User Guide: FLEXINET Fuzzy Risk Web-based Application

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Introduction

This is a user guide for the fuzzy risk web-based application that allows for risk and BSC analysis on Global Production Network (GPN) configurations. The prototype software was developed as part of the EU FP7 funded FLEXINET project.

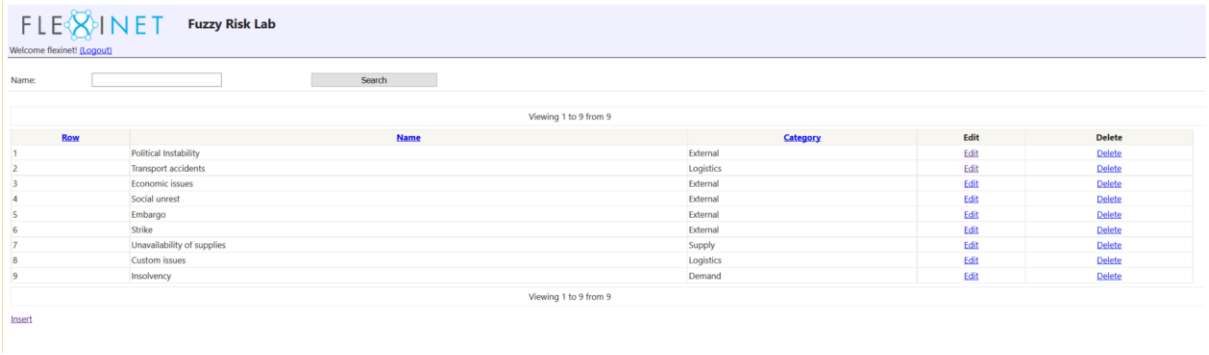
To use the software, run the portable version **'run.bat'** file. This should be located in the main folder of the portable version.

It will open a browser window and a user login page. Both the username and password are **flexinet.**

Once logged-in, the **Main Page** will appear with a number of options.

Risk Factors

A list of globally defined risk factors are accessible through the **Manage Risk Factors**.



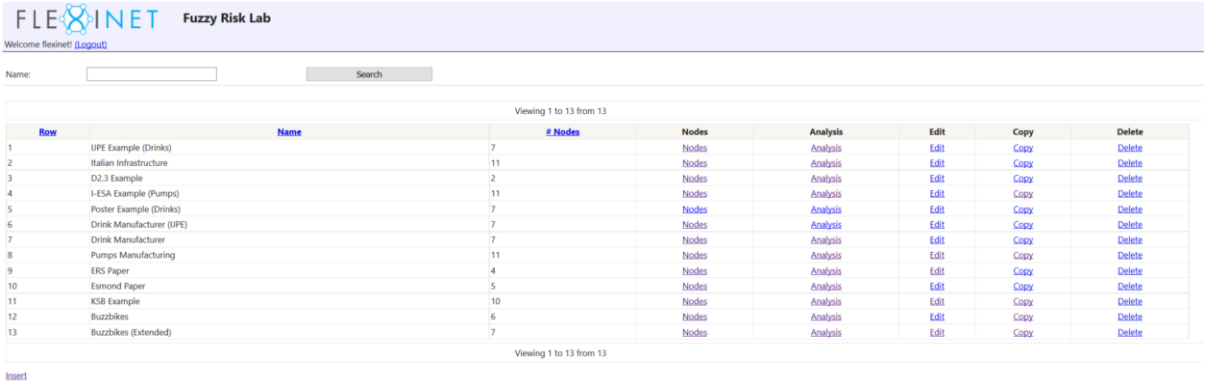
User can **Insert**, **Delete** or **Edit** the risk factors in this page. When you click Edit, the following form will be shown to allow editing:

Risk factors are determined by their name, description (textual), category (i.e. Supply, Production, Logistics, Demand, Information and Control, and, External), zone of influence (Global, Region Level 1-4 and Actor Specific), Company Definition, Company History with the risk and possible Mitigation Methods.

Projects

The first option on the main page, **Manage Projects**, contains the most important functionalities of the software (including risk analysis and BSC analysis).

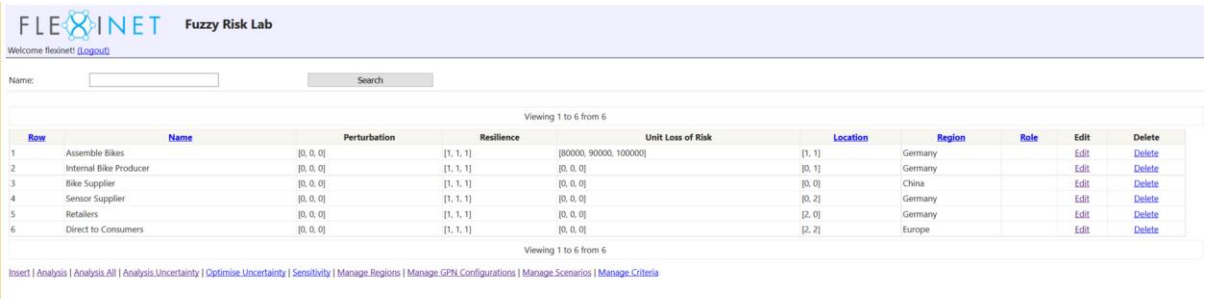
Once you click on **Manage Projects**, a list of currently defined projects will be shown. Please note that you can create new projects (using the **Insert** button) or make an exact copy of an already existing project. The second option is useful when you need to modify parts of a project for experimentation but also would like to retain the original copy.



The bulk of project data is available on **Nodes** page, where a list of nodes defined in the project will appear, and also, links to other relevant pages of information and analysis in the project.

Nodes

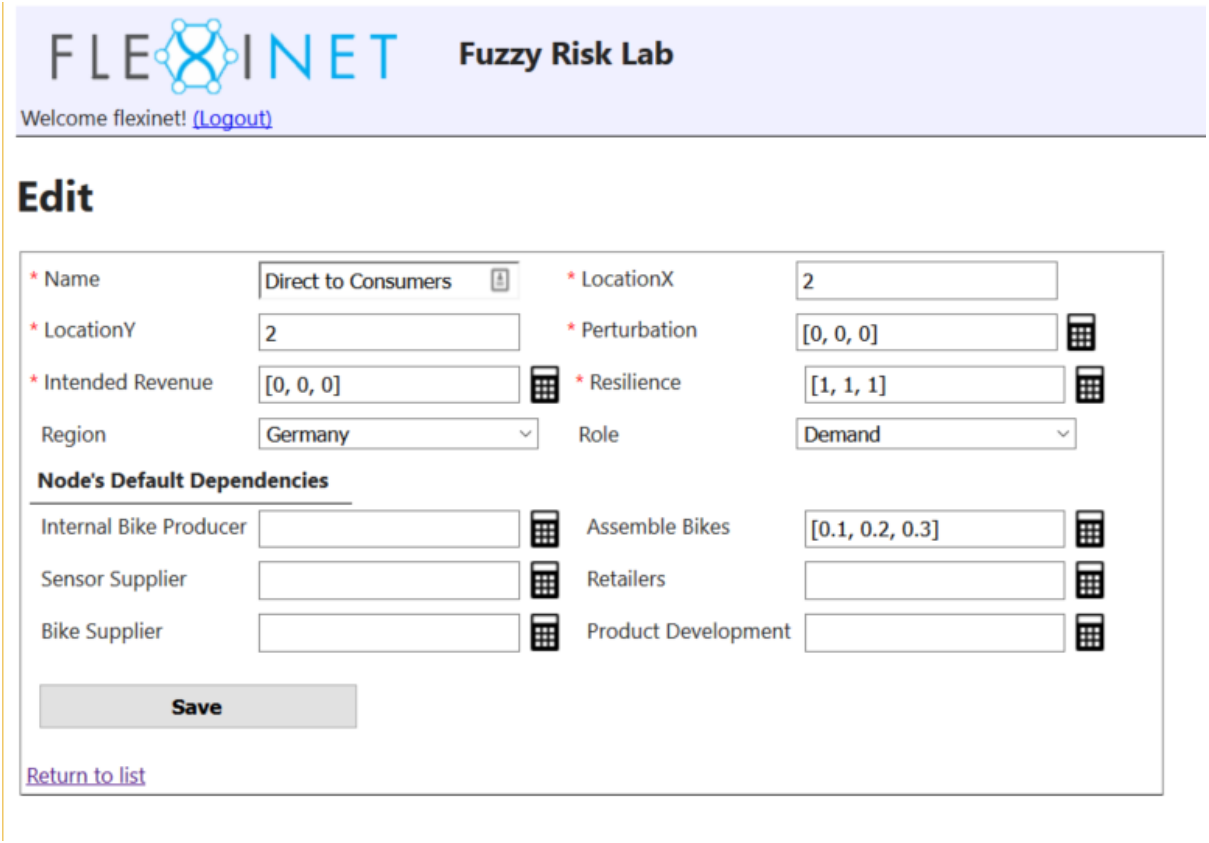
You can see the Nodes page for the Buzzbikes (extended) project.



