	0
Indirect disease Costs	372.879	-44.822	3.036.703	-110.107	-1.087.546	-446.860	-1.687.926	0
TOTAL	531.824	-36.669	3.705.688	50.908	-437.413	-180.471	-1.073.594	0

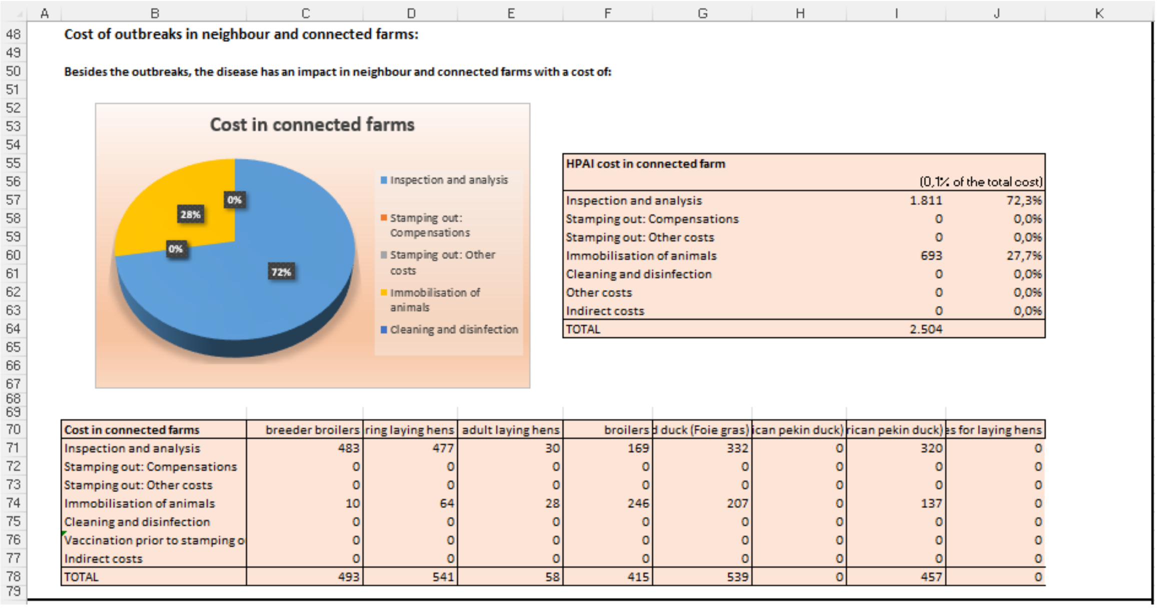
Mean costs of outbreaks per type of farms

	breeder broilers	ring laying hens	adult laying hens	broilers	d duck (Foie gras)	ican pekin duck)	rican pekin duck)	es for laying hens
Outbreak investigation	243	243	243	76	400	400	400	0
Immobilisation of animals	0	0	0	0	0	0	0	0
Stamping out: Compensations	553.424	0	103.822	78.809	199.035	193.416	242.599	0
Stamping out: Other costs	-406.195	52	20.818	-6.514	-44.731	64.523	-100.599	0
Cleaning and disinfection	7.858	7.858	7.811	7.811	7.811	7.811	7.811	0
Treatments	0	0	0	0	0	0	0	0
Direct disease Costs	3.617	0	1.104	326	19	240	3.373	0
Indirect disease Costs	372.879	-44.822	607.341	-55.054	-271.887	-446.860	-421.982	0
	531.824	-36.669	741.138	25.454	-109.353	-180.471	-268.399	0

Source: Authors' own elaboration.

The second part of the sheet shows tables and pie charts of costs in neighbouring and epidemiologically connected farms.

In a similar structure as for outbreaks in affected farms, a pie chart and a table present the costs of the disease in the at-risk farms and a second table displays the total costs for each type of farm (table in cells B70 to J78).



