ARTISANEFOOD DELIVERABLE D8.1

FEATURES NEEDED FOR THE ARTISANEFOOD DECISION-SUPPORT TOOL

WP8: Safety decision-support tool for Mediterranean artisanal food producers

WP8 aims to develop a safety decision-support IT tool, assembling all project's outputs, to enable artisanal producers to assess the safety of their traditional and bio preservation-based manufacturing processes, and generate sampling schemes and control charts upon their current and target safety levels

- *Task 8.1: Strategy for the development of the decision-support tool (M16-M20) (Lead: CNIEL; Participants: IPB, UO, UCO, USDA, CNIEL, ANSES, AUA, UNIBO, UIZ, ISBST/UMA) -> in link with D8.1 and D8.2 – see after*
- *Task 8.2: Development of new methods for the model-based risk analysis and decision (M20-M24) (Lead: USDA-ARS; Participants: IPB, UO, UCO, USDA-ARS, CNIEL, ANSES, AUA, UNIBO, UIZ, ISBST/UMA) -> activity mainly conducted by the French partner*
- *Taks 8.3: Implementation of features in the food safety decision-support tool (M22-M35) (Lead: ANSES; Participants: IPB, UO, UCO, USDA, CNIEL, ANSES, AUA, UNIBO, UIZ, ISBST/UMA) -> prototype available for the French cheese model – implemented in R at that stage*
- *Taks 8.4: Testing by artisanal producers (M33-M36) (Lead: CNIEL; Participants: IPB, UO, UCO, USDA, CNIEL, ANSES, AUA, UNIBO, UIZ, ISBST/UMA)*

Deliverables:

- *D8.1: Report from each partner on the utility of risk assessment tools : each partner to list in detail the inputs of the process risk models and the outputs expected from the simulations, including results issued from the (bio-) intervention strategies). WP leader CNIEL propose a short list of features that a decision-support tool should have and propose a list of existing tools by the 10th of june; each partner complete the list by the 20th of june*
- *D8.2: Plan design of the decision support tool (DEM, CO; Month 28)*

In November 2022, a presentation of the predictive microbiology and risk assessment tools was made by partners CNIEL (Fanny Tenenhaus-Aziza) and ANSES (Laurent Guillier) during an online workshop gathering all the partners of the Artisanefood projet, including students of the project.

The agenda of the workshop meeting was:

- Monday, November, the 21st - Morning session : 9:30 AM to 12:00 AM
- Introduction on Quantitative Risk Assessment applied to microbiology.
- Building a process risk model
- Application on the software R and Excel -> Excel was required and installation of the software RStudio and in particular the package "fitdistrplus" encouraged (https://posit.co/download/rstudio-desktop/)
- Monday, November, the 21st - Afternoon session 1:30 to 4:00 PM
- Application on MicroHibro -> participants were required to create an account on the MicroHibro website https://www.microhibro.com/
- Presentation of RAKIP

- Tuesday, November, the 22nd - Afternoon session 1:30 to 4:00 PM
- Introduction on microbiological sampling plan
- Building a sampling plan
- Application on existing tools

Up to 26 participants participated to the workshop during the two days.

Following this workshop, the participants had an overview of the quantitative risk assessment tools, and of the way to build a Quantitative microbiological Risk Assessment (QMRA) based on data collected during production of traditional products (physical and chemical results, microbiological results), using R code or MicroHibro. They were also able to interpret the simulation results of exposure and risk assessment results obtained after simulations of a QMRA model, as well as understanding better the efficiency of microbiological monitoring of product during the production or before being put on the market.

Partners of the Artisanefood project had different objectives in terms of modelling: some of them assess growth or inactivation rates with and/or without intervention strategies including bio-preservation intervention; others simulate the behavior of the bacteria of interest during the process, until the consumption to assess the level of exposure of the consumer. The last ones assess the probability of being ill and/or the probability of detection of a contaminated batch before putting it on the market. Finally, all partners are interested in comparing the impact of intervention strategies on the outputs of the process risk model they developed in previous WP. Thus, degrees in modelling activity vary among partners and the decision support tool of the Artisanefood project, developed on WP8, needed to be discussed among partners.