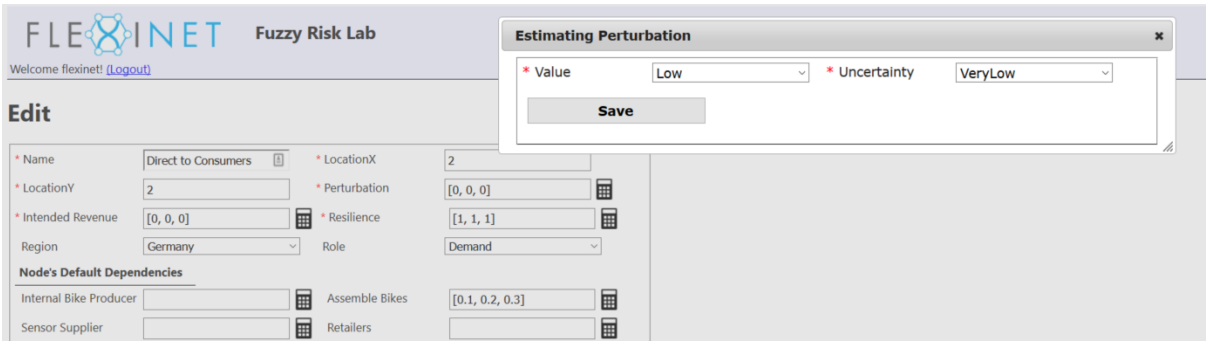
You can **Insert**, **Delete** or **Edit** project nodes in this page.

The links at the bottom of this page will allow you to run risk **Analysis,** generate an overall risk analysis report (**Analysis All**), analyse the sensitivity to uncertainty (**Analysis Uncertainty**), analyse the sensitivity to the parameter values (**Sensitivity**), manage the regions in the project (**Manage Regions**), **Manage GPN Configurations**, Manage Risk Scenarios (**Manage Scenarios**) and manage BSC criteria, weights, value and view the results of BSC analysis (**Manage Criteria**). We will go through these options later.

When you **Edit** a node, a form will appear that asks for the main information about the node, including its name, location on the diagram (LocationX for horizontal position and LocationY for vertical position), the default perturbation value (can be changed later in risk scenarios or via the sliders), the intended revenue of the node (useful for determining the cost/loss of risk), resilience (the responsiveness of the node to the disruption), the region and role (useful for BSC score cards). Also, a list of default dependency values is settable here. Please note these values are for when the edited node is dependent on the nodes listed (for example, the first item in the following figure is about the dependency of 'Direct to customers' on 'Internal Bike Produced'). Also, these are the values for the default GPN configuration and can be changed for other configuration (we'll see this later).

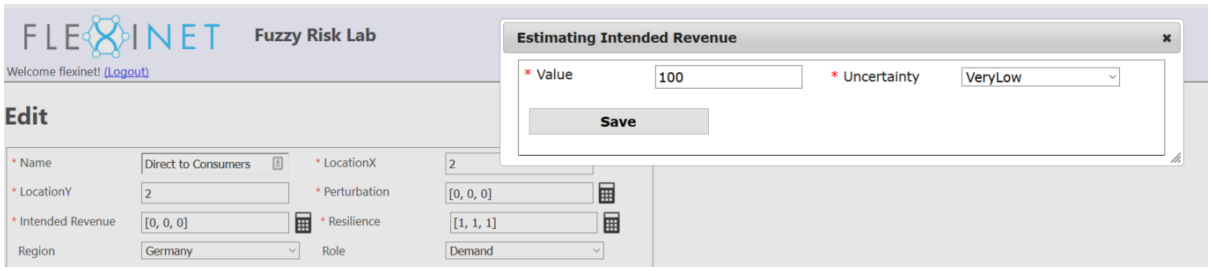


As many of the parameters on this page are fuzzy (determined by a 3-tuple: the lowest possible value, the most likely value and the highest possible value), a button (with a calculator icon) is shown in front of them to support you providing the information. In case of resilience and perturbation, the page will look as presented below:

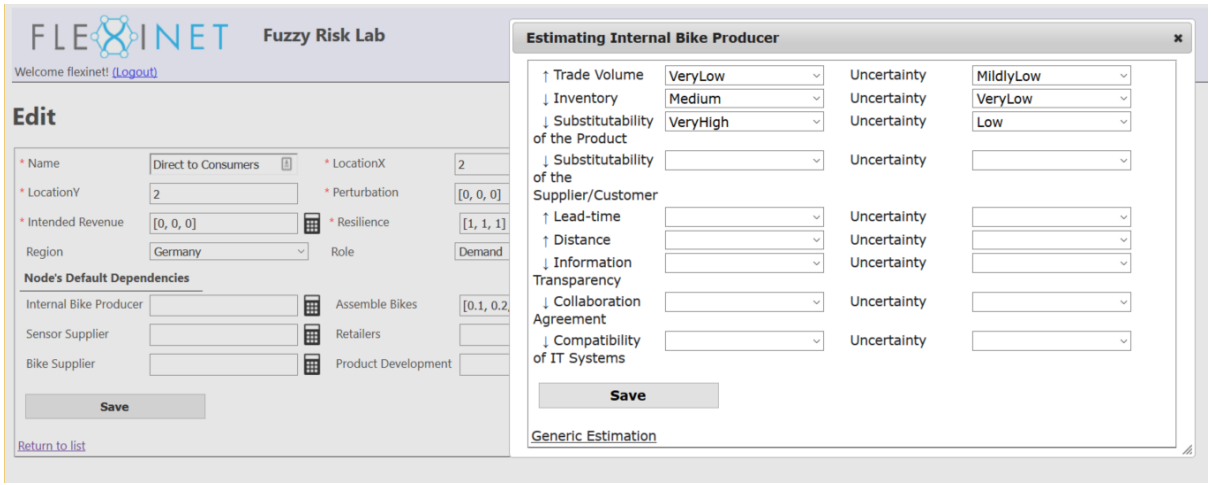


You will need to provide your estimate with linguistic values and your uncertainty estimate (or in-confidence) in the estimated value. The possible linguistic value options are Very Low, Low, Mildly Low, Medium, Mildly High, High and Very High.

For Intended Revenue, as the parameter is financial and not normalised, you will need to provide the estimate as a number:



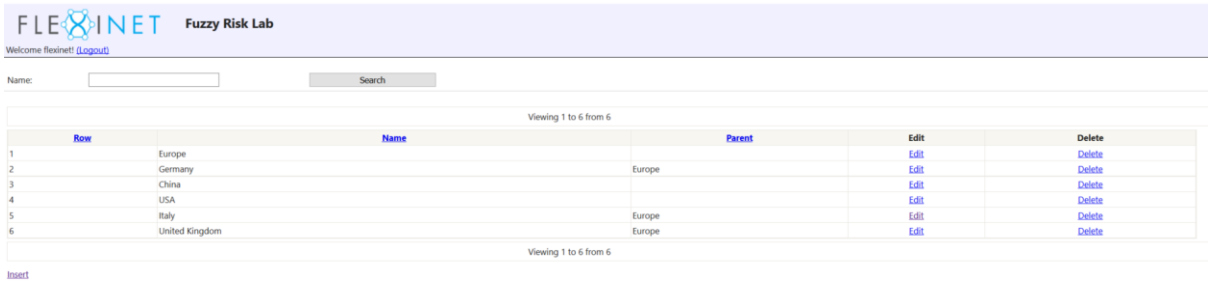
Also, for dependencies, a multi-criteria approach (as defined in D2.3) is used to facilitate and improve the calculation of the parameter. In this page, you should provide information for as many criteria as is relevant to the link:



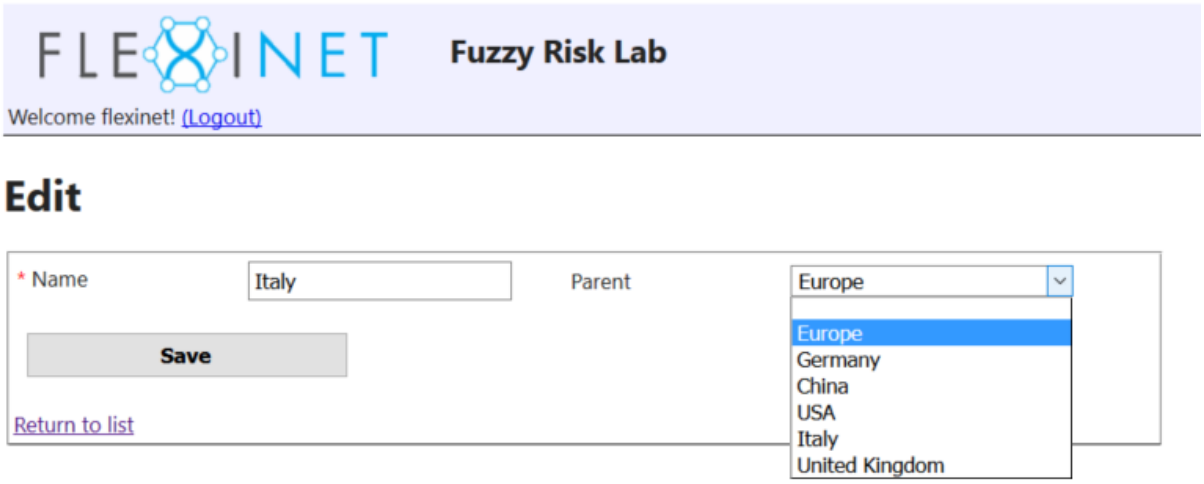
Please note that if you **Insert** a node, the dependency parameters will not show immediately. You need to complete the insert and then edit the node back again to find dependency parameters.