Cost of outbreaks in neighbour and connected farms:

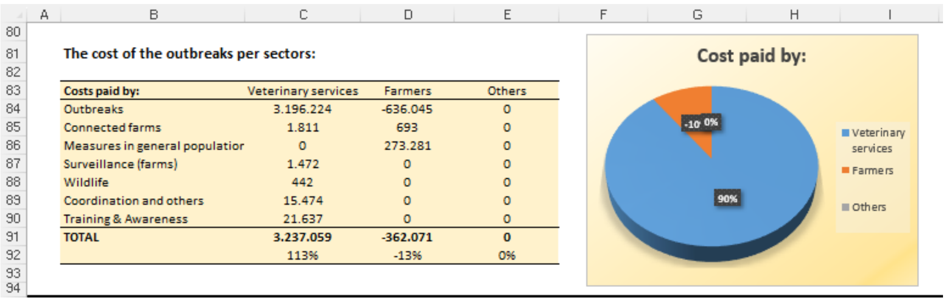
Besides the outbreaks, the disease has an impact in neighbour and connected farms with a cost of:

HPAI cost in connected farm		
		(0,1% of the total cost)
Inspection and analysis	1.811	72,3%
Stamping out: Compensations	0	0,0%
Stamping out: Other costs	0	0,0%
Immobilisation of animals	693	27,7%
Cleaning and disinfection	0	0,0%
Other costs	0	0,0%
Indirect costs	0	0,0%
TOTAL	2.504	

Cost in connected farms	breeder broilers	ring laying hens	adult laying hens	broilers	d duck (Foie gras)	ican pekin duck)	rican pekin duck)	s for laying hens
Inspection and analysis	483	477	30	169	332	0	320	0
Stamping out: Compensations	0	0	0	0	0	0	0	0
Stamping out: Other costs	0	0	0	0	0	0	0	0
Immobilisation of animals	10	64	28	246	207	0	137	0
Cleaning and disinfection	0	0	0	0	0	0	0	0
Vaccination prior to stamping o	0	0	0	0	0	0	0	0
Indirect costs	0	0	0	0	0	0	0	0
TOTAL	493	541	58	415	539	0	457	0

Source: Authors' own elaboration.

Finally, a pie chart and a table (in cells B83 to E92) show the total costs by sector (i.e. who pays the costs). The categories considered are veterinary services, farmers or others.



The cost of the outbreaks per sectors:

Costs paid by:	Veterinary services	Farmers	Others
Outbreaks	3.196.224	-636.045	0
Connected farms	1.811	693	0
Measures in general populatior	0	273.281	0
Surveillance (farms)	1.472	0	0
Wildlife	442	0	0
Coordination and others	15.474	0	0
Training & Awareness	21.637	0	0
TOTAL	**3.237.059**	**-362.071**	**0**
	113%	-13%	0%

Source: Authors' own elaboration.

Breakdown of costs spreadsheet

This is the "core" sheet of the model's outputs, showing the final cost of all items included in the study. The results are presented in a table and grouped into five different colour-coded sections:):

- The first section (**blue**) includes **direct costs** due to the disease and treatment (i.e. the cost of stamping-out is not included in this part).
- The second section (**orange**) lists the costs of **diagnostics, control and eradication** measures in affected farms and the indirect costs of the disease (i.e. lost opportunities).
- The third section (**brown**) evaluates the indirect costs and the costs of measures applied in **farms at risk** (e.g. neighbouring or epidemiologically connected farms).
- The fourth section (**green**) illustrates the costs of prevention and surveillance activities in **domestic birds, wildlife, and vectors**.
- The last section (**yellow**) shows the costs of **communication**, awareness campaigns, coordination, and **bureaucratic tasks**.
-

Following the columns from left to right, the table shows:

- "***Items***" and "***Details***" (columns B and C, respectively) describe the different activities and aspects considered for the calculations.
- ***Costs by stakeholder*** **- in column D the user should indicate which stakeholder pays the cost of each item** (i.e. #VS - Veterinary Services; #F - Farmer (F); or #O - Others). This column is unprotected and is the only column that **can be changed by the user**. Columns E to G show in detail the amount paid for each measure by the different stakeholders.
- ***Total country costs*** - Column H and BF show the overall cost of different groups of items for the country/region.
- ***Costs by farm type*** **-** Columns J to BD show the costs by type of farm (i.e. results for Type #1 in columns J to N; for Type #2 in columns P to T, and so on). The same information is given for each type of farms. For example, for Type #1:
    - **Column J** shows the mean number of **units** (as described in column C).
    - **Column K** shows the **cost per unit**.
    - **Column L** gives the mean **cost per farm**.
    - **Column M** is the **number of farms** that incurred the costs.
    - **Column N** is the **total cost** of each item.
- **Total country costs** - Column BF shows the overall cost for the whole country/region.

