Universidade Federal de Pernambuco
Center for Decision Systems and Information Development

Flexible and Interactive Tradeoff (FITradeoff)

PRATICAL USER GUIDE

Recife, 2021

SUMMARY

PRACTICAL USER GUIDE

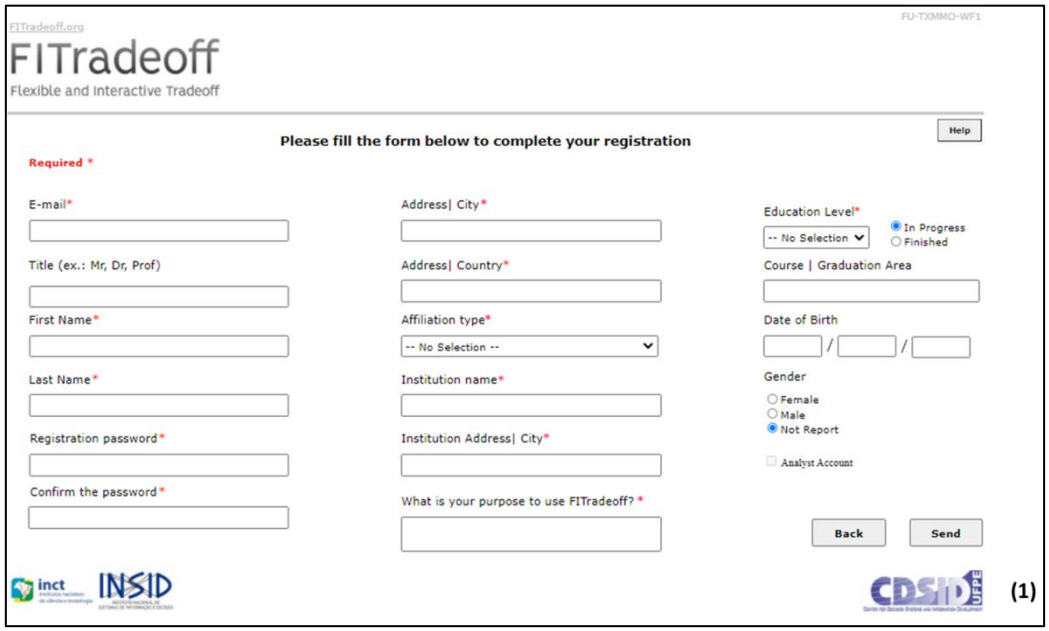
1. The System

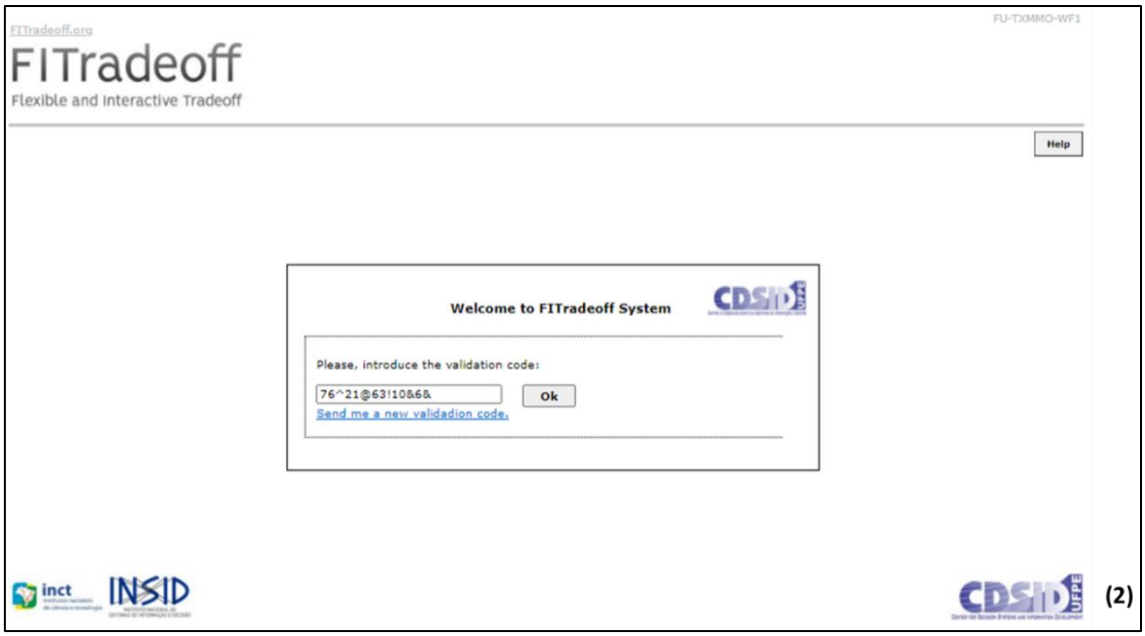
FITradeoff - Flexible and Interactive Tradeoff Elicitation FU-TXMMO-WF1 elicits the scale constants of the additive model in a flexible and interactive way for the problems of choice and ranking, its DSS is available at http://cdsid.org.br/fitradeoff/. This version allows the use of linear and non-linear value functions, conducting holistic evaluations to inform dominance relations between the alternatives of the problem, besides allowing the performance of sensitivity analysis of the results. The Decision Support System (DSS) was developed in Delphi environment and uses the LP Solve package to solve linear programming. A C++ package is used for the same purpose.

2. Access

To access the FITradeoff system, the user should fill out the form on the website **(1)**. Then, an email containing a verification code will be sent to the address provided, this code must be entered during the first access tothe DSS.

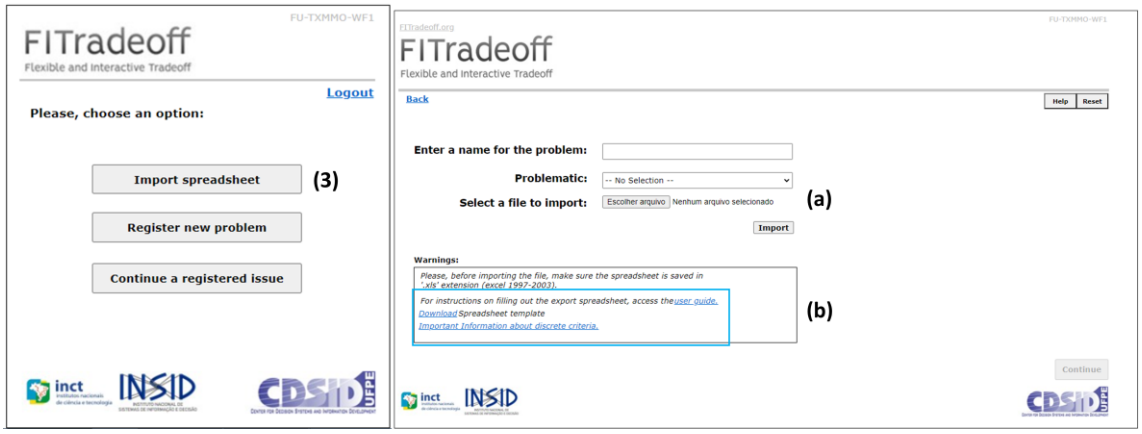
We reinforce that the user must use the email and password registered since the first access to the DSS, the verification code will only be requested after the access to the system **(2)**. If necessary, it is possible to request a new confirmation code.



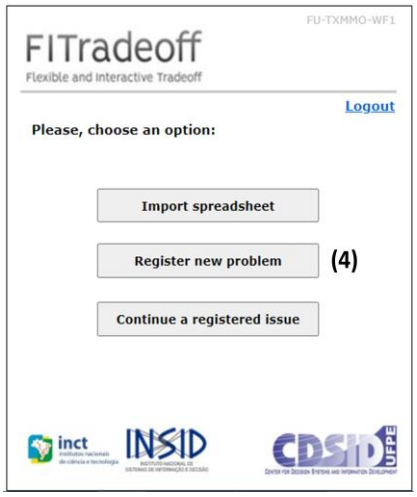


3. Data Entry

The new FITradeoff system allows the entry of data via Excel spreadsheet in the format.xls(compatibility 2003)**(a)**. For this purpose, the user should click on the"Import spreadsheet"option after accessing the system **(3)**. On the input screen it is possible to download a template spreadsheet to introduce the problem and view practical information regarding the use of discrete criteria**(b)**.

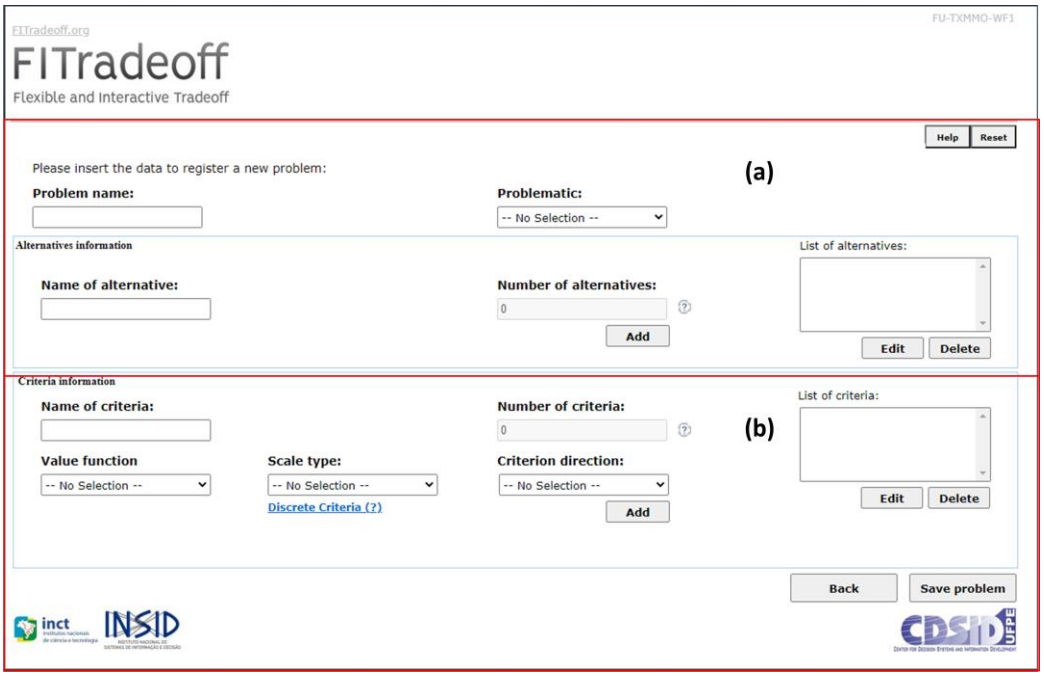


It is also possible to introduce the problem data manually, which can be especially useful for the ones who do not use Excel. For that, the user should click on "Register new problem"**(4)**.