Regions

Regions can be modified in the **Regions** page. Once clicked, you will see a list of regions already defined in the project. They consist of a Name and a Parent Region. The Parent is optional and all regions without a Parent will be considered at the top of the hierarchy.

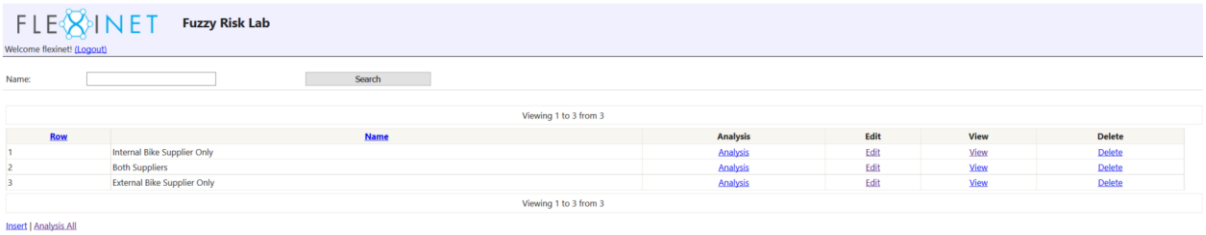


When you Edit or Insert a region, you are allowed to select the parent from the list of already defined regions.

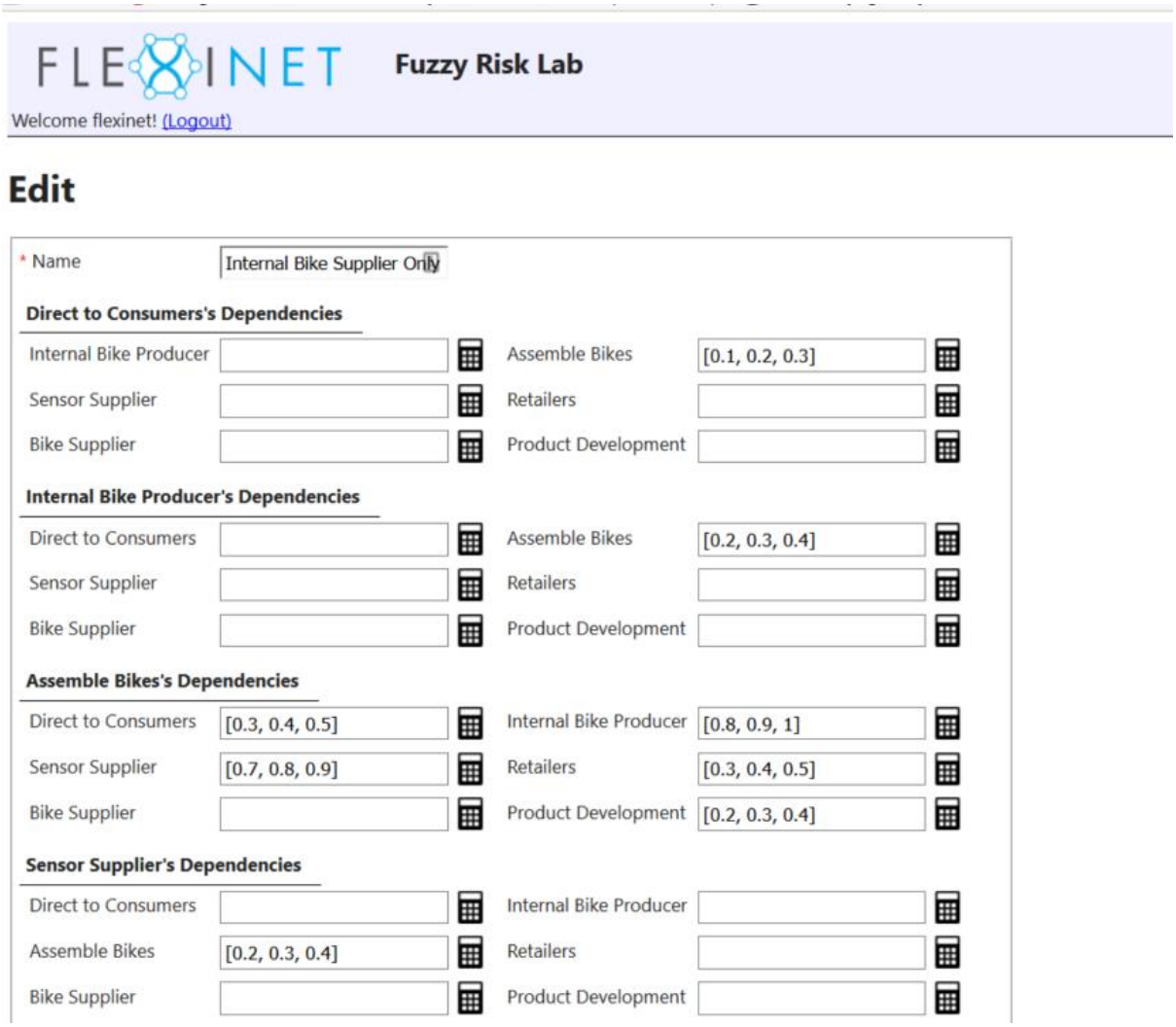


GPN Configurations

GPN Configurations are different alternatives for defining relationships among nodes. The result of risk analysis should be able to find the best configuration. A GPN configuration is only made out of the dependency values. Lack of a dependency is assumed to mean that a link does not exist between the relevant nodes.



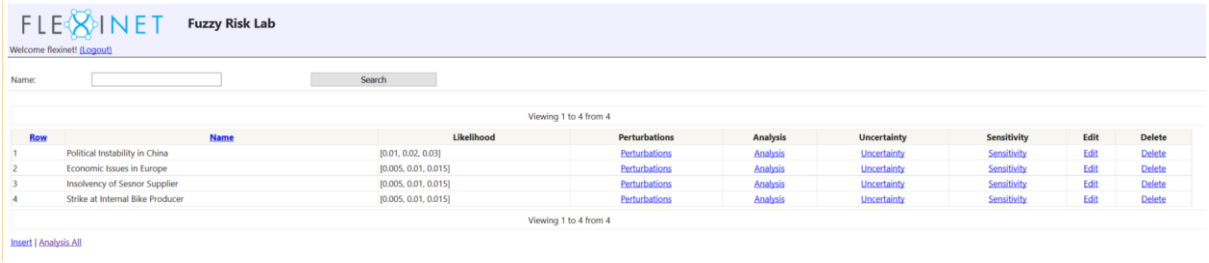
You can **Insert**, **Delete** or **Edit** GPN configuration in the relevant page. Please note that when you **Insert** a new configuration, it will bring the default dependency values (defined on the Node Edit page) as a starting point that should help you quickly create a new configuration by just making the necessary adjustments.



You can also run the risk **Analysis** on the GPN configuration or **View** the diagram. We will discuss these later on.

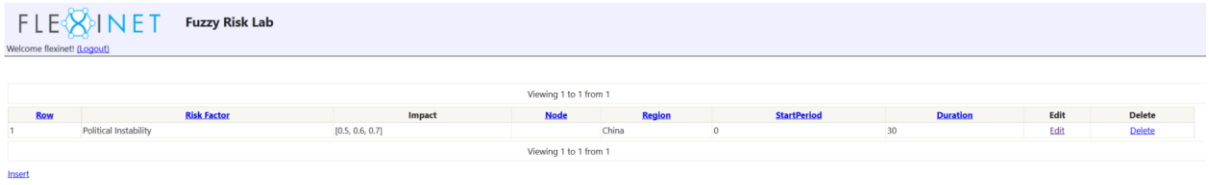
Risk Scenarios

Risk scenarios are defined in the **Manage Scenarios** page. Each scenario has a likelihood and also consists of multiple perturbations. The following shows the main Manage Scenarios page, where risk scenarios can be updated:

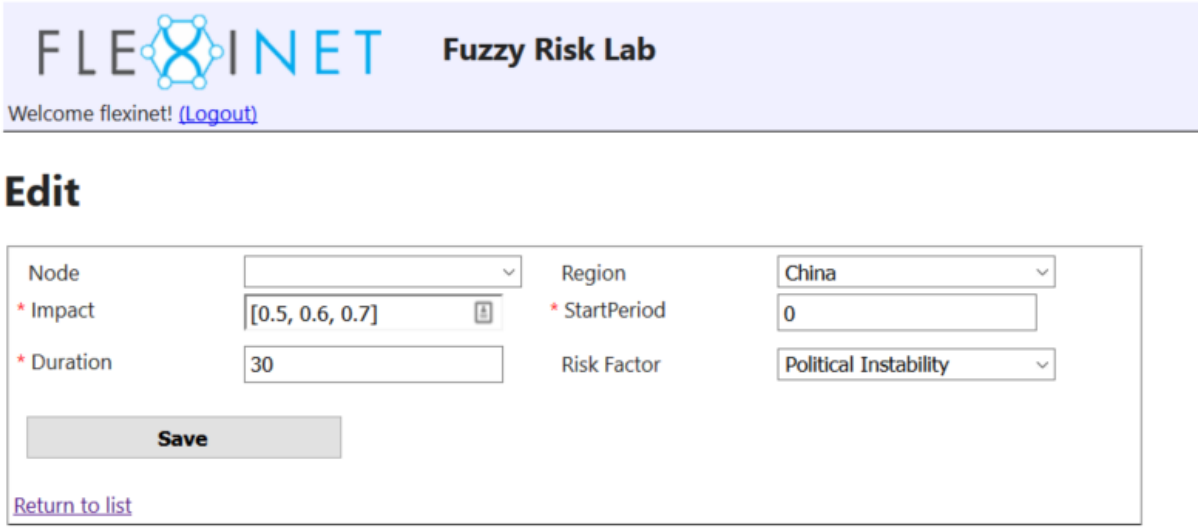


Editing the scenario will bring a form that allows us to change the name and likelihood of the scenarios:

However, to define perturbations, we need to click on the **Perturbations** link for that risk scenario which bring a new page with perturbations that are already defined for the risk scenario.