Some additional notes:

- Monetary values are shown in the currency selected in the "Inputs" sheet (Cell I10).
- The results for the different farm types can be shown or hidden using the $\boxed{+}$/ $\boxed{-}$ button at the top of the sheet.

Scrolling through the rows displays the five sections that make up the table:

Direct costs of the disease (Rows 5 to 12)

This section calculates the costs of the disease due to production losses and mortality (excluding stamping-out). The item "***Dead birds***" (**Row 5**) covers the costs of birds that died because of the disease, (i.e. excluding birds culled as a part of control/eradication measures). The costs of the

"***Disposal***" is shown in **row 6.** The production losses for birds that survive are evaluated in **row 7**, ("**Birds in production**") and in **row 8** ("***Eggs not produced").*** The cost of other losses, if specified in the INPUT spreadsheet, is shown in **row 9**.

Treatments (Rows 11-16)

The economic impact of treatments can be important, especially when stamping-out is not done. The table shows the amount spent on up to two ***drugs*** in **rows 12 and 14**, the cost of their ***application*** in **rows 13 and 15**, and the **extra work** for the farmer in **row 16**.

Control and eradication activities in outbreaks. This section presents two different parts, diagnostic and control measures:

1. "Diagnosis of outbreaks (and suspected outbreaks)" in rows 19 to 25.
    - The time spent to inspect a farm and to travel to the farm (back and forward) is shown in **row 20**, and the travel cost (i.e. fuel, depreciation, and maintenance of the vehicle…) in **row 21**.
    - Sampling (**Row 22**) includes all the material needed to sample a farm (vacutainers, needles, containers for tissue samples, etc.).
    - The transport of samples to the laboratory per farm is shown in **row 23.**
    - Laboratory techniques: The model allows two different tests to be considered, the costs of which are shown in **rows 24 and 25** (the average number of tests per outbreak is calculated in item 32 of the "INPUT" spreadsheet).
2. "**Eradication / Control measures in outbreaks**": This section covers the

This section (rows from 29 to 59) covers the activities performed at outbreak sites.

- Immobilization of farms (Rows 28 to 33), which includes:
    - The total fixed costs for each additional day that birds remain in the farms are given in **row 29**.
    - The costs of culling for welfare reasons and for destruction of eggs are shown in **rows 30 and 31 and 32 and 33** respectively, 30 and 32 relating to the compensation paid by the veterinary services and the other two items include the cost paid by the farmers.

- Stamping-out (Rows 34 to 36): In case of total or partial stamping-out, the cost of the destroyed birds is usually compensated by the government (**row 35)**. However, in some cases this compensation may not fully cover the costs incurred (i.e. the cost of a dead bird) and farmers have to pay the difference **rows 36**.
- Sacrifice and carcass disposal costs (Rows 37 to 42): **Rows 38 to 43** include the time spent by the official veterinarian, the farmer and others; the costs of carcass disposal (burial, incineration, or transport to rendering plant); the destruction of eggs present in the farms and of other materials are included in **rows 41 and 43**.
- The costs of cleaning, disinfection, and insect control (Rows 44 to 51) include the time spent by the official veterinarian and the farmer **(Rows 45 to 47)**, the cost of disinfectants and insect control products (e.g., fumigation) are in **Rows 48 and 49**, the cost of the time for insect control (in terms of working hours) **(Row 50)** and other control measures **(Row 51)**.

- Activities prior to the introduction of new birds (Rows 52 to 55) include the possibility of introducing sentinel birds, with the associated costs of inspection and analysis **(Rows 53 and 54)**, and the opportunity costs of maintaining the farm in a non-productive state **(Row 55)**.
- Indirect costs due to lost opportunities in rows 56 to 59: The loss of opportunity due to the time that the farm remains without birds or with fewer birds before restocking is considered by the model (i.e. meat and eggs not produced by the birds that are removed/culled or die from the disease) (**Row 57**). **Row 58** shows the cost of salaries during non-productive months and **Row 59** shows the expected savings in fixed costs due to reduction in salaries, electricity, water, and other commodities during this period.