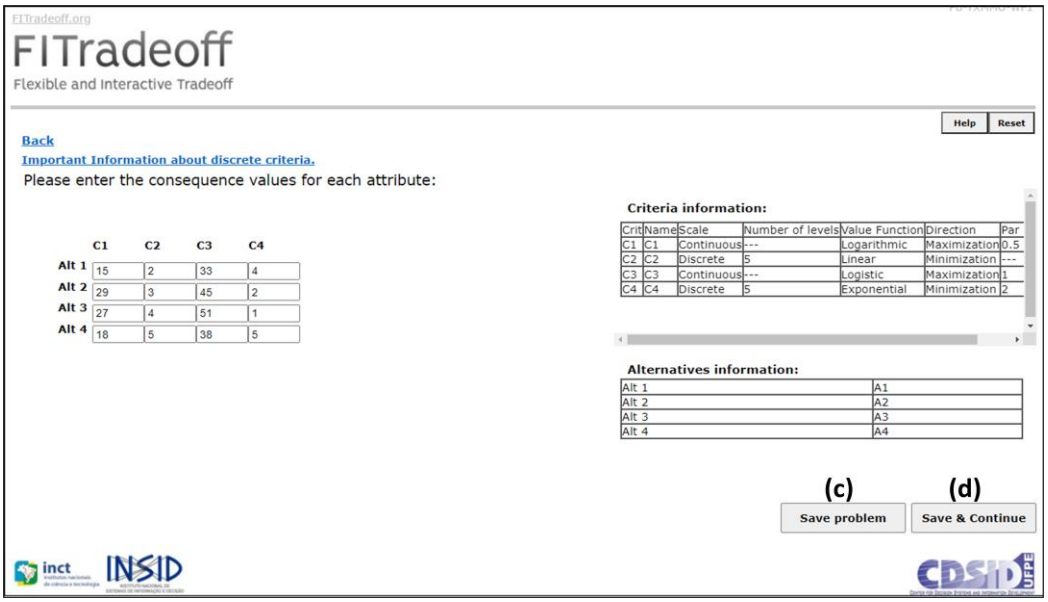
In order to guarantee the correct operation of FITradeoff DSS, the user shall fill in all the fields on the data entry page. Initially, thedecision-maker (DM)mustenter some information such as the problem name, the type of the problem(whether it is a choice or a ranking problem), as well as the alternatives names. The system will count the number of alternatives as the DM introduces its names.

Then, the DM shall declare the criteriaas well as the typeof theirvalue functions. In case of a non-linear value function, its parameters values shall be informed.The DM shall also inform whether the criterion scale is continuous or discrete, and in the second case, introduce the respective number of levels. Finally, it is required to inform the criteriapreference direction(maximization/minimization). To save the criterion information, the user shall click on the button “Add”.



By clicking on "Save problem"**(c)**, the system will save all the information introduced so far. The DSS also presents the “Save & Continue” option**(a).**, that leads to the next steps in the problem resolution, being only possible when all the consequences values have been added in the editable matrix.

Important: all the information regarding the declared criteriashall be informed.



3.1 Data entry: What is new in this release?

The new FITradeoff system makes it possible to use non-linear value functions for intra-criterion evaluation. Currently, in addition to the linear function already considered in previous versions of the DSS, it is possible to considered exponential, logarithmic and logistic functions. In such cases, the user must provide the function parameters 'a' and 'b'. Where 'a' ≥ 0 and 'b' $\neq 0$.

Code	Function	Equation
1	Linear	$v_{ij}(x_i) = \frac{x_i - Min(j)}{Max(j) - Min(j)}$
2	Exponential	$v_{ij}(x_i) = be^{ax_i}$
3	Logarithmic	$v_{ij}(x_i) = bln(ax_i)$
4	Logistics	$v_{ij}(x_i) = be^{\frac{-a}{x_i}}$

Another point that demands attention refers to the evaluation of discrete criteria.The DSS currently considers a global scale. In other words, if the user informs

the system that the constructed scale consists of 'n' levels, all of these levels will be considered in the intra-criterion evaluation even though the consequence matrix may not have consequences belonging to all those levels.

For instance, consider a maximization criterion consisting of seven discrete levels, when performing the intra-criterion evaluation, the system will consider that the best and worst consequences are, respectively, seven and one without checking whether there are alternatives with those consequences. In addition,the DMshould be aware of the predefined scales accepted by the DSS. The table below presents the possible consequences for the discretescale criteria according to the number of levels reported.

Number of levels	Scale Levels (Discretization)
2	0.1 (Binary Criterion)
3	1,2,3
4	1,2,3,4
5	1,2,3,4,5
6	1,2,3,4,5,6
7	1,2,3,4,5,6,7

Important information:

1. If the criterion cannot be evaluated according to the scales presented above, it is possible to make an approximation by considering them as continuous.
2. For 2-level discrete criteria, a consequence with a value of 0 does not necessarily indicates the absence of ownership, but only that the alternative has the worst income.

4. Model Sheet

To enter the input data into the FU_TXMMO_WF1, the Excel spreadsheetintroducedshould have the FITradeoffstandard format. The information should be filled in as follows: **(a)**criteria name, **(b)**type of criteria, **(c)**types of value function, **(d)**parameters, in case of non-linear value function, **(e)**number of discrete scale levels,**(f)** the alternatives namesand **(g)**its consequences values.

Excel Cell	A	B	C	D	E	
1	Criteria	Criterion 1	Criterion 2	Criterion 3	Criterion 4	(a)
2	0- Cont Min; 1- Cont Max 2- Disc Min; 3- Disc Max;					(b)
3	Weights:					
4	Type:					(c)
5	a:					(d)
6	b:					
7	c:					(e)
8	Alternatives:	Consequences Matrix				(f)
9	Alternative 1					
10	Alternative 2					(g)
11	Alternative 3					
12	Alternative 4					

Criteria: Row 1 should be filled in, starting from column B, with the name of the problem criteria. The number of columns will change according to the number of criteria considered in the problem. In the figure, there is a 4-criteria-problem.

Type of criteria: There are four types of criteria that can be assigned to the problem criteria: Cont Min, Cont Max, Disc Min, and Disc Max;

Type of criterion	description
0- Continuous minimization	Criterion with any value within the limited range by the minimum and maximum assumed performances. The lower the value in the criterion, the more preferred it is.
1- Continuous maximization	Criterion with any value within the limited range by the minimum and maximum assumed performances. The higher the value in the criterion, the more preferred it is.
2- Discret minimization	Discrete criteria admit only values on an established point scale (Section 3). The lower the value in the criterion, the more preferred it is.
3- Discret maximization	Discrete criteria admit only values on an established point scale (Section 3). The higher the value in the criterion, the more preferred it is.

Type of value functions: Line 4 must be filled with the type of value function that each criterion will assume during intra-criterion evaluation. The values recognized by FITradeoff rangefrom 1 to 4. In which 1-linear function, 2-exponential function, 3-logarithmic function and 4-logistic function (S-Shape);

Parameters: Parameters 'a' and 'b' (lines 5 and 6) shall be filled in whenever the value function considered is non-linear, otherwise, the fields shall be blank.