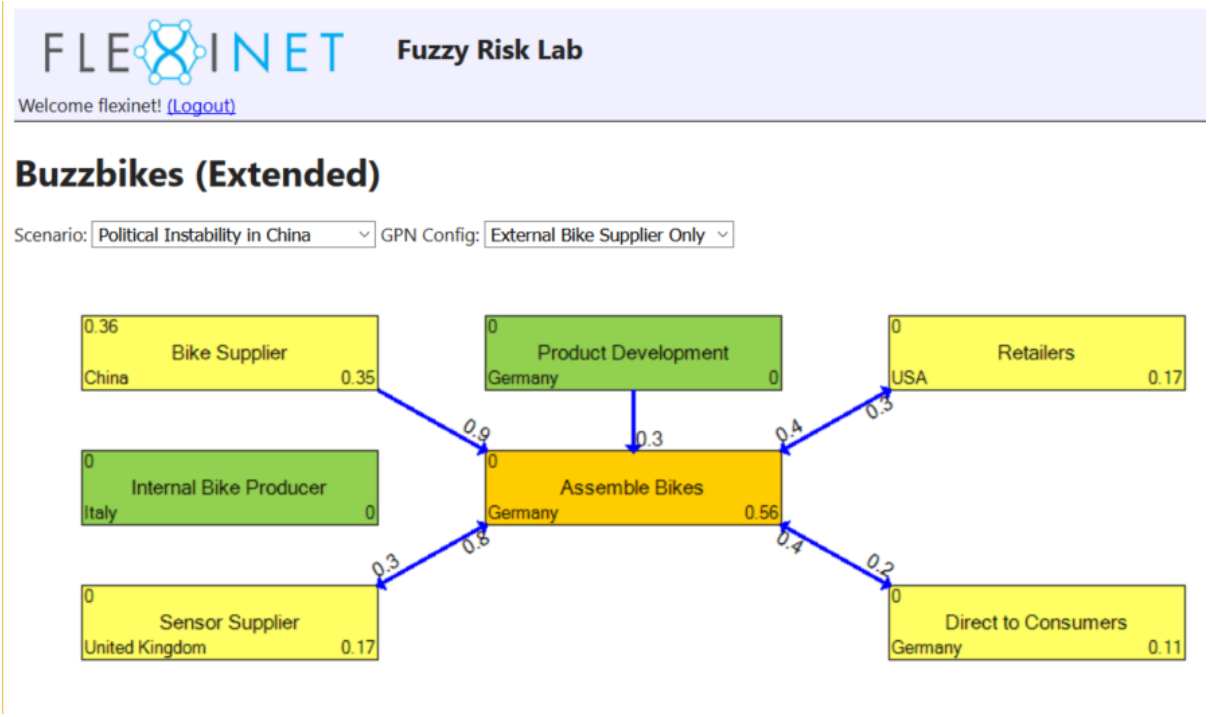
Every perturbation contains information about the impact of the perturbation, the node or region that is affected (if a region is assumed to be affected, all the nodes within that region will be affected equally), the starting time period and duration of the effect. These can be **Edit**ed by the following form:



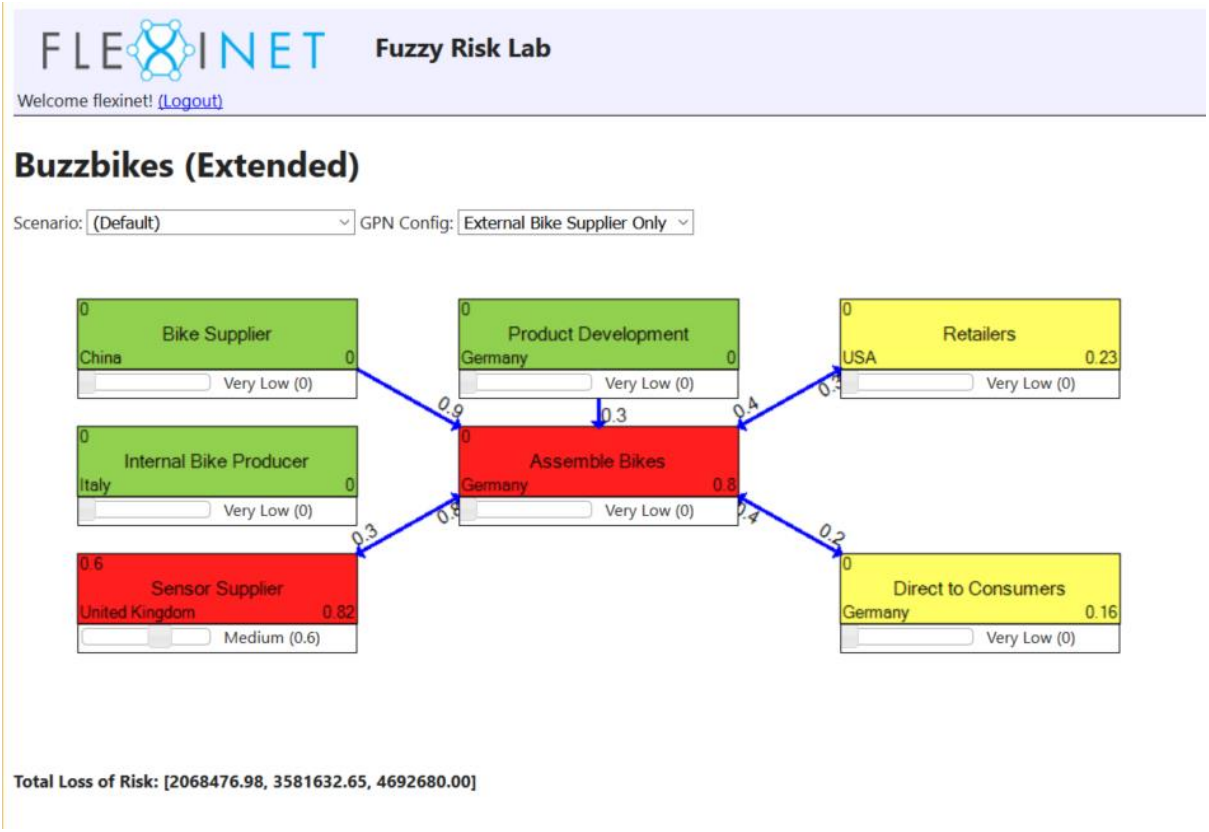
Additionally, it is possible to run the **analysis**, **uncertainty** sensitivity or parameter **sensitivity** on individual risk scenarios by clicking on the relevant link in front of the risk scenario.

Risk Analysis

The risk analysis page allows us to see the results and impact of risk scenarios on the GPN configurations individually. This is a central point of the software, as it allows the decision make to have immediate feedback on the risks. The page look as follows:



You can use the drop down for risk scenario and GPN scenario to change either of them and see the impact it has on the results immediately. Also, by selecting the (Default) risk scenario, an ad-hoc mode is enabled and you can use the sliders to change the perturbation impact directly on the page, as shown below:



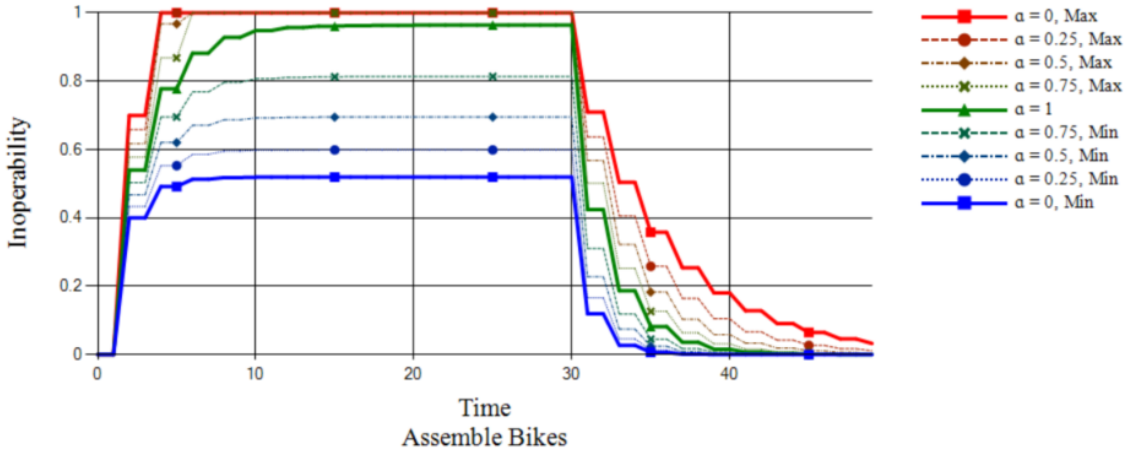
The value at the top left corner of each node represents the average impact of perturbation/disruption to the node, while the value at the bottom right is the average value of the inoperability (that also determines the colour of the node, ranging from green for low inoperability, yellow for medium and red for high). The region of the node is show on the bottom left corner and the name in the middle. The sliders also have a description that repeats the selected value of sliders, which is the impact of perturbation. At the bottom of the page, a total loss (cost) of risk is reported for the scenario that can be used to understand the financial impact of risks.