Measures in Neighbour and epidemiologically connected farms (Rows 62 to 94)

For at-risk farms, the calculations are very similar to those for farms affected by outbreaks. In particular, this section considers the costs of visiting and testing the farms, immobilization, stamping-out, and cleaning and disinfection.

- Surveillance in at-risk farms: After the declaration of the disease in the corresponding farms, visiting, sampling and analysis of the at-risk farms are applied (**Rows 63 to 64**).
- Immobilization of farms/Sacrifice due to welfare: Farms in the vicinity of outbreaks may also be quarantined until the outbreak has been eradicated. The immobilization of neighbouring farms entails costs, as birds cannot be sent to other units or to slaughterhouses and eggs cannot be traded and should be culled for welfare reasons. The longer the period of immobilization, the greater the economic impact. The costs incurred due to the additional days that the birds spend on the farm are considered in **Row 66.** The costs due to the culling of birds for welfare and the immobilization of eggs are covered in **Rows 67 to 70.** These items include the compensation paid by the veterinary services, and the remainder cost paid by the farmers.
- Stamping-out and disinfection in at-risk farms (rows 71 to 86): In some cases, the authorities may decide to pre-emptively cull birds in at-risk farms without waiting for the laboratory test results. The costs incurred due compensation paid by the government and the difference paid by the farmers are calculated in **rows 72 and 73,** the costs of culling and carcass disposal in **rows 75 and 78,** and the cost of vaccination (in case birds are culled after vaccination) in **rows 80 to 82.** Cleaning and disinfection are included in **rows 84 to 86**.
- Tests to confirm the farms are disease free: Additional sampling and testing are usually carried out prior to allowing movements from the immobilized farms or to increase surveillance during the outbreak (**rows 88 to 90**).
- Loss of opportunity and other: Loss of opportunity are indirect costs for connected farms are described in **rows 92 to 94**, using the same calculations as for outbreaks (i.e. eggs and meat not produced by the removed/culled birds).

Control measures in the general population **(Rows 96 to 112)**

This section refers to the costs of measures applied in all (or part) of the non-affected farms in the country/region.

Farms in the region may also be quarantined for a period of time. The immobilization of farms entails costs due to the impossibility of sending birds to other units or slaughterhouses and they are given in **Rows 98-103**). The costs of vaccination are shown in **rows 104 to 109**.

Finally, the costs due to other activities carried out on non-affected farms are given in **rows 111 and 112**.

Surveillance activities (Rows 114 to 133)

- Surveillance activities in poultry (Rows 114 to 118): Up to two different active surveillance protocols may be applied to farms. For each strategy, the time spent travelling to the farms is taken into account. Please note that the active surveillance related to the visit to epidemiologically linked or high-risk farms is already included in the part describing the measures in neighbouring and epidemiologically connected farms.
- Wildlife surveillance (Rows 126 to 129 and control measures (Rows 121 to 125) is calculated taking into account the activities carried out and the time spent by the personnel involved

- Vector surveillance (Rows 130 to 133): The time spent for setting traps and other costs associated with the trapping, the time spent by an entomologist identifying the species and other possible costs are considered here.

Control of movements (rows 135 to 143)

The costs of checkpoints and activities to prevent the movement of birds between affected and unaffected zones or with foreign countries are shown in **rows 119 to 122** and **rows 124 to 127**, respectively.

The costs of checkpoints and activities to prevent the movement of birds between affected and unaffected zones or with foreign countries are shown in in **rows 119 to 122** and **124 to 127**, respectively.

Coordination, training, and awareness campaigns (Rows 147 to 160)

These activities may take place throughout the country or only in affected or at-risk areas.

- The costs of coordination and bureaucratic tasks are calculated in terms of working hours and are presented in **rows 147 to 149**.
- **Row 152** shows all expenses related to the organization of training (i.e. modules, courses, etc.).
- Awareness-raising campaigns (**rows 153 to 158**) include the costs of graphic design, printing, and distribution of posters or leaflets, and other awareness-raising tools such as videos, infographics, etc.