To engage this discussion on the decision support tool, partners were required to list in detail the inputs and the outputs of the process risk model they are building, including results issued from the intervention strategies (based on bio-preservation or not). Partners were provided with a list of features to be included in the support-decision tool, for which they had to say if they are of interest or not, with justification. In annex are provided the lists of possible inputs and outputs of the process risk model, and the list of possible features to be implemented in the Artisanefood decision-support tool. Instructions given to the partners to answer the Artisanefood questionary are listed in annex 2.

The contributions received from the partners were compiled (Annex3). The last column of the excel file provides a proposition on the inputs/outputs/modules to be included in the Artisanefood decision-support tool.

The main conclusion are that the future tool should :

- Include the following inputs:
    - Microbiological results collected on raw material, products (presence/non detection results or quantification of the concentration)
    - Physical and chemical parameters of the product during process collected during transformation and/or during shelf life; at least ph, aw.
    - If a biopreservation or any other intervention was applied and which one
    - Growth or inactivation model parameters (from primary and/or secondary model) – these parameters should be present in the tool to perform simulations of the bacterial behaviour all along the process
    - If possible, a threshold of concentration to comply with (expressed as a concentration and/or prevalence)
- Provide the following outputs:

    - Contamination level, expressed as prevalence and/or concentration of the finished products.
    - If possible, a comparison of the relative impact of an intervention procedure of the final contamination and/or the capacity in respecting a threshold.
- Propose the following features:
    - Entering microbiological and physico-chemical data
    - Predicting the concentration in the finished products according to the predictive microbiology model uploaded in the tool.
    - Allowing to perform statistical process control for microbial counts.

ANNEX 1

POSSIBLE INPUTS OF THE PROCESS RISK MODEL	POSSIBLE OUTPUTS OF THE PROCESS RISK MODEL
• Microbiological results collected on raw material, products (presence/non detection results or quantification of the concentration) • Physical and chemical parameters of the product during process collected during transformation and/or during shelf life • Description of the intervention strategy if appropriate (for example sorting rules of the raw milk based on control of hygienic practices) • Challenge test data (with and/or without intervention strategies) • kinetic parameters (for example growth/inactivation rates obtained with and/or without intervention strategies) assessed from challenge tests data and using predictive microbiology model or directly from the literature. • Consumption data • Dose-response model or parameters of the dose-response model, issued from the literature. • Sampling plans applied to a batch before being on the market or during production	• Contamination level of the raw material or the products during production or the finished product (including prevalence, concentration and associated variability) • Contamination level of the raw material or the products during production or the finished product (including prevalence, concentration and associated variability) following the implementation of the intervention strategies • Relative impact of the process on the contamination (number of log reduction/increase of the microbial population • Exposure of consumers to selected pathogens when eating artisanal foods (prevalence and/or concentration of the consumption units or dose ingested by portion/period, with associated variability) • Risk of foodborne disease (function of the consumer profile (i.e., more or less susceptible people) as well as eating habits (i.e., ready-to-eat or intended to be eaten cooked) • Probability of detection of a contaminated batch and/or operating characteristic curves • Percentage of products meeting regulatory requirements

POSSIBLE FEATURES TO BE IMPLEMENTED IN THE ARTISANEFOOD DECISION-SUPPORT TOOL
• Database browser containing challenge test data • Database browser of kinetic parameters • Database browser of predictive microbiology models • Growth/no growth predictor • Growth fitting tool • Inactivation fitting tool • Growth predictor • Inactivation predictor • Risk assessment tool • Model comparison of results obtained with the baseline scenario vs scenario with intervention strategy (for example relative risk reductions) • Sensitivity analysis module to find the parameters of the model having the most impact on the output • Sampling plan tool • Control chart tool in the context of statistical process control for microbial counts

ANNEX 2

Instructions to answer the Artisanefood questionary for deliverable D8.1

Open the excel file attached to the email.