Scale levels: See information presented in section 3;

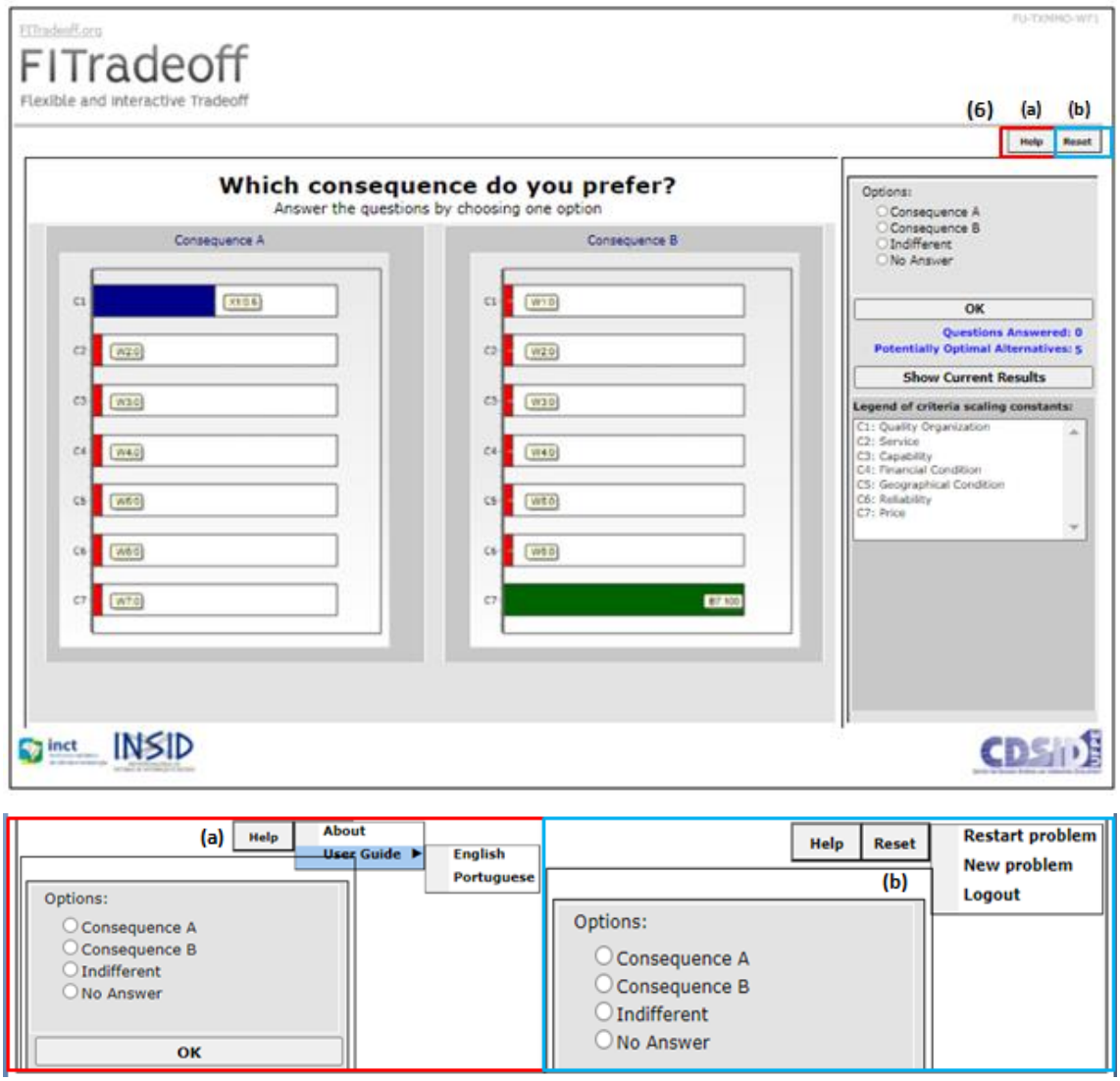
Alternatives: From row 9onward, column A of the Excel spreadsheet represents the name of the alternatives for the problem. The number of rows will change according to the number of alternatives considered. In the figure, there is a 4-alternatives-problem;

Consequence Matrix Values: Each cell in the consequence matrix represents the performance of an alternative evaluated against a criterion. For example, cell B10 should be filled with the value that represents the performance of Alternative 2 in criterion C1.

5. Resuming Problems

By choosing "Continue a registered issue" **(5)** it is possible to resume registered problems, even those ones that had already been solved. This option is useful in cases of a network outage or ccasesthat the decision-maker wishes to redo it.

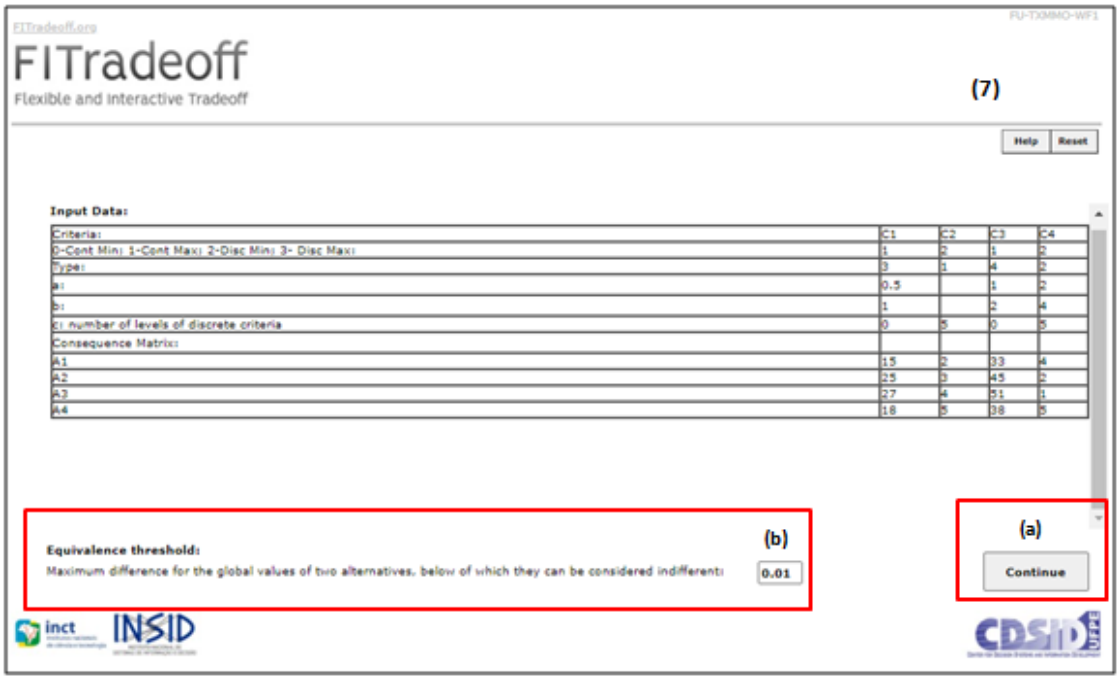
By selecting this option, the user will be redirected to the running point at the time of the break. If the DM wish to restart the problem resolution, it may be donebyclicking on the reset button available on the different screens of theDSS and then selecting the option "Restart problem" **(6).**If necessary, it is possible to download this user guide or even consulting the FITradeoff method references by clicking on “Help”.



6. Input Page

After entering the problem information, the "Input" page will be displayed to the user, there all the information imputed by the decision-maker is presented**(7)**. In this page, it is rather important to pay attention tothe "Equivalence threshold" **(b)**. This value refers to the maximum difference that the global valuereferring to a pair of alternatives can assume for such alternatives to be considered indifferent to each other. If the DM introducesthe value zero, then a pair of alternatives will be considered indifferent, only if such alternatives have the sameglobal value for the entire viable weight space.

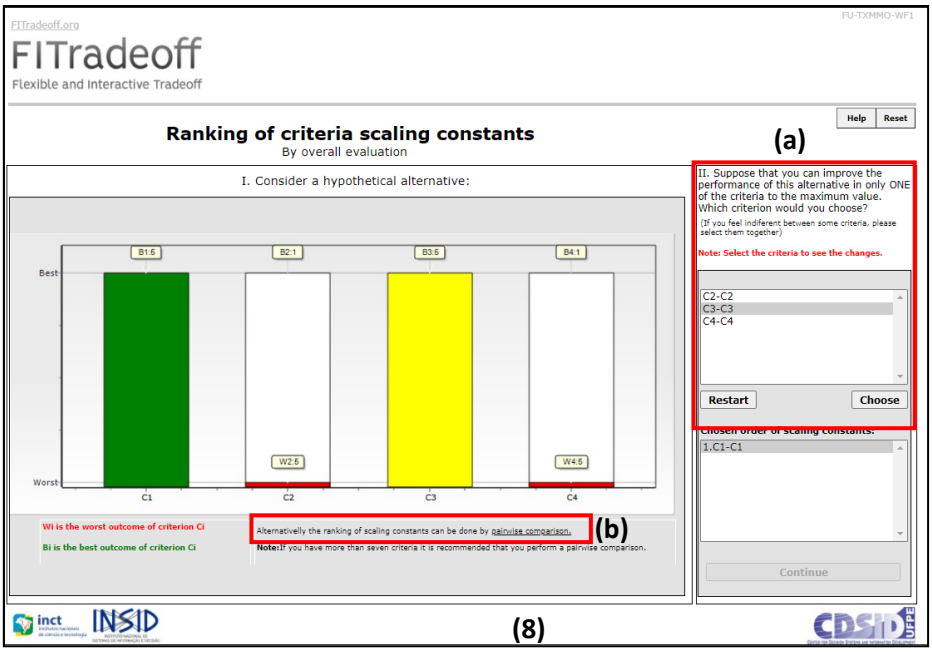
On this same page, after checking the imputed data, the decision-maker should click on “continue”**(a)**tostart the flexible elicitation by ranking the criteria scaling constants.