Qualitative evaluation of indirect and non-monetary costs spreadsheet

The spreadsheet "Qualitative evaluation" provides a framework for a qualitative assessment of indirect and non-monetary costs. The objective of this sheet of the tool is to highlight other relevant effects of transboundary animal diseases. In addition to the economic costs of the disease and controlling it, epidemics can have other effects on human health, the environment, and on social and political behaviour, which must also be considered. Some of these can be assessed in economic terms, such as the indirect costs of trade or the impact on human health, but they are outside the scope of this tool.

The effects have been divided in seven areas and 19 items:

- Socio-economic vulnerability (4 items in rows 9 to 12)
- Trading (4 items in rows 15 to 18)
- Human health (3 items in rows 21 to 23)
- Animal welfare (2 items in rows 26 to 27)
- Environment (2 items in rows 30 to 31)
- Social behaviour (2 items in rows 34 to 35)
- Political response (2 items in rows 38 to 39)

Each area has two to four different items that can be evaluated using a semi-quantitative score from zero or one to five, considering the likelihood of the disease occurrence and the importance of the consequences. The level of concern for each item is rated in four categories (i.e. low, moderate, high, and extreme) by combining likelihood and consequences.

For each of the proposed items indicate:

The **likelihood** of occurrence in **Column E** by scoring 0 for null to 5 for almost certain to occur. The table below shows the scoring criteria for the assessment of likelihood:

Level	Meaning	Definition
0	Null	If the disease is not a zoonosis or does not affect wildlife, the likelihood of these items is zero.
1	Rare	The risk event is almost impossible to occur. There is less than 1% chance of occurrence in a given timeframe.
2	Unlikely	The risk event is unlikely to occur but is not impossible. There is a 1–10% chance of occurrence in a given timeframe.
3	Possible	The risk event has a moderate chance of occurring. There is a 10–50% chance of occurrence in a given frame time.
4	Likely	The risk event is probable and expected to occur. There is a 50–90% chance of occurrence in a given timeframe.

5	Almost Certain	The risk event is almost certain to occur. There is over a 90% chance of occurrence in a given timeframe.

Source: Authors' own elaboration.

The severity of the **consequences** in **Column F,** using a score of 1 to 5 (from insignificant/negligible to severe/catastrophic consequences). The table below shows the scoring criteria for the assessment of consequences:

Level	Meaning	Definition
0	Not applicable	This response is chosen when the queried information is deemed irrelevant, non-applicable, or absent within the scope of the respondent's context or knowledge base.
1	Insignificant/ Negligible	Negligible harm, minimal financial losses, minor inconveniences, or no adverse effects at all. These consequences have no significant impact on safety, health, operations, or the environment.
2	Minor	Slight impact that is manageable without significant efforts. They may involve minor injuries, minor property damage, limited financial losses, or minor disruptions. While noticeable, these consequences are not considered severe.
3	Moderate	This level may include injuries requiring medical attention, moderate property damage, financial losses of moderate significance, or disruptions that affect operations but are not catastrophic.
4	Major	Involves serious injuries, substantial property damage, substantial financial losses, or disruptions that have a major impact on critical functions and require immediate action and resources.
5	Severe/ Catastrophic	Represents the highest level of impact. It involves severe injuries or fatalities, extensive and irreversible property damage, massive financial losses, or disruptions that threaten the organization's existence or public safety.

Source: Authors' own elaboration.

The level of concern assessed by the model is shown in **Column G** and is classified in four categories (low, medium, high, and extreme) according to the possible combinations shown in the table below. If the likelihood score is zero (as in the case of diseases which are not zoonotic), the level of concern is considered to be "null". The category colours help to highlight the values of the different scores. The table below shows the risk metrics adopted:

		Consequences				
		Insignificant / Neglegible	Minor	Moderate	Major	Severe / Catastrophic
Likelihood		1	2	3	4	5
1	Rare	Low	Low	Medium	Medium	High
2	Unlikely	Low	Medium	Medium	Medium	High
3	Possible	Low	Medium	Medium	High	Extreme
4	Likely	Medium	Medium	High	High	Extreme
5	Almost Certain	Medium	High	High	Extreme	Extreme

Source: Authors' own elaboration.