If you click on any of the nodes in the diagram, details of the results for that node will be shown. This will look like the following:

Go back to GPN - Edit Nodes

Name: Assemble Bikes

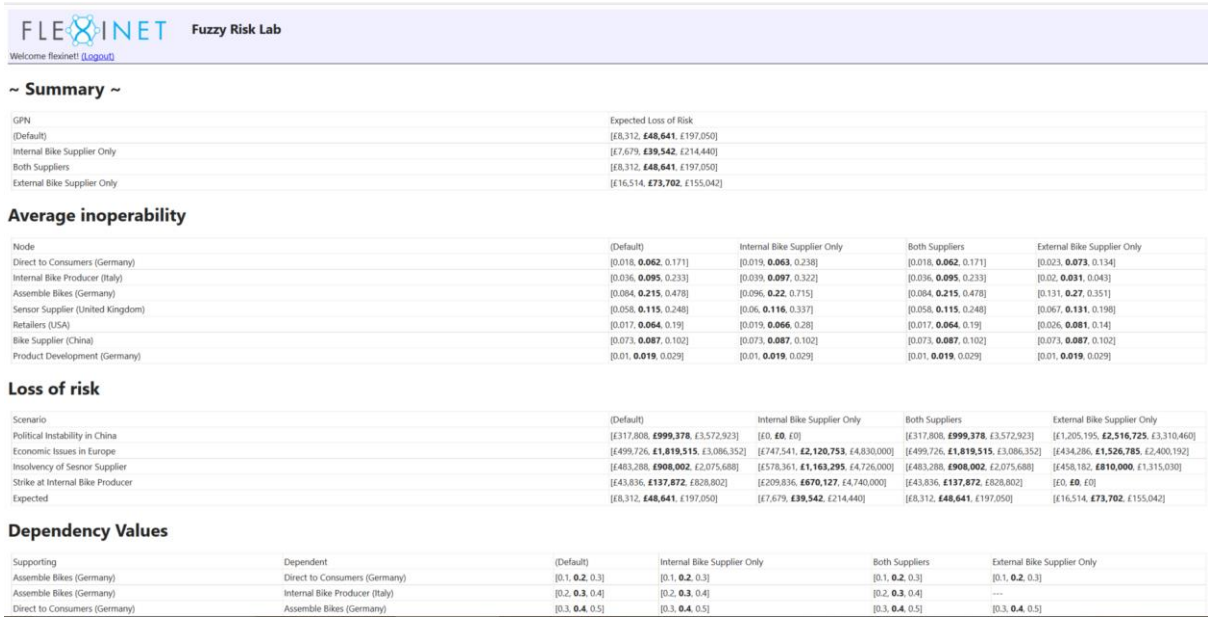
Perturbation (init.): [0, 0, 0]	Perturbation (def.): [0, 0, 0]
Inoperability (avg.): [0.3013, 0.5593, 0.6621]	Inoperability (steady): [0, 0.0003, 0.0326]
Loss of Risk: [1205194.78, 2516725.02, 3310460.46]	



This include the dynamic changes in the inoperability, including different degrees of belief (from the most optimistic to the most pessimistic) and average values. You can click on the **Go back to GPN** to return back to the diagram.

Risk Analysis All

The risk **analysis** page shows the individual reports, while Risk **Analysis All** page aggregates the results per GPN configuration and shows the overall view. This is useful in making a decision about the best configuration and also, it can serve as a documentation facility (by printing and arching the page, which contains all the relevant details).



FLEXINET **Fuzzy Risk Lab**

Welcome flexinet! (Logout)

~ Summary ~

GPN	Expected Loss of Risk
(Default)	[£8,312, **£48,641**, £197,050]
Internal Bike Supplier Only	[£7,679, **£39,542**, £214,440]
Both Suppliers	[£8,312, **£48,641**, £197,050]
External Bike Supplier Only	[£16,514, **£73,702**, £155,042]

Average inoperability

Node	(Default)	Internal Bike Supplier Only	Both Suppliers	External Bike Supplier Only
Direct to Consumers (Germany)	[0.018, **0.062**, 0.171]	[0.019, **0.063**, 0.238]	[0.018, **0.062**, 0.171]	[0.023, **0.073**, 0.134]
Internal Bike Producer (Italy)	[0.036, **0.095**, 0.233]	[0.039, **0.097**, 0.322]	[0.036, **0.095**, 0.233]	[0.02, **0.031**, 0.043]
Assemble Bikes (Germany)	[0.084, **0.215**, 0.478]	[0.096, **0.22**, 0.715]	[0.084, **0.215**, 0.478]	[0.131, **0.27**, 0.351]
Sensor Supplier (United Kingdom)	[0.058, **0.115**, 0.248]	[0.06, **0.116**, 0.337]	[0.058, **0.115**, 0.248]	[0.067, **0.131**, 0.198]
Retailers (USA)	[0.017, **0.064**, 0.19]	[0.019, **0.066**, 0.28]	[0.017, **0.064**, 0.19]	[0.026, **0.081**, 0.14]
Bike Supplier (China)	[0.073, **0.087**, 0.102]	[0.073, **0.087**, 0.102]	[0.073, **0.087**, 0.102]	[0.073, **0.087**, 0.102]
Product Development (Germany)	[0.01, **0.019**, 0.029]	[0.01, **0.019**, 0.029]	[0.01, **0.019**, 0.029]	[0.01, **0.019**, 0.029]

Loss of risk

Scenario	(Default)	Internal Bike Supplier Only	Both Suppliers	External Bike Supplier Only
Political Instability in China	[£317,808, **£999,378**, £3,572,923]	[£0, **£0**, £0]	[£317,808, **£999,378**, £3,572,923]	[£1,205,195, **£2,516,725**, £3,310,460]
Economic Issues in Europe	[£499,726, **£1,819,515**, £3,086,352]	[£747,541, **£2,120,753**, £4,830,000]	[£499,726, **£1,819,515**, £3,086,352]	[£434,286, **£1,526,785**, £2,400,192]
Insolvency of Sesnor Supplier	[£483,288, **£908,002**, £2,075,688]	[£578,361, **£1,163,295**, £4,726,000]	[£483,288, **£908,002**, £2,075,688]	[£458,182, **£810,000**, £1,315,030]
Strike at Internal Bike Producer	[£43,836, **£137,872**, £828,802]	[£209,836, **£670,127**, £4,740,000]	[£43,836, **£137,872**, £828,802]	[£0, **£0**, £0]
Expected	[£8,312, **£48,641**, £197,050]	[£7,679, **£39,542**, £214,440]	[£8,312, **£48,641**, £197,050]	[£16,514, **£73,702**, £155,042]

Dependency Values

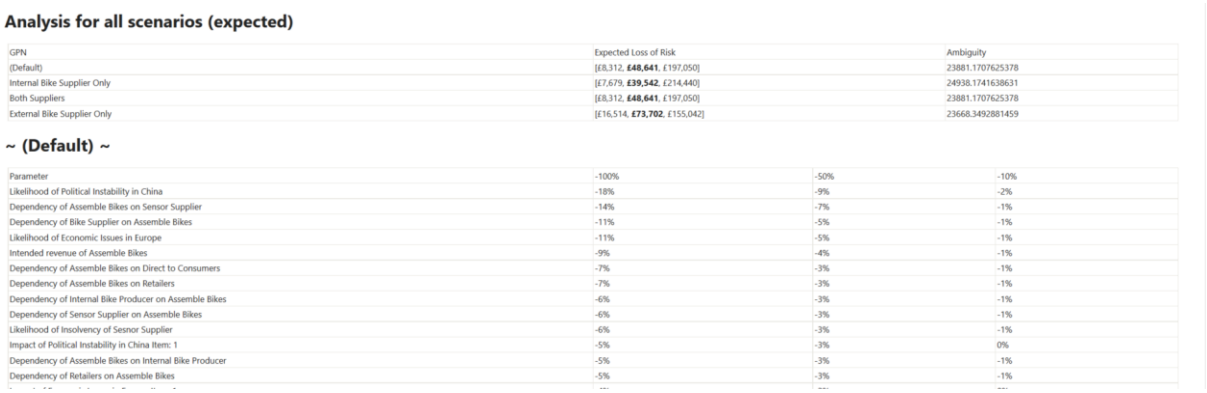
Supporting	Dependent	(Default)	Internal Bike Supplier Only	Both Suppliers	External Bike Supplier Only
Assemble Bikes (Germany)	Direct to Consumers (Germany)	[0.1, **0.2**, 0.3]	[0.1, **0.2**, 0.3]	[0.1, **0.2**, 0.3]	[0.1, **0.2**, 0.3]
Assemble Bikes (Germany)	Internal Bike Producer (Italy)	[0.2, **0.3**, 0.4]	[0.2, **0.3**, 0.4]	[0.2, **0.3**, 0.4]	---
Direct to Consumers (Germany)	Assemble Bikes (Germany)	[0.3, **0.4**, 0.5]	[0.3, **0.4**, 0.5]	[0.3, **0.4**, 0.5]	[0.3, **0.4**, 0.5]

It contains a Summary, a table of average inoperabilities, Loss of risk report, Dependency values (for all GPN configurations), Risk scenarios and also a report generated for all individual GPN

configurations, which contains the diagram (with dependency values), loss of risk and average inoperabilities for the configuration and all the dynamic inoperability charts for the configuration.