Rename the excel sheet with “name of the partner/product/pathogen”.

Duplicate the sheets if several couples of “product/bacteria” are studied by the partner.

For each input/output/feature, please justify with concrete elements (examples of data, model, objective, etc) corresponding to your products for your case-product in the dedicated column.

If new inputs/outputs/features are not listed, please add some lines with the name of the inputs/outputs/features and the justifying elements corresponding to this new line.

In case of question, please write to ftenenhaus@cniel.com

ANNEX 3

POSSIBLE INPUTS OF THE PROCESS RISK MODEL												
• Microbiological results collected on raw material, products (presence/non detection results or quantification of the concentration)	In the eventual development of a new application for food artisans, the inclusion of microbiological prevalence and occurrence data needs to be compulsory.	In the eventual development of a new application for food artisans, the inclusion of microbiological prevalence and occurrence data needs to be compulsory.	The new application should be available to include such type of data regarding microbial prevalence and concentration since they will be used as model inputs.	The new application should be available to include such type of data regarding microbial prevalence and concentration since they will be used as model inputs.	L. monocytogenes was not detected in any of the samples.	The prevalence of Salmonella in sausages was 10% (6/60).	In the eventual development of a new application for food artisans, the inclusion of microbiological prevalence and occurrence data needs to be compulsory.	In the eventual development of a new application for food artisans, the inclusion of microbiological prevalence and occurrence data needs to be compulsory.	Presence of LM, ND=5.85 log CFU/ml.	Presence of *Listeria monocytogenes* on final product	Presence/absence data available for Listeria monocytogenes, Salmonella and E. coli	genomes from pathogen microorganisms isolated from collected samples were analysed.	To be included
• Physical and chemical parameters of the product during process collected during transformation and/or during shelf life	Parameters such as pH/aw should be provided if there are predictive microbiology models in place that use them as inputs	Parameters such as pH/aw should be provided if there are predictive microbiology models in place that use them as inputs	Physicochemical parameters may be included regarding the specific product. Temperature, pH, water activity together with chemical/biological preservatives could be added as inputs.	Physicochemical parameters may be included regarding the specific product. Temperature, pH, water activity together with chemical/biological preservatives could be added as inputs.	The average pH is 5.87 The average water activity is 0.855	The average pH is 5.87 The average water activity is 0.855	Parameters such as pH/aw should be provided if there are predictive microbiology models in place that use them as inputs	Parameters such as pH/aw should be provided if there are predictive microbiology models in place that use them as inputs	pH0 = _water activity0 = _ acidity during shelflife 7 days at 4°C= and pH 7 days = _water activity 7 days = _acidity during shelflife 7 days at 4°C=	pH and water activity :At day 0 of drying pH=5.89 aw=0.9784 ; at day 8 of drying pH=5.75 and aw=0.6404	pH, AW, Temperature, lactic acid available for a soft cheese made from raw milk		To be included, at least ph, aw. These parameters will be helpful in case a secondary growth/inactivation model is considered/used for simulation of bacterial behaviour all along the process. Even if not used in the simulation because only kinetic parameters of a primary growth/inactivation model are used to perform simulation, these caracteristics of the product are informative for the user.
• Description of the intervention strategy if appropriate (for example sorting rules of the raw milk based on control of hygienic practices)	Specific intervention strategies should be known to the food producers, hence a short description provided	Specific intervention strategies should be known to the food producers, hence a short description provided	Intervention strategies should be known as well as hygienic management practices to improve food safety.	Intervention strategies should be known as well as hygienic management practices to improve food safety.	Stater culture addition in fresh sausage Merguez	Oregano Essential Oil (EO) was added to a simulated sausage medium (SSM) to inactivate Salmonella spp.	Specific intervention strategies should be known to the food producers, hence a short description provided	Specific intervention strategies should be known to the food producers, hence a short description provided	National standard critical level of LM in raw milk		Sorting rules of the milk at the farm and Rules of products monitoring before being put on the market		To be able to specify in the tool that a biopreservation or any other intervention was applied. This specification will help the user to understand for example the lower value of a growth rate entered in the tool and improve the tracability of results obtained by simulation