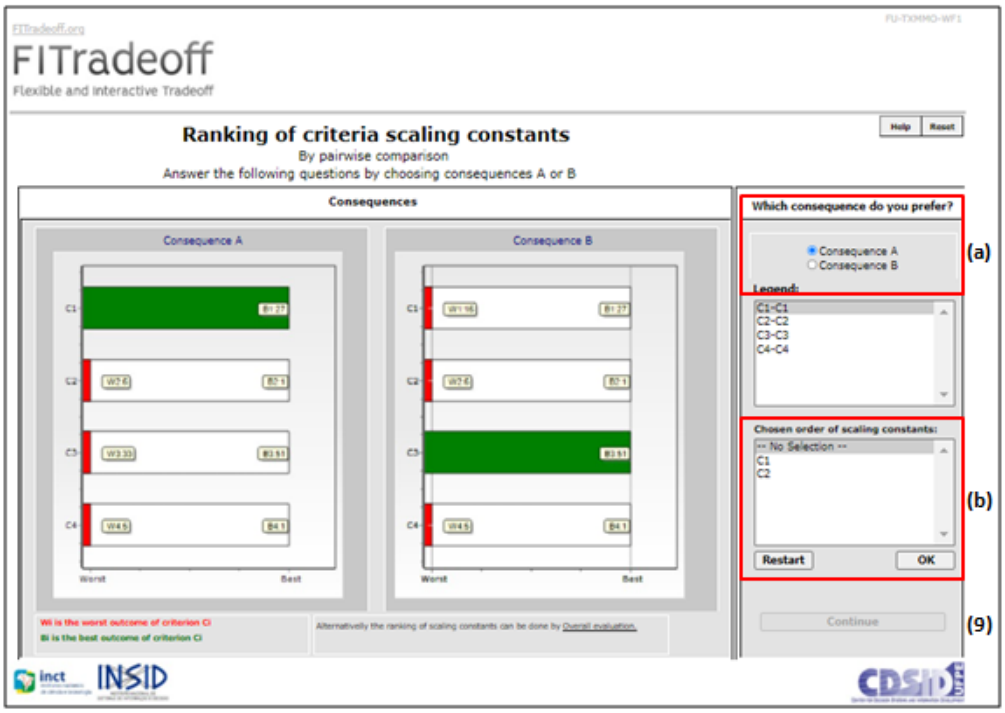
7. Weight Ordering

As available in the standaloneversions of the system, the DSSmakes it possible to carry out the ordering of weights both through overall evaluation and through pairwise comparison between the criteria.

When ordering the criteria by overall evaluation **(8)**, initially, the criteria should be ordered according to itsexpectedimpactin the final result, tanking into account the decision-maker’s preferences besides of the criteria consequences range of values. The DMshould click on the criterion thathe/she considersto have the highest value of scale constant, assuming that it will have its performance optimized to the best possible value. The performance bar of the selected criterion will be indicated in yellow and after clicking on the"choose"button, it will become green. This process should be repeated until all criteria are ordered.

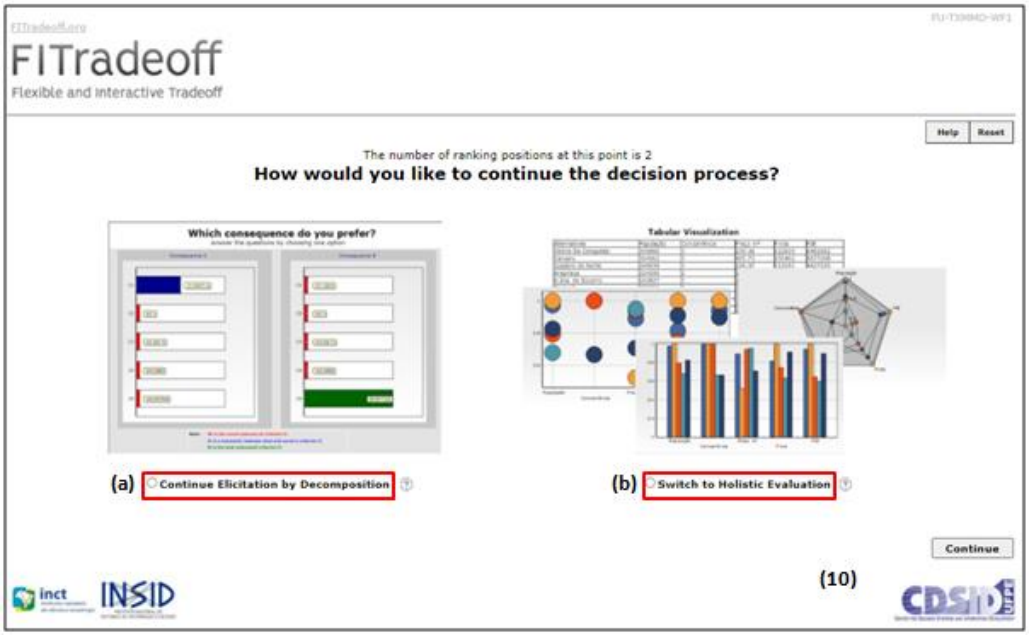


When ordering the criteria by pairwise comparison **(9)**, a hypothetical situation of comparison is presented in graphs, the decision-maker should select whether he/she prefers the consequence A or consequence B **(a)**. The DSS considers a Heuristic to reduce the number of questions asked. As the DM answers the questions, the criteria orderareupdated in the "Chosenorder"box (**b)**.



8. Flexible Elicitation

Having ordered the weights, the decision-maker may then choose between continuing the procedure through Elicitation by Decomposition **(a)** or switch to Holistic Evaluation **(b)**. The " ? " icon provides additional information regarding each procedure.



Along the Elicitation by Decomposition procedure two hypothetical consequences are presented to the DM, in the first scenario, an intermediate consequence value is displayed in a criterion (for which the associated weight appears better positioned in the ranking) and the worst consequencefor all the others, whereas the second scenario presents the best consequence for a subsequent criterion and the worst performance for the others.

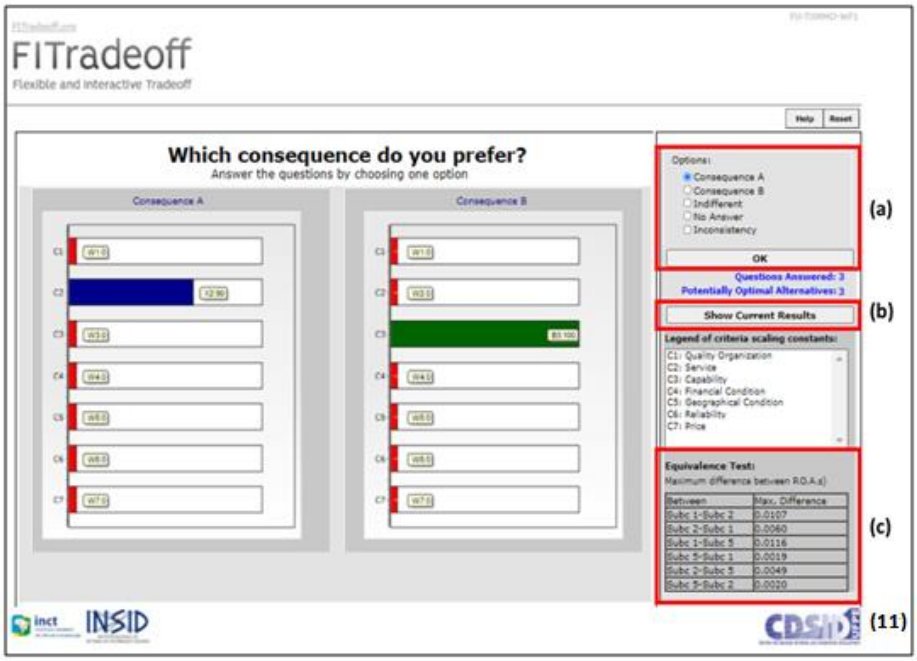
The decision maker is then asked which consequencehe/she prefers**(a)**.The possible answers are "ConsequenceA" to prefer the first consequence presented in the leftmost graph, "ConsequenceB" to prefer the second consequence. It is also possible to choose an indifference, when the decision-maker is equally satisfied with any of the consequences presented. The preferences reported will be used for the construction and resolution of a LPP, enabling the establishment of relationships between alternatives based on the partial information obtained from each question.

The option "No answer" should be selected when for some reason the decision-maker does not wish to answer the question presented, in this case, the DSS will ask the

reason for such an answer and will notask questions for that pair of criteria anymore. The answer "Inconsistency" should be used only when the decision-makerunderstands,from a question presented, he/she has reported some inconsistent preference throughout the process, in this case the DSS will make it possible to return to the previous question or even restart the flexible elicitation without losing the ordering of the weightsinformation.

When,in the problem of choice, up to three potentially optimal alternatives remain, an equivalence test is performed between the remaining alternatives**(c)**. The test consists of verifying whether the maximum difference between each alternative of the group is less than or equal to the equivalent distance value previously reported, if the hypothesis is verified, the DSS returns the alternatives considering them indifferent, otherwise, the test results are presented displaying the maximum difference between the alternatives evaluated pairwise (thedecision-maker himself can use thisinformation to decide if he/she wish to stop the process).

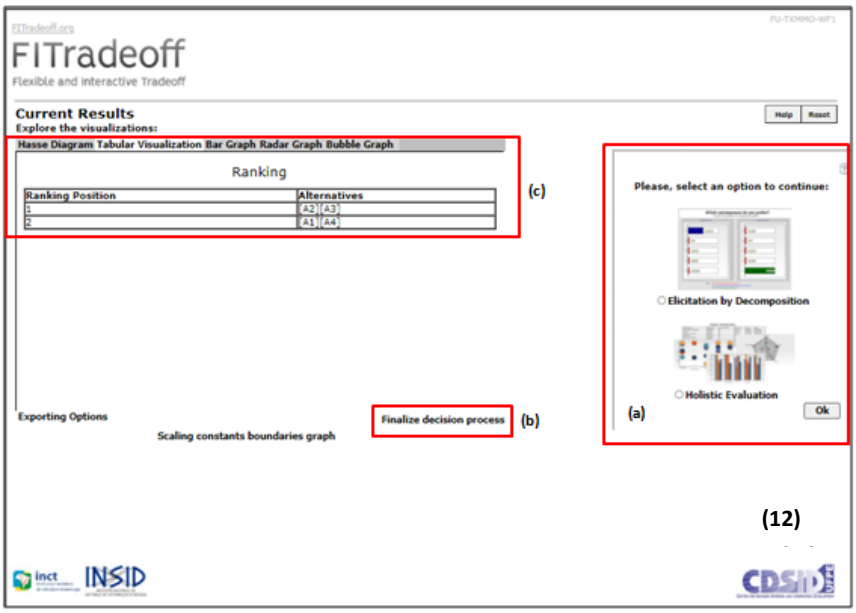
The option for viewing partial results (b) is available on the flexible elicitation screen, by selecting it the decision-makers may visualize the results obtained so far through tabular and graphical visualizations. The DM can also export the data at any time.