Analysing Sensitivity to Uncertainty

The **Analysis Uncertainty** page shows the sensitivity of the final results (loss of risk) uncertainty to the uncertainty of individual parameters. The process for this purpose is reported in D2.4. The results are reported for all risk scenarios:



Analysis for all scenarios (expected)

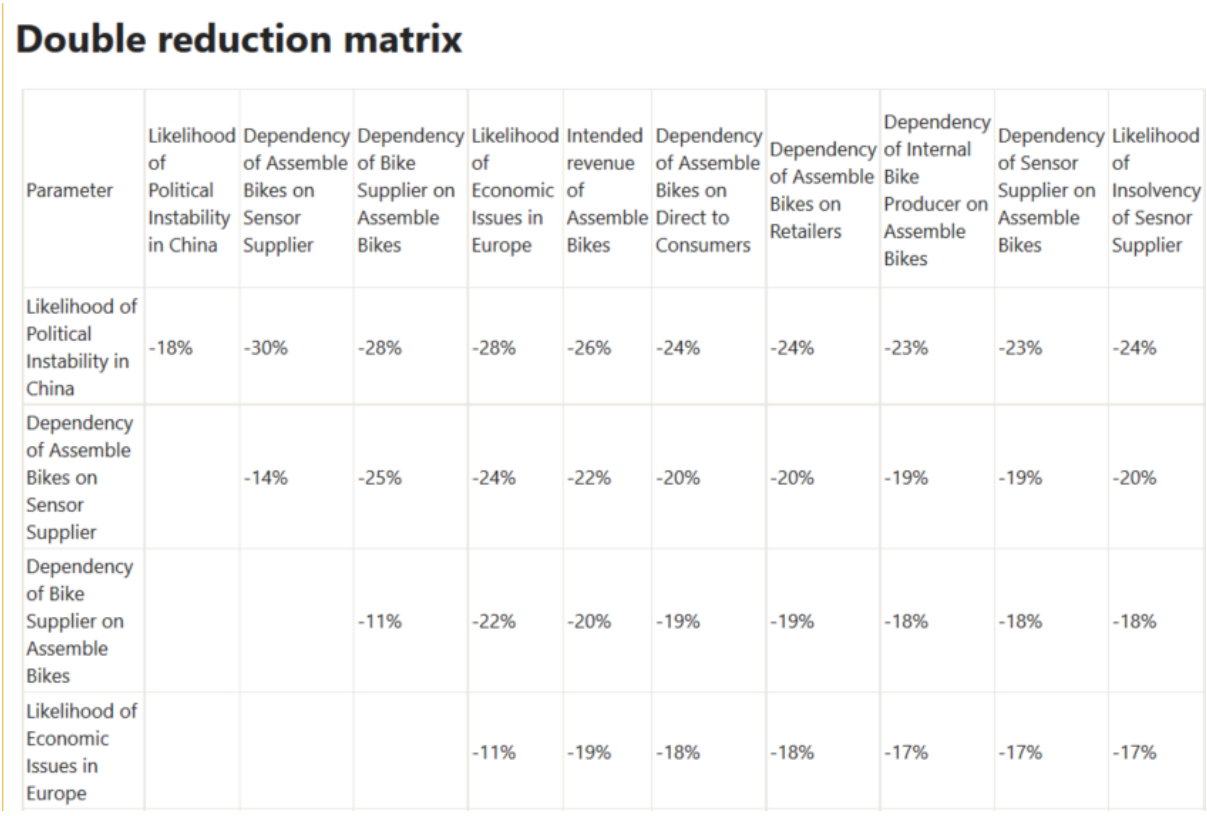
GPN	Expected Loss of Risk	Ambiguity
(Default)	[£8,312, **£48,641**, £197,050]	23881.1707625378
Internal Bike Supplier Only	[£7,679, **£39,542**, £214,440]	24938.1741638631
Both Suppliers	[£8,312, **£48,641**, £197,050]	23881.1707625378
External Bike Supplier Only	[£16,514, **£73,702**, £155,042]	23668.3492881459

~ (Default) ~

Parameter	-100%	-50%	-10%
Likelihood of Political Instability in China	-18%	-9%	-2%
Dependency of Assemble Bikes on Sensor Supplier	-14%	-7%	-1%
Dependency of Bike Supplier on Assemble Bikes	-11%	-5%	-1%
Likelihood of Economic Issues in Europe	-11%	-5%	-1%
Intended revenue of Assemble Bikes	-9%	-4%	-1%
Dependency of Assemble Bikes on Direct to Consumers	-7%	-3%	-1%
Dependency of Assemble Bikes on Retailers	-7%	-3%	-1%
Dependency of Internal Bike Producer on Assemble Bikes	-6%	-3%	-1%
Dependency of Sensor Supplier on Assemble Bikes	-6%	-3%	-1%
Likelihood of Insolvency of Sesnor Supplier	-6%	-3%	-1%
Impact of Political Instability in China Item: 1	-5%	-3%	0%
Dependency of Assemble Bikes on Internal Bike Producer	-5%	-3%	-1%
Dependency of Retailers on Assemble Bikes	-5%	-3%	-1%

Each column represents a change in the uncertainty (ambiguity) of the corresponding parameter and the cell value represents the change in the ambiguity of the loss of risk, as a result of the change in parameter ambiguity.

Also, at the bottom of the page, a double reduction matrix is reported that shows the results if two parameters' ambiguity is reduced (by 100%) simultaneously:



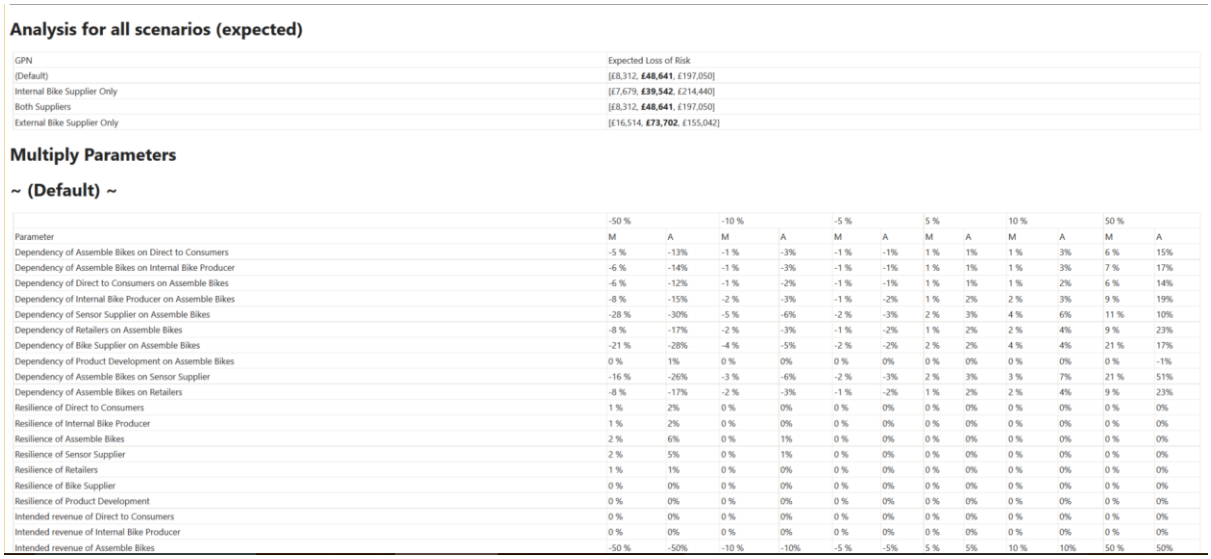
Double reduction matrix

Parameter	Likelihood of Political Instability in China	Dependency of Assemble Bikes on Sensor Supplier	Dependency of Bike Supplier on Assemble Bikes	Likelihood of Economic Issues in Europe	Intended revenue of Assemble Bikes	Dependency of Assemble Bikes on Direct to Consumers	Dependency of Assemble Bikes on Retailers	Dependency of Internal Bike Producer on Assemble Bikes	Dependency of Sensor Supplier on Assemble Bikes	Likelihood of Insolvency of Sesnor Supplier
Likelihood of Political Instability in China	-18%	-30%	-28%	-28%	-26%	-24%	-24%	-23%	-23%	-24%
Dependency of Assemble Bikes on Sensor Supplier		-14%	-25%	-24%	-22%	-20%	-20%	-19%	-19%	-20%
Dependency of Bike Supplier on Assemble Bikes			-11%	-22%	-20%	-19%	-19%	-18%	-18%	-18%
Likelihood of Economic Issues in Europe				-11%	-19%	-18%	-18%	-17%	-17%	-17%

Please note that this is considering all risk scenarios. If you want individual risk scenarios' sensitivity, you should go to the **Manage Scenario** page and select the corresponding **Uncertainty** link.