• Challenge test data (with and/or without intervention strategies)	No need for raw data, but for the fitted kinetic parameters, in case predictive microbiology models are used	No need for raw data, but for the fitted kinetic parameters, in case predictive microbiology models are used	For those fate studies where a predictive model is not available, the users may optionally include such type of data, but preferably model parameters	For those fate studies where a predictive model is not available, the users may optionally include such type of data, but preferably model parameters	L. monocytogenes was notably reduced in Merguez samples that incorporated *E. durans* Y17 starter culture L. monocytogenes was notably reduced in Merguez samples that incorporated L. sakei Y252 starter culture	Higher concentrations favoured early inactivation of Salmonella spp. (maximum 0.3% of EO)	No need for raw data, but for the fitted kinetic parameters, in case predictive microbiology models are used	No need for raw data, but for the fitted kinetic parameters, in case predictive microbiology models are used	Challenge test with without vegetable extract (Weibull equation, time required to tenfolds reduction of ND; = 173.5 h (154.5, 192.5) β= 0.4645 (0.1495, 0.7795) x ND= 5.85 (5.578, 6.123) SE= 1.091 and R-square= 0.7056; Baranyi and Roberts Equation (2) N0 (CFU/mL) = 5.81 Lag time (h)= 25.488 μmax (log CFU/mL/h) = 0.137 Final Value, Nf (CFU/mL) = 4.934 R-square= 0.888 and SE= 0.134 Challenge test with x*CMI vegetable extract Weibull Equation (1) (h)= 44.09 (20.15, 68.03) β= 0.6929 (0.4585, 0.9274) N0 (CFU/mL) = 5.934 (5.607, 6.261) SE= 1.633 and R-square= 0.9035 Baranyi and Roberts Equation (2) N0 (CFU/mL) = 5.86 Lag time (h) =14.943 μmax (log CFU/mL/h)= 0.0257 Final Value, Nf (CFU/mL) = 3.702 R-square= 0.96 and SE= 0.172	challenge test during drying against *L.monocytogenes* with and without adding bioactive extract (control,MIC¾, MIC+3%, MIC+6%)	Behaviour of L. mono and Salmo all along the process No growth was observed		No need to include raw challenge test data. In case of only raw challenge test data available, they should be processed previously in another tool providing adjustement (such as combase) such as growth rate.
• kinetic parameters (for example growth/inactivation rates obtained with and/or without intervention strategies) assessed from challenge tests data and using predictive microbiology model or directly from the literature.	Same as above.	Same as above.	Model parameters, when available should be added as model inputs to estimate microbial growth/survival under specific conditions	Model parameters, when available should be added as model inputs to estimate microbial growth/survival under specific conditions	In the batch where *E. durans* Y17 starter culture was added, the maximum growth rate of L. monocytogenes was -0.000044 ± 0.023 log cfu/g/h, which is lower compared to the control sample with a maximum growth rate of 0.017±0.003 log cfu/g/h. In the batch where L. sakei Y252 starter culture was added, the maximum growth rate of L. monocytogenes was -0.008 ± 0.002 log cfu/g/h, which is lower compared to the control sample with a maximum growth rate of 0.017±0.003 log cfu/g/h.	In a SSM with 0.3% EO, the Weibull parameter (time required for the first log reduction) was 0.86 ±0.01.	Same as above.	Same as above.	cf. Line above	**Growth phase** at 0.0% μ_{max}=11.34 (SE=0.603); at MIC¾ μ_{max}=3.07(SE=0.172) ; at 3×MIC¾ μ_{max}=1.80 (SE=0.171) ; at 6×MIC¾ μ_{max}=2.36 (SE=0.459) ; **Inactivation phase** at 0.0% χ=223.2 (SE=14.52) at MIC¾ χ=221.8 (SE=17.28) at 3×MIC¾ χ= 222.5 (SE=17.04) at 6×MIC¾ χ=173.04 (SE=20.4)	Assessment of kinetic parameters based on challenge test data	No assessment was possible		To be able to include the growth or inactivation model parameters. These parameters will have to be distinguished in function that it feeds a primary and/or second predictive microbiology model.
• Consumption data	No need for consumption data since models will only represent the manufacturing process.	No need for consumption data since models will only represent the manufacturing process.	The consumption module may be out of the scope of the application	The consumption module may be out of the scope of the application			No need for consumption data since models will only represent the manufacturing process.	No need for consumption data since models will only represent the manufacturing process.		N.A	Available for cheese but should be actualized		Majority of the model developped are at the process level. Thus no need for consumption data.