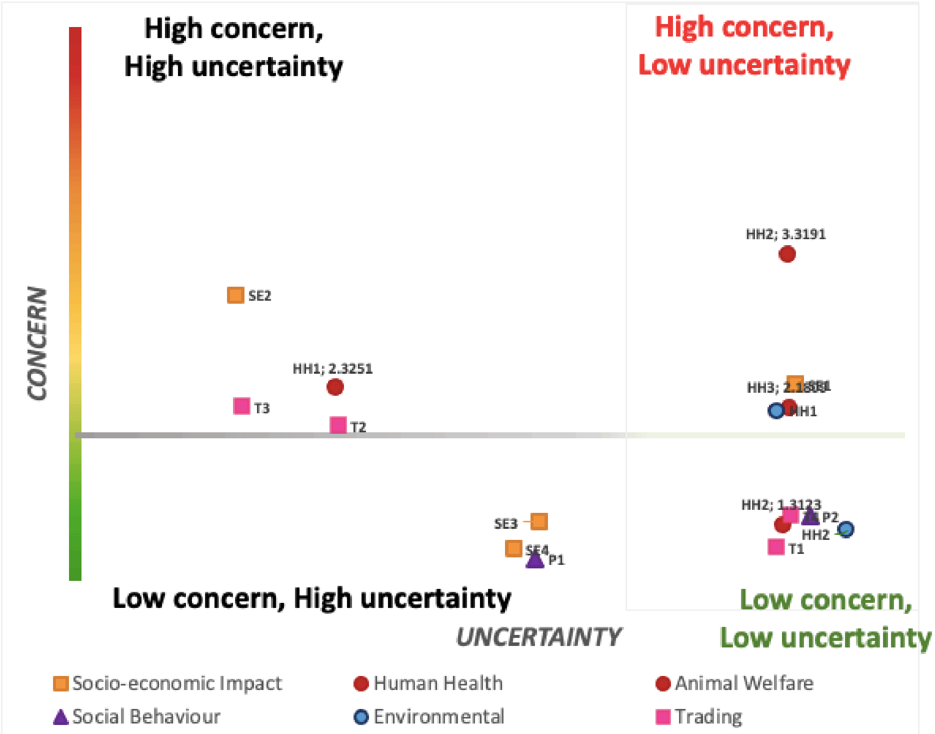
The concept of risk encapsulates uncertainties related to both the likelihood of an event occurring and the potential magnitude of its consequences. Uncertainties arise from factors such as data limitations, biological variations, and measurement errors. While reducing uncertainty does not alter the inherent risk itself, it refines the precision of the assessment. In **Column H**, three different levels of uncertainty can be chosen:

Uncertainty level	Definition
Low	Reflects a high degree of confidence in the available information or data. The information is well-researched, reliable, and supported by robust evidence.
Medium	Indicates a moderate level of confidence in the available information or data. While some research and evidence support decision-making, there may still be gaps or factors that are not fully understood.
High	Reflects a low degree of confidence in the available information or data. The information may be incomplete, conflicting, or based on limited research.

Source: Authors' own elaboration.

Besides the table, a dynamic graph is generated, placing each item based on its risk concern and degree of uncertainty. On the X-axis, the degree of uncertainty, shows the respondent's confidence level. The less the uncertainty, the higher the trust on the evaluation. On the Y-axis, the concern increases in the quadrants as the degree rises.

Items falling in the upper right quadrant will elicit greater concern, as uncertainty is low and concern is high. Conversely, items positioned in the upper left quadrant, where uncertainty is high and concern is low, will be of less worry, as there is a greater level of uncertainty and a lower level of concern.



Source: Authors' own elaboration.

Annex I. How to add a new language?

The default language of the tool is English. Other languages (e.g. French and Spanish) can be selected in cell C14 of the “Introduction” sheet.

Warning: If you change the language, you should translate all text introduced in drop-down menus.

Users can add another language by completing the following steps:

1. Add the name of the language in cell F1 in sheet “Dic”.
2. Translate the words written in English in column D (or in Spanish and French in column E and F respectively) and write them in the same row in column G.
3. In the “Introduction” sheet: Select the new language in cell C14.

Warning: As some sentences are created by combining different texts, some constructions may be incorrect and will have to be modified.