Analysing Sensitivity to Parameter Values

This page shows the sensitivity of the result (cost/loss of risk) to the model value of the individual parameters. Basically, how the result would change, if we change the parameters. This is reported in the following format:



Analysis for all scenarios (expected)

GPN	Expected Loss of Risk
(Default)	[£8,312, **£48,641**, £197,050]
Internal Bike Supplier Only	[£7,679, **£39,542**, £214,440]
Both Suppliers	[£8,312, **£48,641**, £197,050]
External Bike Supplier Only	[£16,514, **£73,702**, £155,042]

Multiply Parameters

~ (Default) ~

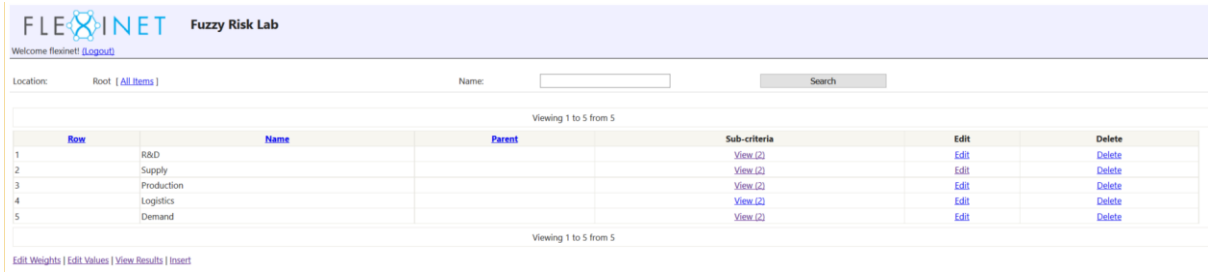
	-50 %		-10 %		-5 %		5 %		10 %		50 %	
Parameter	M	A	M	A	M	A	M	A	M	A	M	A
Dependency of Assemble Bikes on Direct to Consumers	-5 %	-13%	-1 %	-3%	-1 %	-1%	1 %	1%	1 %	3%	6 %	15%
Dependency of Assemble Bikes on Internal Bike Producer	-6 %	-14%	-1 %	-3%	-1 %	-1%	1 %	1%	1 %	3%	7 %	17%
Dependency of Direct to Consumers on Assemble Bikes	-6 %	-12%	-1 %	-2%	-1 %	-1%	1 %	1%	1 %	2%	6 %	14%
Dependency of Internal Bike Producer on Assemble Bikes	-8 %	-15%	-2 %	-3%	-1 %	-2%	1 %	2%	2 %	3%	9 %	19%
Dependency of Sensor Supplier on Assemble Bikes	-28 %	-30%	-5 %	-6%	-2 %	-3%	2 %	3%	4 %	6%	11 %	10%
Dependency of Retailers on Assemble Bikes	-8 %	-17%	-2 %	-3%	-1 %	-2%	1 %	2%	2 %	4%	9 %	23%
Dependency of Bike Supplier on Assemble Bikes	-21 %	-28%	-4 %	-5%	-2 %	-2%	2 %	2%	4 %	4%	21 %	17%
Dependency of Product Development on Assemble Bikes	0 %	1%	0 %	0%	0 %	0%	0 %	0%	0 %	0%	0 %	-1%
Dependency of Assemble Bikes on Sensor Supplier	-16 %	-26%	-3 %	-6%	-2 %	-3%	2 %	3%	3 %	7%	21 %	51%
Dependency of Assemble Bikes on Retailers	-8 %	-17%	-2 %	-3%	-1 %	-2%	1 %	2%	2 %	4%	9 %	23%
Resilience of Direct to Consumers	1 %	2%	0 %	0%	0 %	0%	0 %	0%	0 %	0%	0 %	0%
Resilience of Internal Bike Producer	1 %	2%	0 %	0%	0 %	0%	0 %	0%	0 %	0%	0 %	0%
Resilience of Assemble Bikes	2 %	6%	0 %	1%	0 %	0%	0 %	0%	0 %	0%	0 %	0%
Resilience of Sensor Supplier	2 %	5%	0 %	1%	0 %	0%	0 %	0%	0 %	0%	0 %	0%
Resilience of Retailers	1 %	1%	0 %	0%	0 %	0%	0 %	0%	0 %	0%	0 %	0%
Resilience of Bike Supplier	0 %	0%	0 %	0%	0 %	0%	0 %	0%	0 %	0%	0 %	0%
Resilience of Product Development	0 %	0%	0 %	0%	0 %	0%	0 %	0%	0 %	0%	0 %	0%
Intended revenue of Direct to Consumers	0 %	0%	0 %	0%	0 %	0%	0 %	0%	0 %	0%	0 %	0%
Intended revenue of Internal Bike Producer	0 %	0%	0 %	0%	0 %	0%	0 %	0%	0 %	0%	0 %	0%
Intended revenue of Assemble Bikes	-50 %	-50%	-10 %	-10%	-5 %	-5%	5 %	5%	10 %	10%	50 %	50%

The changes in modal and ambiguity of the results are reported for a change in the individual parameters' modal value (as described in D2.4). The changes examined are -50%, -10%, -5%, 5%, 10% and 50%. The results are reported for all configuration, including the default.

Please note that in addition to the main method (Multiplication) that is described in D2.4, a shifting method is also used to modify parameters values by addition or subtraction. The results are reported after the results for the multiplication method.

GPN BSC Analysis

The **Manage Criteria** page shows the main criteria for evaluating individual nodes for the GPN BSC method. These could be, as described in D2.4, R&D, Supply, Production, Logistics and Demand. Although they can be extended or reduced, as necessary. These upper level criteria would be corresponding to the roles that the nodes can accept (see the Nodes section). When a node is assigned a role, the corresponding BSC structure will be applied to that one node. Please see D2.4 for more information on the method.



FLEXINET **Fuzzy Risk Lab**

Welcome flexinet! (Logout)

Location: Root [All Items] Name: Search

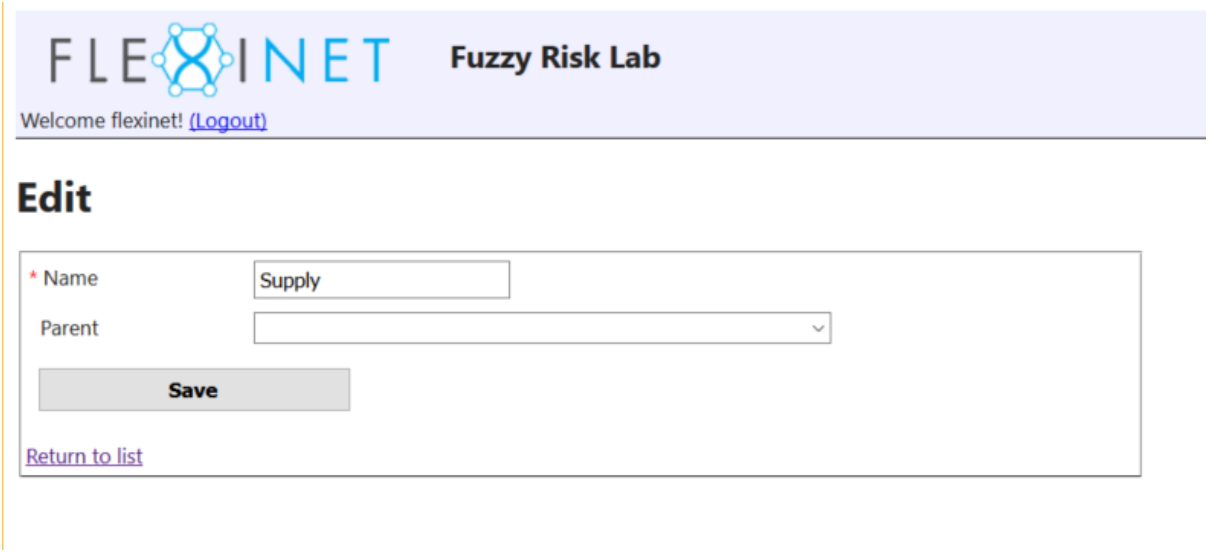
Viewing 1 to 5 from 5

Row	Name	Parent	Sub-criteria	Edit	Delete
1	R&D		View (2)	Edit	Delete
2	Supply		View (2)	Edit	Delete
3	Production		View (2)	Edit	Delete
4	Logistics		View (2)	Edit	Delete
5	Demand		View (2)	Edit	Delete

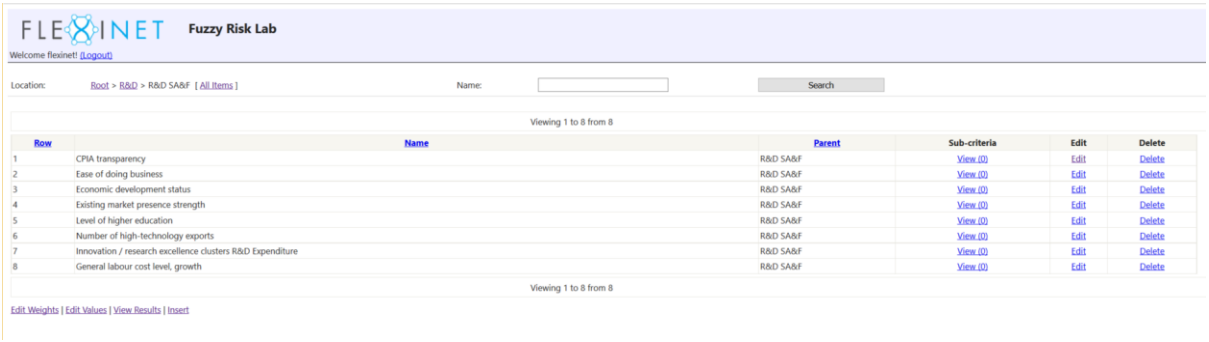
Viewing 1 to 5 from 5

Edit Weights | Edit Values | View Results | Insert

The criteria can be edited through the following form, where the name and parent criteria is set:



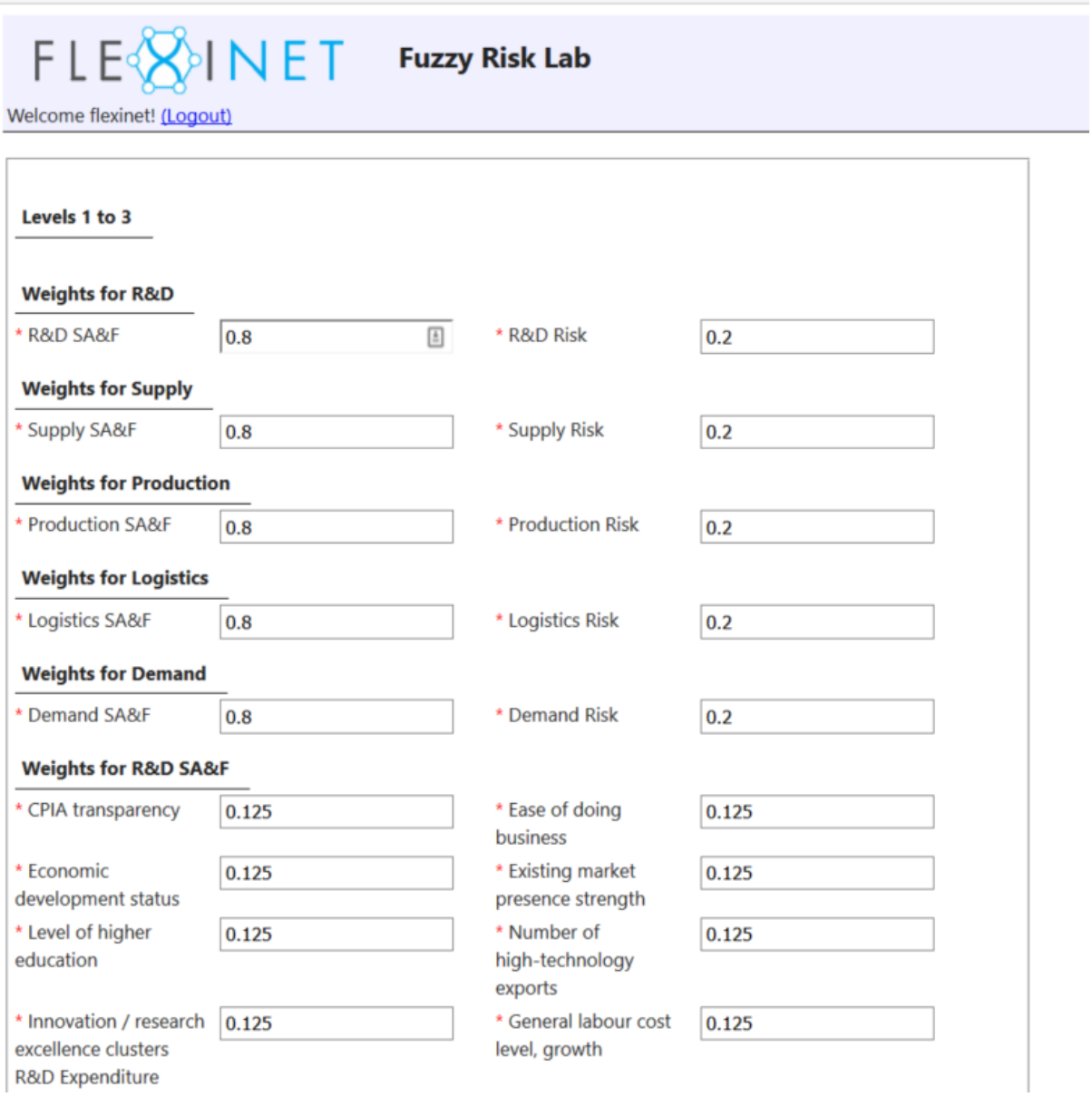
Each criteria can have a number of sub-criteria. These are linked through the Parent field. You can also view the currently assigned sub-criteria by clicking on the **View** link in from of the criteria that brings the list of relevant sub-criteria.



Please note that by clicking on the **Root** link at the top of the page, you can navigate to the upper level criteria, while the **All Items** option also shows all the criteria in the same page, irrespective of their location on the hierarchy. Other links will also appear to navigate to the ancestors of the current nodes (e.g. **R&D** in the above example).

At the bottom of the page, three links for **Editing Weights, Editing Values** and **Viewing Results** are available.

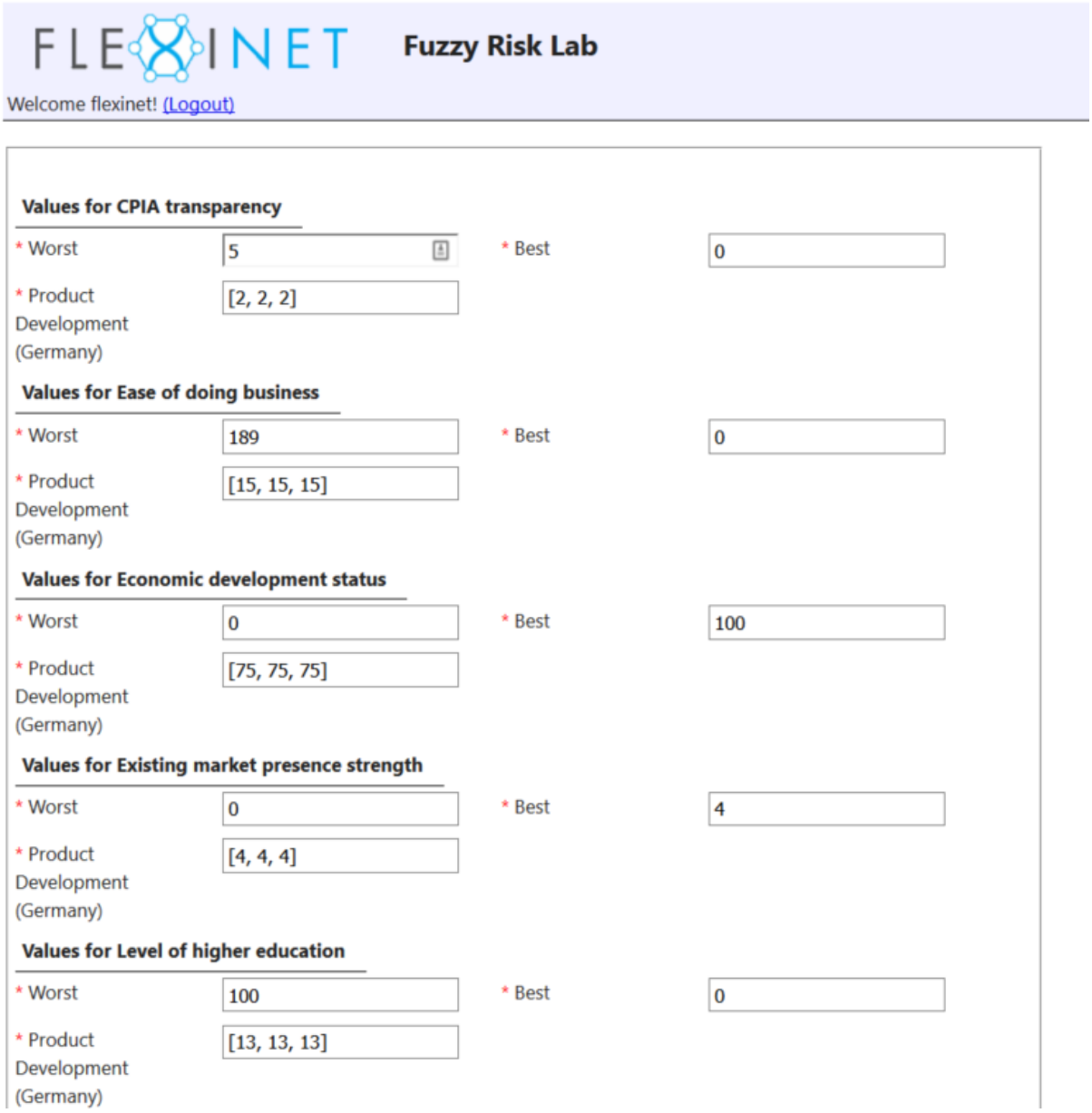
When you click on the **Edit Weight** option, a form is shown that has all the weights needed for the BSC model



Weights are assigned for different levels: (1 to 3) weights for the sub-criteria that will be applied to all nodes in the corresponding role (main criteria), (4) weight of different nodes in the same role for different GPN configurations and (5) weight of different roles for different configurations.

Please note the weights are assumed to be normalised and add up to one on any level (please see the example). However, the software will not generate an error if not.

The **Edit Value** page allows the user to enter all the relevant values for the nodes. These are the values assigned for the lowest level of the BSC score cards, which are the indicators. In each case, the user is expected to put a Worst and Best value (corresponding to Min and Max values for indicators of benefit type, and, Max and Min for indicators of cost type). Also, the user should provide the necessary value information in triangular fuzzy format.



Once the values and weights are all set, the **View Results** page presents the output of the BSC method.

User can drill down on the results (to see a break-down of results) by clicking on the **Show Details** links.