• Dose-response model or parameters of the dose-response model, issued from the literature.	No need for consumption data since models will only represent the manufacturing process.	No need for consumption data since models will only represent the manufacturing process.	The dose response module may be out of the scope of the application	The dose response module may be out of the scope of the application			No need for consumption data since models will only represent the manufacturing process.	No need for consumption data since models will only represent the manufacturing process.	No dose-response model	N.A	Taken from scientific littérature		Majority of the model developped are at the process level. Thus no need for dose response model and/or parameters of dose response model.
• Sampling plans applied to a batch before being on the market or during production	No need for assessing microbiological criteria	No need for assessing microbiological criteria	Sampling plans may be out of the scope of the application. However, information regarding microbial prevalence, concentration could be exported to other software tools dedicated to sampling plans performance	Sampling plans may be out of the scope of the application. However, information regarding microbial prevalence, concentration could be exported to other software tools dedicated to sampling plans performance			No need for assessing microbiological criteria	No need for assessing microbiological criteria	Sampling plans applied to a batch before being on the market	Sampling plan applied to 4 batches during production N = 1000 n = 3 Sample size c = Acceptability criteria d= Number of defectives observed	Programmed next to the risk assessment model		No need to assess the performance of sampling plan at that stage. Outputs obtained with the simulation should be exported to dedicated tools such as Microfibro
POSSIBLE OUTPUTS OF THE PROCESS RISK MODEL												
• Contamination level of the raw material or the products during production or the finished product (including prevalence, concentration and associated variability)	Microbiological occurrence (prevalence/concentration) should be the main output of the process risk model	Microbiological occurrence (prevalence/concentration) should be the main output of the process risk model	This information would be used as the main model output. Variability between batches may be considered as well.	This information would be used as the main model output. Variability between batches may be considered as well.	Contamination level of the finished product was 3.77 Log CFU/g	Contamination level of the finished product is 6.25 Log CFU/g	Microbiological occurrence (prevalence/concentration) should be the main output of the process risk model	Microbiological occurrence (prevalence/concentration) should be the main output of the process risk model	Initial value(challenge)=5.809 CFU/mL	N.A	Provided by the model		Contamination level, expressed as prevalence and/or concentration of the finished products, should be the main outputs of the decision-support tool.
• Contamination level of the raw material or the products during production or the finished product (including prevalence, concentration and associated variability) following the implementation of the intervention strategies	The final contamination level applying the intervention strategy should be compared to the baseline scenario (no biointervention used)	The final contamination level applying the intervention strategy should be compared to the baseline scenario (no biointervention used)	This information could be included to compare the effectiveness of the intervention strategy against a baseline condition.	This information could be included to compare the effectiveness of the intervention strategy against a baseline condition.	After 144 hours, the contamination level of L. monocytogenes in the finished product, where *E. durans* Y17 starter culture was added, was found to be 3.69 Log CFU/g. After 144 hours, the contamination level of L. monocytogenes in the finished product, where L. sakei Y252 starter culture was added, was found to be 3.0 Log CFU/g.	After 6 hours of exposure to oregano EO, Salmonella spp. was not detected in any of the samples.	The final contamination level applying the intervention strategy should be compared to the baseline scenario (no biointervention used)	The final contamination level applying the intervention strategy should be compared to the baseline scenario (no biointervention used)	Final Value of finished product with CMI, N_f (CFU/mL) = 3.702	N.A	Provided by the model for intervention strategy based on sampling		Contamination level, expressed as prevalence and/or concentration of the finished products, should be the main outputs of the decision-support tool. The information on the biopreservation or any other intervention applied will help distinguish the "intervention scenario" versus "the no intervention scenario" (baseline).