9. Results Screen

It is possible to access the results screen either during the flexible elicitation, by displaying the partial results, or at the end of process**(12)**. This page presents the tabular and graphical views of the results obtained based on the current level of information.

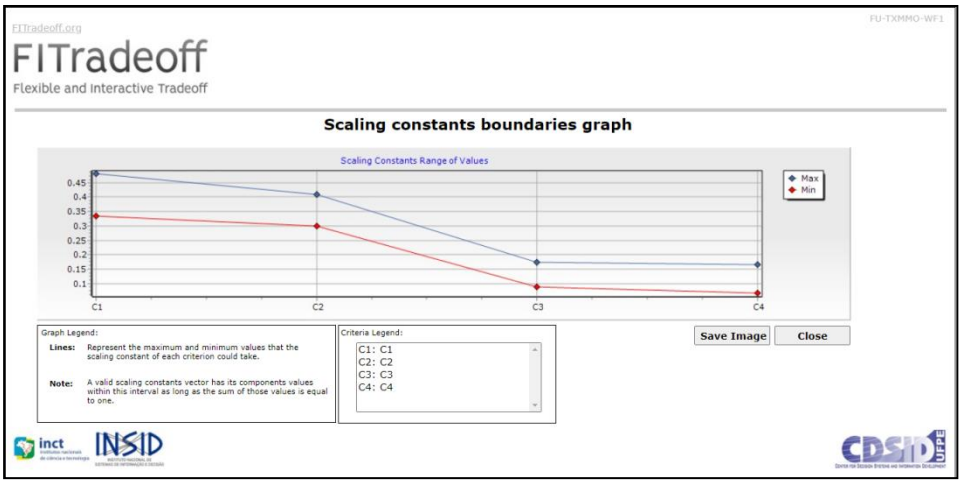
Four types of visualizations are provided, in which three of them are graphical: bar, bubble and radarchart**(a)**. Such visualizations help the decision-maker to observe the differences of each alternative when evaluated against the problem criteria in a more intuitive way, providing him/herwith tools for a better decision.



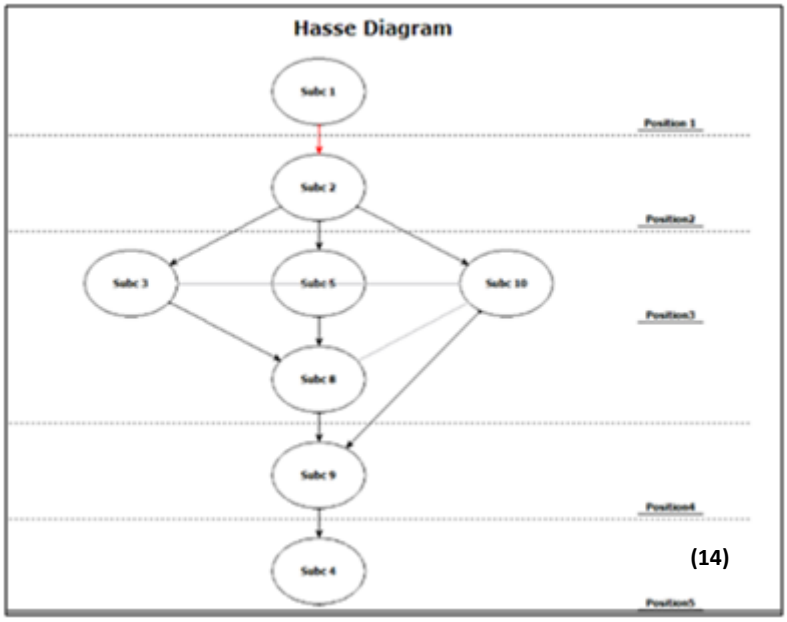
In this page it is also possible tofinalize the elicitation process. This optioninforms the system that either the decision-maker no longer wishes to answer the questions, or the information generated up to that moment is enough for his/hers purposes.

Important: Once requested to interrupt the process, it will only be possible to return to the elicitation by restarting the problem.

FITradeoff also provides a graph containing the range of admissible values for thecriteria scaling constants **(13)**, this graph is updated after each preference statement allowing the DMto observe the behavior of the weight space throughout the process. This graph can be exported by clicking on “Save Image”.



Additionally, when the problem consists of ranking alternatives, theHasse Diagram (HD) is also available. This graph shows the dominance relationships established between the alternatives and the different levels that these alternatives arein the ranking **(13)**.



(14)

In brief, the diagram presents the positions in which the alternatives occupy in the ranking, as well as thedominance relationships established between pairs of alternatives, which are represented by the arcs or links. The diagram will be available as soon as the decision-maker access the partial or final results, being necessary to wait for three seconds so then the button “Hasse Diagram” becomes enabled.

When it comes to the representation of the dominance relationships stablished through decomposition and the holistic evaluation, this version of FITradeoff DSS portrays it by using different colors of arcs. Alternatives that remain without arcs up to the current level of information, are considered as incomparable so far. The table below summarizes this information,which is illustrated in figure **(14).**

ARC COLOR	RELATION
Black	Dominates/Dominatedby Flexible Elicitation
Red	Dominates/DominatedbyHolistic Assessment
Grey	Indifference

10. Holistic Assessment

Holistic evaluation (HE) is undoubtedly the greatest differential of this version of the FITradeoff decision support system since it combines different concepts for decision support. The new DSS enables the decision-maker to introduce information both through decomposition evaluation (flexible elicitation) and holistic evaluation.

10.1 What does this mean in practice?

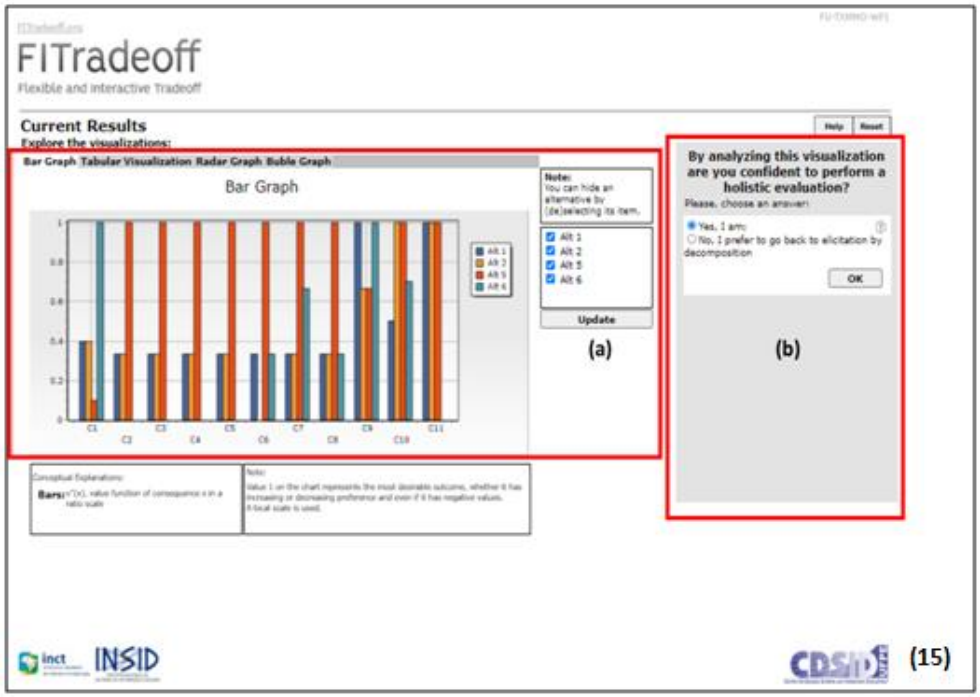
With the introduction of holistic evaluation, the decision-maker can, throughout the elicitation process, make comparisons between problem alternatives. To do this, he/sheshould use any of the four views available in the system (bar, radar, bubblechartor tabular visualization) **(16)**. If the decision-maker feels comfortable, he/she can inform relations of preferences between those alternatives. Such relationships willbe included in the linear programming model, soonly weight vectors in agreement with the informed relations are considered. In thisway, the DSS incorporates a new source of relevant information to the resolution of the problem.

To perform the HEthe DM should follows the steps described below:

Step 1: On the partial results page, choose to continue the elicitation procedure by performing a Holistic Evaluation and click on “Ok”;

Step 2: Choose the type of visualization in which you feel most comfortable to performthe evaluation. It is possible to deselect the alternatives and update the charts so that only the desired alternatives **(a)** are displayed;

Step 3: Answer the question displayed in the bar on the right side of the screen **(b)**.If it was possible to find a type of visualization that you comfortable with, answer "yes" to continuethe process, otherwise select “no” and click on “Ok”.