• Relative impact of the process on the contamination (number of log reduction/increase of the microbial population	This would be an interesting comparator statistics to have, if possible.	This would be an interesting comparator statistics to have, if possible.	Increase/decrease of microbial population during manufacturing would be useful as a performance indicator of the process.	Increase/decrease of microbial population during manufacturing would be useful as a performance indicator of the process.			This would be an interesting comparator statistics to have, if possible.	This would be an interesting comparator statistics to have, if possible.	Final Value of the finished product without CMI, Nf (CFU/mL) = 4.877	N.A	Provided by the model as a percentage of risk reduction when applying a specific sampling protocol		If possible. If not, the user may compare the results of two scenarios outside the tools, in a Excel sheet for example.
• Exposure of consumers to selected pathogens when eating artisanal foods (prevalence and/or concentration of the consumption units or dose ingested by portion/period, with associated variability)	No need for this. In any case the application is intended for processing only. Secondly, not all countries have consumption data.	No need for this. In any case the application is intended for processing only. Secondly, not all countries have consumption data.	As stated in the model inputs section, this information seems to be out of the scope of the application.	As stated in the model inputs section, this information seems to be out of the scope of the application.			No need for this. In any case the application is intended for processing only. Secondly, not all countries have consumption data.	No need for this. In any case the application is intended for processing only. Secondly, not all countries have consumption data.	No available data	N.A	Provided by the model		No need
• Risk of foodborne disease (function of the consumer profile (i.e., more or less susceptible people) as well as eating habits (i.e., ready-to-eat or intended to be eaten cooked)	There is no need to conduct risk characterisation.	There is no need to conduct risk characterisation.	Since the application is mainly focused on assessing the effect of processing variables on the final microbial growth/survival, these outputs may not be considered.	Since the application is mainly focused on assessing the effect of processing variables on the final microbial growth/survival, these outputs may not be considered.	Less susceptible people/Intended to be eaten cooked	Less susceptible people/Intended to be eaten cooked	There is no need to conduct risk characterisation.	There is no need to conduct risk characterisation.	•more susceptible people, ready-to-eat product	N.A	Provided by the model		No need
• Probability of detection of a contaminated batch and/or operating characteristic curves	No need for assessing microbiological criteria	No need for assessing microbiological criteria	As stated in the model inputs section, this information seems to be out of the scope of the application.	As stated in the model inputs section, this information seems to be out of the scope of the application.			No need for assessing microbiological criteria	No need for assessing microbiological criteria	Put % of detectection based on 10 producers, detection of nbre pf product/10, and % de producteur chez qui tu as détecté LM, analyse LABoet	N.A	Provided by the model		No need
• Percentage of products meeting regulatory requirements	This would be an interesting statistics to have, if possible.	This would be an interesting statistics to have, if possible.	A threshold values to include microbial limits according to national/international regulations may be added as a comparison. Percentage of units above/below these limits is useful to be reported.	A threshold values to include microbial limits according to national/international regulations may be added as a comparison. Percentage of units above/below these limits is useful to be reported.			This would be an interesting statistics to have, if possible.	This would be an interesting statistics to have, if possible.	Put % of no detectection based on 10 producers, no detection of nbre pf product/10, and % de producteur chez qui tu as détecté LM, analyse LABoet	N.A	Not provided by the model		If possible, the tool could include a treshold value (from regulation for example), expressed either as a concentration and/or a percentage of contaminated products, to which the output of the simulation could be compared. These values should be included as inputs in the tool, and an appropriate output should be generated for the comparison.
POSSIBLE features to be implemented in the Artisanalfood decision-support tool												
• Database browser containing challenge test data	Raw data is already part of a deliverable, so no need for creating database browser.	Raw data is already part of a deliverable, so no need for creating database browser.	This information is already included in previous deliverables.	This information is already included in previous deliverables.			Raw data is already part of a deliverable, so no need for creating database browser.	Raw data is already part of a deliverable, so no need for creating database browser.	Yes	Yes	No		No need since already provided in previous deliverables
• Database browser of kinetic parameters	Kinetic parameters are compulsoy and should be hidden in the application. Users should not be able to alter the kinetic parameters.	Kinetic parameters are compulsoy and should be hidden in the application. Users should not be able to alter the kinetic parameters.	This information should be included and considered for microbial predictions. Nevertheless, it can be only edited by administrators.	This information should be included and considered for microbial predictions. Nevertheless, it can be only edited by administrators.			Kinetic parameters are compulsoy and should be hidden in the application. Users should not be able to alter the kinetic parameters.	Kinetic parameters are compulsoy and should be hidden in the application. Users should not be able to alter the kinetic parameters.	Yes	Yes	No		Kinetic parameters should be present in the tool to allow performing simulations of bacterial behaviour. However no database of kinetics parameters is needed as a module of the tool
• Database browser of predictive microbiology models	This is not the objective of the platform; other tools contain predictive microbiology models	This is not the objective of the platform; other tools contain predictive microbiology models	This is out of scope of the application.	This is out of scope of the application.			This is not the objective of the platform; other tools contain predictive microbiology models	This is not the objective of the platform; other tools contain predictive microbiology models	Yes, Weilbul and Baranyi models	Yes, Weilbul and Huang models	Predictive models developped within the model should be available through simulations of bacterial behaviour only		Predictive microbiology models developped during the project will be integrated in the tool and used to perform simulation using kinetic parameters uploaded. However no database of predictive microbiology models is needed as a module in the tool
• Growth/no growth predictor	This is not the objective of the platform; other tools contain predictive microbiology models	This is not the objective of the platform; other tools contain predictive microbiology models	This is out of scope of the application.	This is out of scope of the application.			This is not the objective of the platform; other tools contain predictive microbiology models	This is not the objective of the platform; other tools contain predictive microbiology models	Growth	yes	No		No need. A majority of growth models were developped. Other tools such as Sym'previus" propose growth/no growth interface with a probability of growth according to specific environmental conditions
• Growth fitting tool	This is not the objective of the platform; other tools are able to fit microbial kinetic models.	This is not the objective of the platform; other tools are able to fit microbial kinetic models.	This is out of scope of the application.	This is out of scope of the application.			This is not the objective of the platform; other tools are able to fit microbial kinetic models.	This is not the objective of the platform; other tools are able to fit microbial kinetic models.	• Growth fitting tool	It software	No		The fitting activity should be performed outside the tool.
• Inactivation fitting tool	This is not the objective of the platform; other tools are able to fit microbial kinetic models.	This is not the objective of the platform; other tools are able to fit microbial kinetic models.	This is out of scope of the application.	This is out of scope of the application.			This is not the objective of the platform; other tools are able to fit microbial kinetic models.	This is not the objective of the platform; other tools are able to fit microbial kinetic models.	• Inactivation fitting tool	It software	No		The fitting activity should be performed outside the tool.
• Growth predictor	This is not the objective of the platform; other tools contain predictive microbiology models in prediction mode.	This is not the objective of the platform; other tools contain predictive microbiology models in prediction mode.	This is out of scope of the application.	This is out of scope of the application.			This is not the objective of the platform; other tools contain predictive microbiology models in prediction mode.	This is not the objective of the platform; other tools contain predictive microbiology models in prediction mode.	• Growth predictor	Growth rate and lag phase	Results for growth predictions should be available		The simulation of the behaviour of the microorganisms, all along the process should be possible with the tool. However, it shouldn't be restricted to growth only.