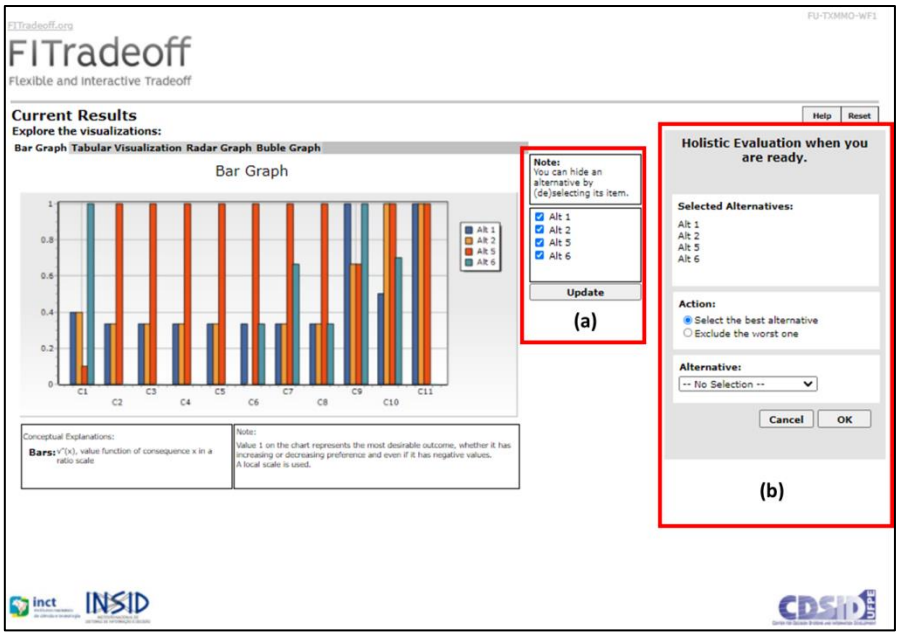


10.2 Choice problem

Step 4: Having chosen to proceed, a group of alternatives should be chosen (≥ 2) containing the onesyou wish to evaluate holistically **(a).** In this case, you shall select only the alternatives that you wish to evaluate and then click on “Update”**;**

Step 5: If youselected more than two alternatives, you should choose between excluding a single alternative from the group or selecting the one that is considered the best **(b)**. If only two alternatives have been selected, the system automatically considers that this is the selection of the best alternative in the pair;

Step 6: Choose the alternative. The chosen alternative will be eliminated or indicated as the best one of the group, leading to the elimination of the others. The action taken will depend on the previous step.



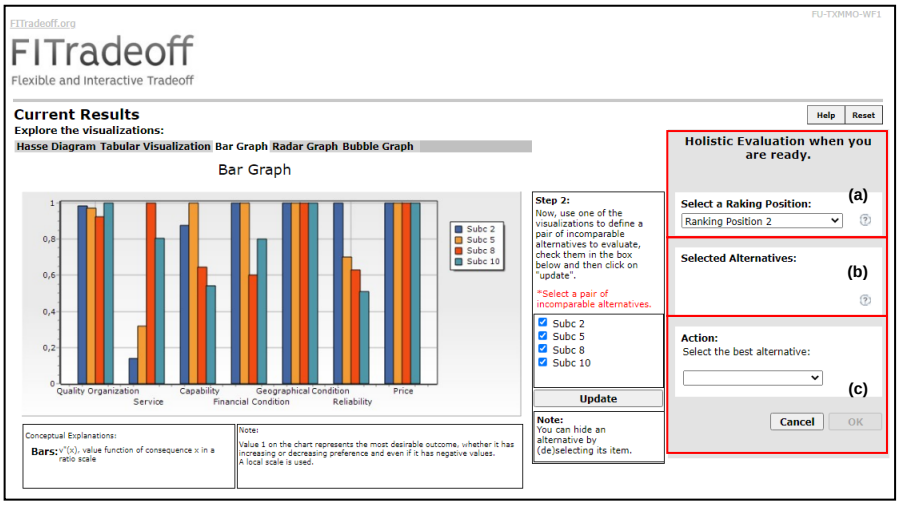
10.3 Ranking problematic

Step 4: Havingchosen to proceed, the decision-maker will be invited to choose a ranking positionin which he/she wants to evaluate the alternatives.Note that only ranking positionin which there is at least a pair of incomparable alternativesfor the current level of information will be displayed **(a).** In order to evaluate the dominance relations, the DM may visualize the Hasse Diagram;

Step 5: A pair of incomparable alternatives should be chosen to the evaluation. For that, the DM shall select only the pair of alternatives he/she wishes to evaluate, in case there already is a dominance relation between the selected alternatives, a warning will be displayed in**(b)**, otherwise, their names will me displayed there;

Step 6: Choose the alternative**(c)**. As in the ranking problem it is only possible to perform pairwise evaluations, the DM will be asked to select the best alternative of the pair. It is also worthnotingthat for this problem there is no exclusion of the unchosen alternative, but rather the selection of the considered the best, establishing a relation of dominance between the analyzed pair;

Following these steps, the HE will be informed and included in the linear programming model. Note that, if necessary, it is possible to cancel the process by clicking the"cancel"button**.**



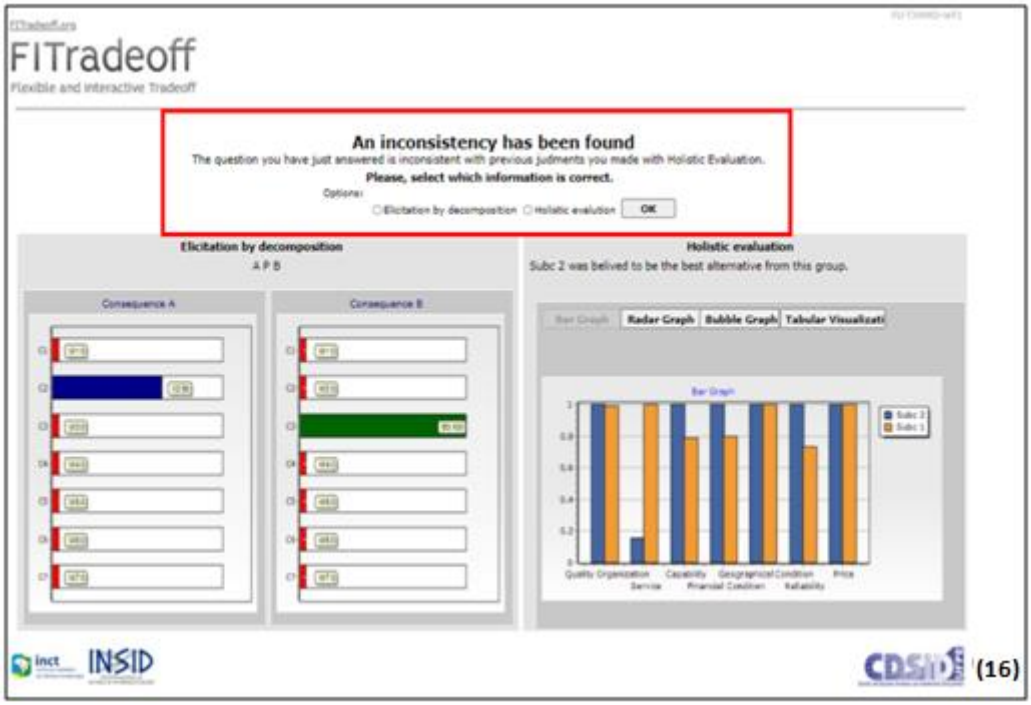
It is worth noting that, when selecting the group of alternatives to be evaluated, all graphic visualizations of the DSS will be updated so that only the selected alternatives are displayed having their consequencesvalues adjusted, considering a local ratio scale within the subset evaluated.

It is important that before performing a HE the decision-maker consults the Hasse Diagramwhen dealing with the ranking problematic and the"IndifferenceMatrix" when it comes to the choice problematic.These featuresallow to visualize the relations established between the alternatives, so that the decision-maker can verify the feasibilityof the holisticevaluation without having to make a series of actions to only then visualize the alternatives that can actuallybe evaluated.

11. Inconsistency test

With the inclusion of holistic evaluation, decision-makers may provide conflicting information through decomposition evaluation and holistic evaluation. This can occur given the distinct nature of the assessments and information generated. Therefore, it is extremely important to perform aninconsistency test throughout the process, in order to prevent the weight space tobecoming unviable.

After performing at least one HE, the test begins to be performed with each question answered in the decomposition (flexible elicitation). If an inconsistency is found, a validation process is carried out with the decision-maker, in which the information given in the elicitation question and in the holistic evaluation is compared, thus, asking which of the two information is in fact in accordance with the actual preferences of the decision-maker **(17)**.



If the decision-maker chooses the information provided in the flexible elicitation, then the information generated by the holistic evaluation is discarded and the alternatives are reevaluated with the information from the elicitation and other non-inconsistent holistic evaluations.

If, on the other hand, the decision-maker chooses to keep the information of the holistic evaluation, then the preference informed in the elicitation is reversed, that is, if the answer given was A, its inversion to B occurs, if it was B, it becomes A and if the answer was an Indifference, then the preference is reversed for "No Answer".

During the inconsistency test, the decision-maker will have access to all previously available views to enable a secure assessment of the decision they should make.