• Inactivation predictor	This is not the objective of the platform; other tools contain predictive microbiology models in prediction mode.	This is not the objective of the platform; other tools contain predictive microbiology models in prediction mode.	This is out of scope of the application.	This is out of scope of the application.			This is not the objective of the platform; other tools contain predictive microbiology models in prediction mode.	This is not the objective of the platform; other tools contain predictive microbiology models in prediction mode.	• Inactivation predictor	Time required for the first Log reduction and shape of the inactivation curve	Results for inactivation predictions should be available		The simulation of the behaviour of the microorganisms, all along the process should be possible with the tool. However, it shouldn't be restricted to inactivation only.
• Risk assessment tool	This is not the objective of the platform, since the platform is intended for artisanal producers. The simpler the better.	This is not the objective of the platform, since the platform is intended for artisanal producers. The simpler the better.	This is out of scope of the application.	This is out of scope of the application.			This is not the objective of the platform, since the platform is intended for artisanal producers. The simpler the better.	This is not the objective of the platform, since the platform is intended for artisanal producers. The simpler the better.	Yes	Yes	No		No need
• Model comparison of results obtained with the baseline scenario vs scenario with intervention strategy (for example relative risk reductions)	A simple statistic that should be presented as an output	A simple statistic that should be presented as an output	A percentage or relative index can be included as model comparison.	A percentage or relative index can be included as model comparison.			A simple statistic that should be presented as an output	A simple statistic that should be presented as an output	Yes	Yes	If possible		If possible
• Sensitivity analysis module to find the parameters of the model having the most impact on the output	This is not the objective of the platform, since the platform is intended for artisanal producers. The simpler the better.	This is not the objective of the platform, since the platform is intended for artisanal producers. The simpler the better.	This is out of scope of the application.	This is out of scope of the application.			This is not the objective of the platform, since the platform is intended for artisanal producers. The simpler the better.	This is not the objective of the platform, since the platform is intended for artisanal producers. The simpler the better.	Yes, Weilbul and Baranyi models, R2: 0.71-0.96	Yes, Weilbul and Huang models, coefficient R2: 0.9854-0.9675 and (RSS),(RMSE).	Provided by our model but very difficult to generalize		No need
• Sampling plan tool	This is not the objective of the platform, other apps such as Microfibro can design sampling plans.	This is not the objective of the platform, other apps such as Microfibro can design sampling plans.	This is out of scope of the application.	This is out of scope of the application.			This is not the objective of the platform, other apps such as Microfibro can design sampling plans.	This is not the objective of the platform, other apps such as Microfibro can design sampling plans.	No	Yes	Provided by our model but very difficult to generalize		No need
• Control chart tool in the context of statistical process control for microbial counts	This feature would be very useful for artisanal producers to detect deviations from their processes. Simple to use, and allow producers to have their data recorded in the app.	This feature would be very useful for artisanal producers to detect deviations from their processes. Simple to use, and allow producers to have their data recorded in the app.	This is very interesting for industrials in order to know potential deviations of the production process.	This is very interesting for industrials in order to know potential deviations of the production process.			This feature would be very useful for artisanal producers to detect deviations from their processes. Simple to use, and allow producers to have their data recorded in the app.	This feature would be very useful for artisanal producers to detect deviations from their processes. Simple to use, and allow producers to have their data recorded in the app.	Yes	Yes	Very interesting feature		Important to have this feature in the tool