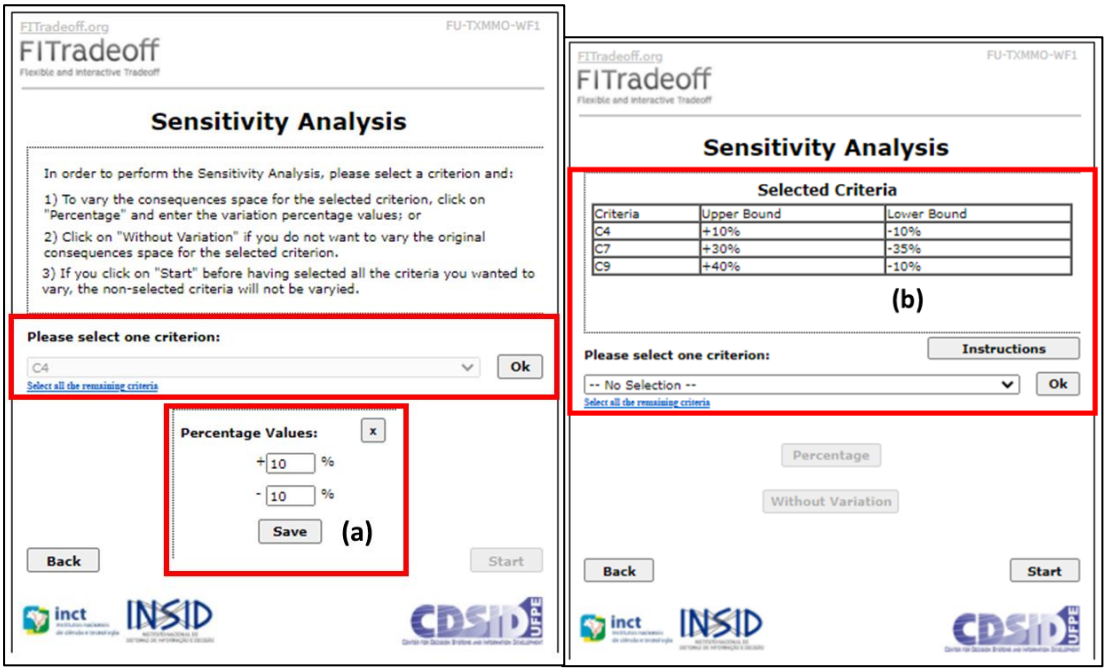
12. Sensitivity Analysis

The new version of the FITradeoff System also allows the performance of Sensitivity Analysis (SA) forboth the problematics of choice and ranking.The process consists of generating different scenarios varying the consequences of the alternatives in the criteria indicated and solving the problem according to the space of weights found up to that moment.

The sensitivity analysis becomes available to the decision-maker whenthe problem is finalized, either because a solution has been found or in case the decision-

makers indicated that he/she no longer wishes to continue responding to flexible elicitation.

When he/she clicks on the"SensitivityAnalysis"button in the resultspage, a screen will be displayed wherethe decision-maker shall select each criterion to be variedand then report the percentages of variation by clicking on "Save"**(a)**. Afteradding the first criterion, a table is displayed containing the name and variation percentages of each selected criterion (**b)**.

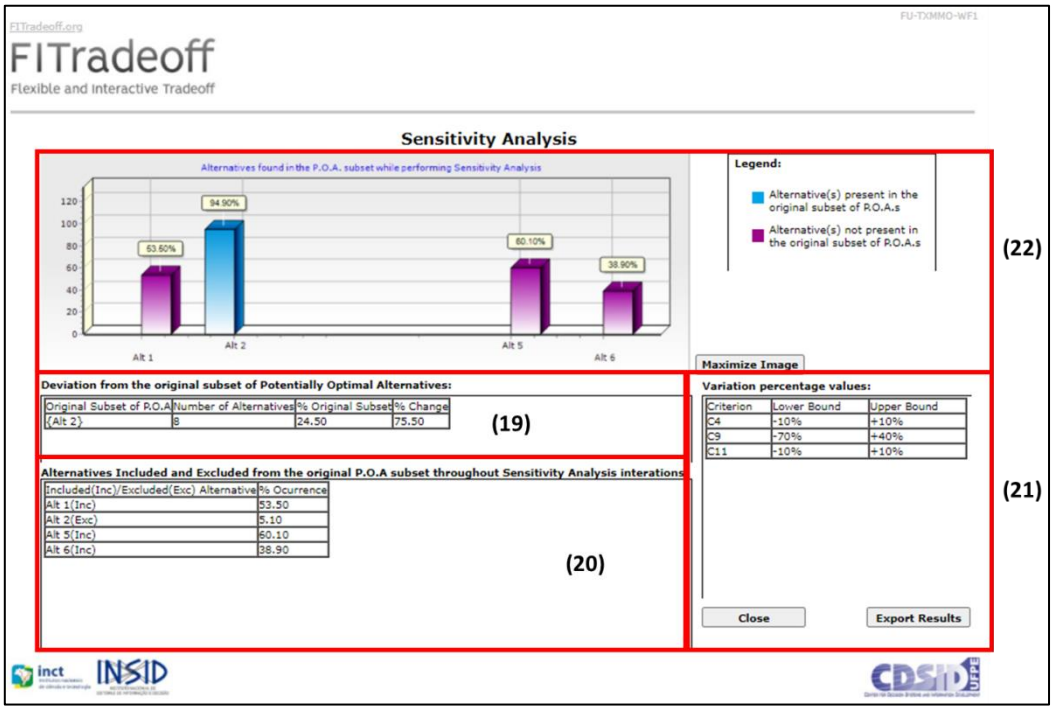


A novelty in thisstep is that different from the standaloneversion, it is notnecessary to select allthe criteria informing whether or not this will be varied, the new version allows thedecision-maker to select only the group of criteria that he/she wants to vary and start the process. In this case, all unselected criteria will be considered as non-varied. Another facility provided is useful for situations where the DM wants to varyall non-selected criteria considering the same percentage, for this, just click on "select all thecriteria/remaining criteria".

12.1 SAfor choice problematic

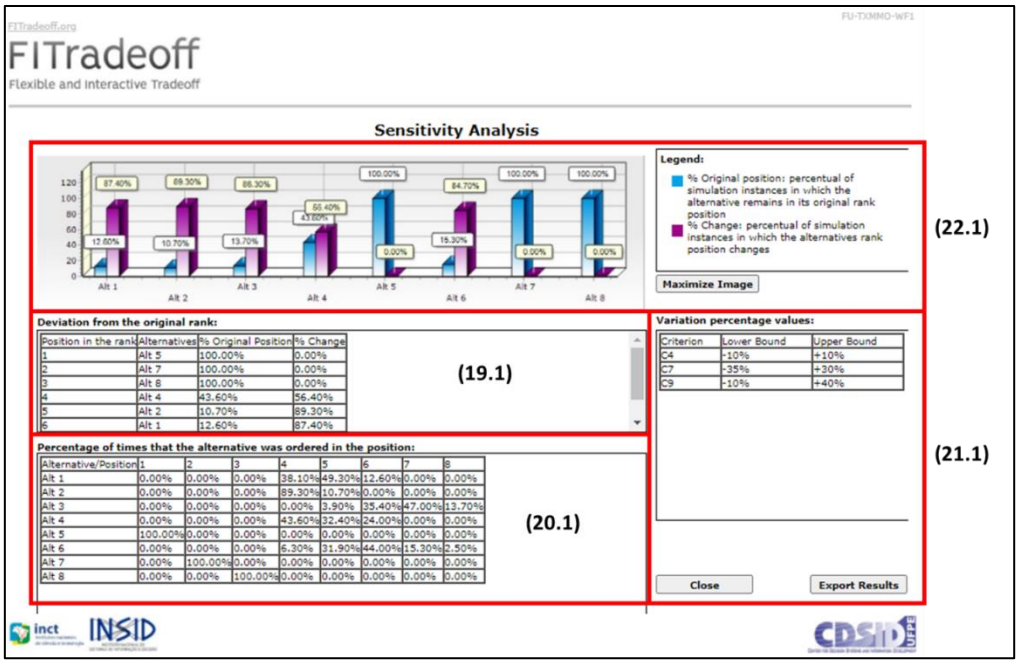
After all instances, the sensitivity analysis results page will be displayed, where the following elements can be observed: **(19)** Table of the original problem solution set, which in addition to showing the alternatives present in the original solution, indicates

the number of problem alternatives and the percentage of change in the originalsolution. **(20)** Table of alternatives included and excluded throughout the process, which indicates all the alternatives that entered or left the original solution set as well as the percentage of instances in which they were included or excluded. **(21)** Table of varied criteria, displays the selected criteria and the percentage of variation. **(22)**Graph that displays the alternatives of the original solution set (in blue) and the alternatives included in the set (in purple) with the percentages referring to the number of scenarios in which they were in the solution set.



12.2 SA for ranking problematic

Concerning AS of ranking, the results page contains the following elements: **(19.1)** Table with the percentages of deviation of each alternative from its original positions in the original solution ranking. **(20.1)** Table with the percentage of times in which each alternative occupied a certain position in the ranking **(21.1)** Table of varied criteria, showing the selected and the percentage of variation. **(22)** Graph with two series that show the percentage of times that an alternative remained in its original position (blue series) and how much was changed, regardless of the position occupied (purple series).



In bothproblems, it is possible to export the data. If doing so, an Excel spreadsheet containing the imputed data of the consequence matrix, the range of possible values for the scale constants, thefinalranking obtainedor the potentially optimal alternative, as well as the results obtained in the sensitivity analysis willbe downloaded. More details are seen in Section 13.

Important: it is worth remembering that the range of values of the consequences for each criterion are important for determining the value of the scale/weight constants, so that in the SA it is essential that the greatest and smallest original consequence of the problem are maintained, which the DSS does introducing these consequences instead of those outside the original range of consequences.

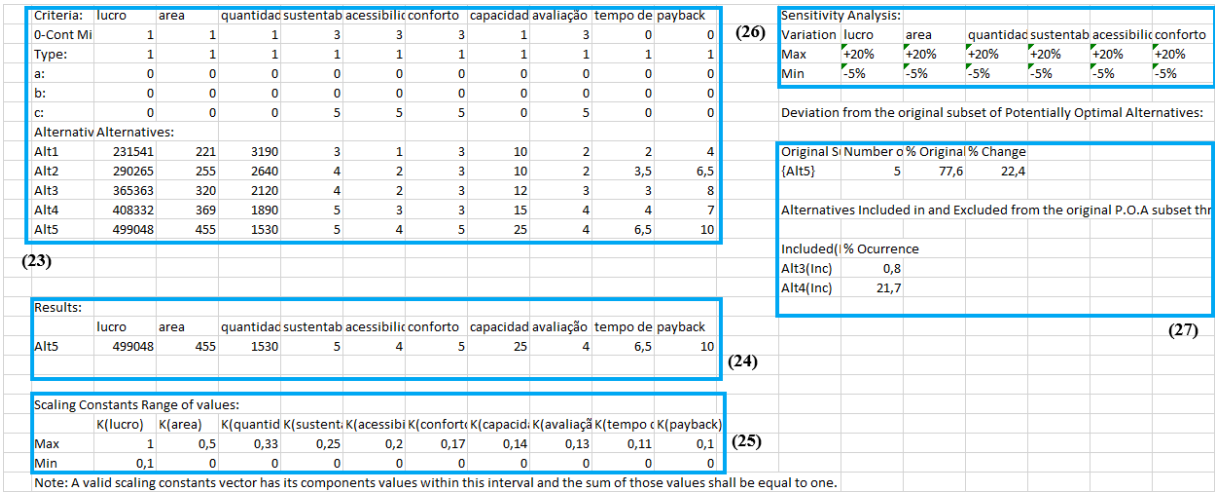
13 Export spreadsheets of the analyses

The FU_TXMMO_WF1 system providesan Excel spreadsheetfor the user to download the results and analyses of the problem studied. These can be exported on the results pages or after performing a sensitivity analysis. Different output templates are available for choice and rankingissues.

13.1 Output spreadsheet- Choice problematic

The spreadsheet contains the input data provided by the user **(23),** the final result found with respective real consequences of the alternative(s) in each criterion**(24),** and

respective ranges of admissible values of the criteria weights **(25).** In addition, the document contains the criteria selected for sensitivity analysis with the respective percentage of variation **(26),** the POA(s) originally found(s), and a list of alternatives included or excluded in the solution with the respective percentage of occurrence **(27).**



Criteria:	lucro	area	quantidad	sustentab	acessibilic	conforto	capacidad	avaliação	tempo de	payback
0-Cont Mi	1	1	1	3	3	3	1	3	0	0
Type:	1	1	1	1	1	1	1	1	1	1
a:	0	0	0	0	0	0	0	0	0	0
b:	0	0	0	0	0	0	0	0	0	0
c:	0	0	0	5	5	5	0	5	0	0
Alternativ	Alternatives:									
Alt1	231541	221	3190	3	1	3	10	2	2	4
Alt2	290265	255	2640	4	2	3	10	2	3,5	6,5
Alt3	365363	320	2120	4	2	3	12	3	3	8
Alt4	408332	369	1890	5	3	3	15	4	4	7
Alt5	499048	455	1530	5	4	5	25	4	6,5	10

(23)

Results:										
	lucro	area	quantidad	sustentab	acessibilic	conforto	capacidad	avaliação	tempo de	payback
Alt5	499048	455	1530	5	4	5	25	4	6,5	10

(24)

Scaling Constants Range of values:										
	K(lucro)	K(area)	K(quantid	K(sustent	K(acessibi	K(confort	K(capacid	K(avaliaçã	K(tempo c	K(payback)
Max	1	0,5	0,33	0,25	0,2	0,17	0,14	0,13	0,11	0,1
Min	0,1	0	0	0	0	0	0	0	0	0

(25)

Note: A valid scaling constants vector has its components values within this interval and the sum of those values shall be equal to one.

(26)

Sensitivity Analysis:						
Variation	lucro	area	quantidad	sustentab	acessibilic	conforto
Max	+20%	+20%	+20%	+20%	+20%	+20%
Min	-5%	-5%	-5%	-5%	-5%	-5%

Deviation from the original subset of Potentially Optimal Alternatives:

Original Si	Number o	% Original	% Change
{Alt5}	5	77,6	22,4

Alternatives Included in and Excluded from the original P.O.A subset thr

Included(	% Ocurrence
Alt3(Inc)	0,8
Alt4(Inc)	21,7

(27)

13.2 Output spreadsheet- Ranking problematic

For rankingproblematic, the spreadsheet also contains the input data provided by the user but instead of the POAS, it contains the final ranking found **(28),**the range of admissible criteria weight values is also exported**(29).** In addition, the export spreadsheet includes the evolution of the dominance matrix throughout each response cycle (either in the decomposition assessment or holistic evaluation), which allows verifying the cycle in which each relationship of dominance or indifference was established **(30).**

Additionally, the document contains the criteria selected for the sensitivity analysis with respective percentage of variation, the variationpercentagerelated to the original positions occupied by each alternative, as well as the percentage of times that each alternative occupied a certain position of the ranking along the analysis**(31).**

Criteria:	lucro	area	quantidad	sustentab	acessibilic	conforto	capacidad	avaliação	tempo de	payback	Ranking:
0-Cont Mi	1	1	1	3	3	3	1	3	0	0	1
Type:	1	1	1	1	1	1	1	1	1	1	2
a:	0	0	0	0	0	0	0	0	0	0	3
b:	0	0	0	0	0	0	0	0	0	0	4
c:	0	0	0	5	5	5	0	5	0	0	5
Alternativ	Alternatives:										
Alt1	231541	221	3190	3	1	3	10	2	2	4	
Alt2	290265	255	2640	4	2	3	10	2	3,5	6,5	
Alt3	365363	320	2120	4	2	3	12	3	3	8	
Alt4	408332	369	1890	5	3	3	15	4	4	7	
Alt5	499048	455	1530	5	4	5	25	4	6,5	10	

(28)

Scaling Constants	Range of values:									
Max	1	0,33	0,25	0,2	0,17	0,14	0,13	0,11	0,1	0,09
Min	0,18	0	0	0	0	0	0	0	0	0

Note: A valid scaling constants vector has its components values within this interval and the sum of those values shall be equal to one.

(29)

Dominance Matrix:					
Cicle 1	Alt1	Alt2	Alt3	Alt4	Alt5
Alt1	0	0	0	0	0
Alt2	0	0	0	0	0
Alt3	1	1	0	0	0
Alt4	1	1	1	0	0
Alt5	1	1	1	1	0

(30)

Sensitivity Analysis:					
Variation percentage values:	lucro	area	quantidad	sustentab	acessibili
Max	+10%	+10%	+10%	+10%	+10%
Min	-10%	-10%	-10%	-10%	-10%

Deviation from the Original Ranking					
Position in the rank	1	2	3	4	5
Alternatives	Alt5	Alt4	Alt3	Alt2	Alt1
% Original Position	100%	99,4%	86,1%	84,3%	78,3%
% Change	0%	0,6%	13,9%	15,7%	21,7%

Percentage of times that the alternative was ordered in the position:

Alternative/Position	Alt1	Alt2	Alt3	Alt4	Alt5
1	0%	0%	0%	0,6%	100%
2	0%	0%	13,9%	99,4%	0%
3	1,2%	15,7%	86,1%	0%	0%
4	20,5%	84,3%	0%	0%	0%
5	78,3%	0%	0%	0%	0%

(31)

14 Application Report (Export Summary)

The application report is a document available for the situations in which the DM wants a record of the sequence of responses and actions performed during the elicitation procedure. Standard output models are available, differing only if the alternatives will be displayed in terms of potentiality optimal alternatives**(32)** (problem of choice) or the number of levels **(33)** (problem of ranking).

The spreadsheetcontains the number of cycles, the value of consequence A,thevalue of consequence B, the decision maker's response, the partialresult for each cycle, and the information regarding the HEs performed.

Application report								
Cycle	Consequence A	Consequence B	Answer	Potentially optimal alternatives	Holistic Evaluation (HE) performed?	Alternatives compared in HE	Answer(HE)	Potentially optimal alternatives after HE
0			Ordering...	Subc 1,Subc 2,Subc 5,Subc 9,Fic1	no			
1	50,000 of Quality Organiz	Best of Price (100)	Consequence A	Subc 1,Subc 9,Fic1	yes	Subc 1,Subc 2	Subc 1 is preferred	Subc 1,Subc 5,Subc 9,Fic1
					yes	Subc 1,Subc 5	Subc 1 is preferred	Subc 1,Subc 9,Fic1
2	50,000 of Quality Organiz	Best of Service (100)	Consequence A	Subc 1,Subc 9,Fic1	no			
3	50,000 of Service	Best of Capability (100)	Consequence A	Subc 1,Subc 9,Fic1	no			
4	50,000 of Capability	Best of Financial Conditio	Consequence A	Subc 9,Fic1	no			
5	50,000 of Financial Condit	Best of Geographical Conc	Consequence A	Subc 9,Fic1	no			
6	50,000 of Geographical Cc	Best of Reliability (100)	Consequence A	Subc 9,Fic1	no			

(32)

Application report								
Cycle	Consequence A	Consequence B	Answer	Number of levels	Holistic Evaluation(HE) performed?	Alternatives compared in HE	Answer(HE)	Number of levels after HE
0			Ordering...	4	no			
1	50,000 of Quality Organ	Best of Price (100)	Consequence A	4	yes	Subc 1,Subc 2	Subc 1 is prefe	4
2	50,000 of Quality Organ	Best of Service (100)	Consequence A	5	no			
3	50,000 of Service	Best of Capability (100)	Consequence B	5	no			
4	50,000 of Capability	Best of Financial Conditio	Consequence B	5	no			
5	50,000 of Financial Con	Best of Geographical Conc	Consequence B	5	no			
6	50,000 of Geographical	Best of Reliability (100)	Indifferent	5	no			
7	50,000 of Reliability	Best of Price (100)	Indifferent	5	no			

(33)