STORYLINE OF DSS IN SELECTION OF MITIGATION MEASURES

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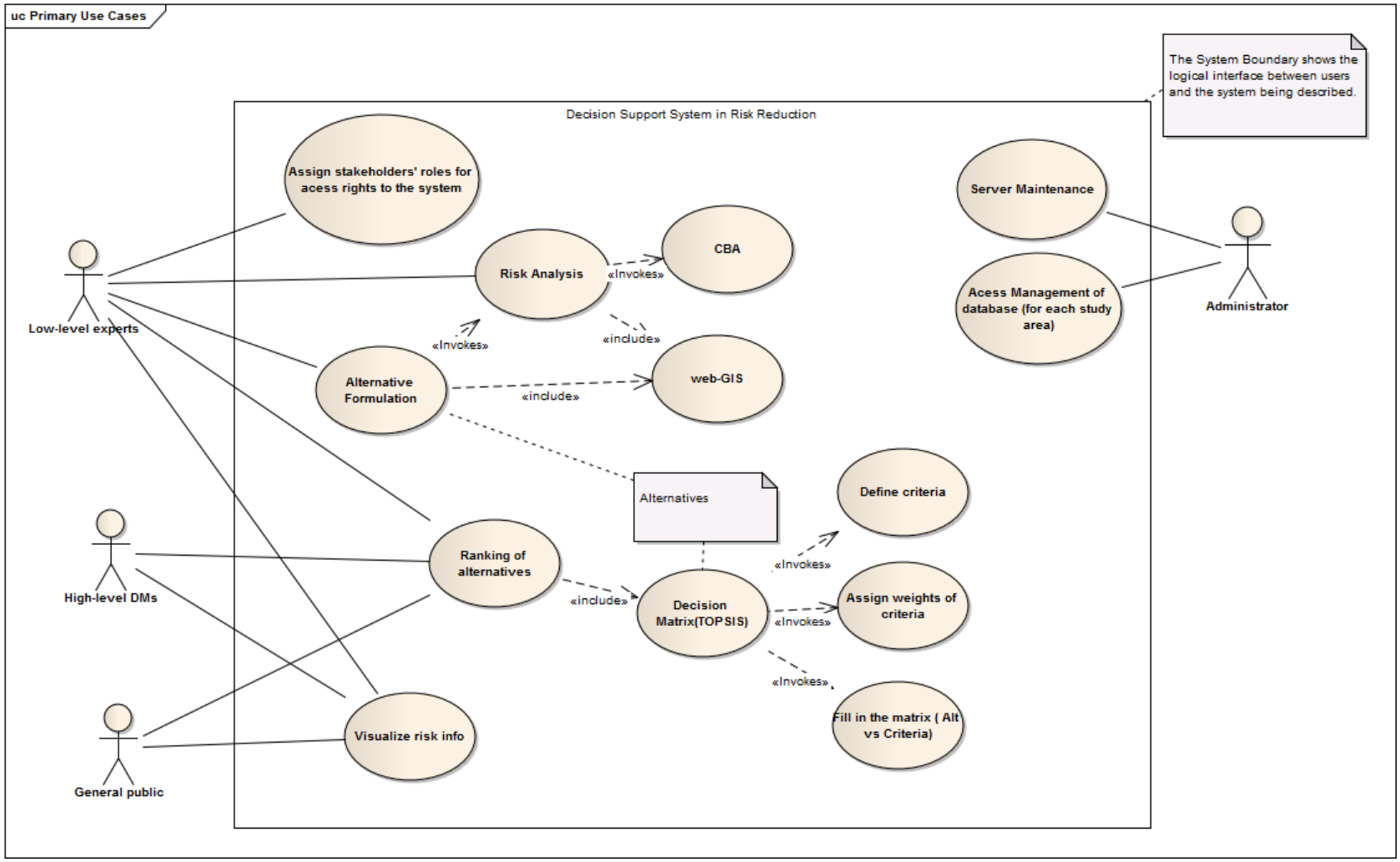
SEVENTH FRAMEWORK PROGRAMME

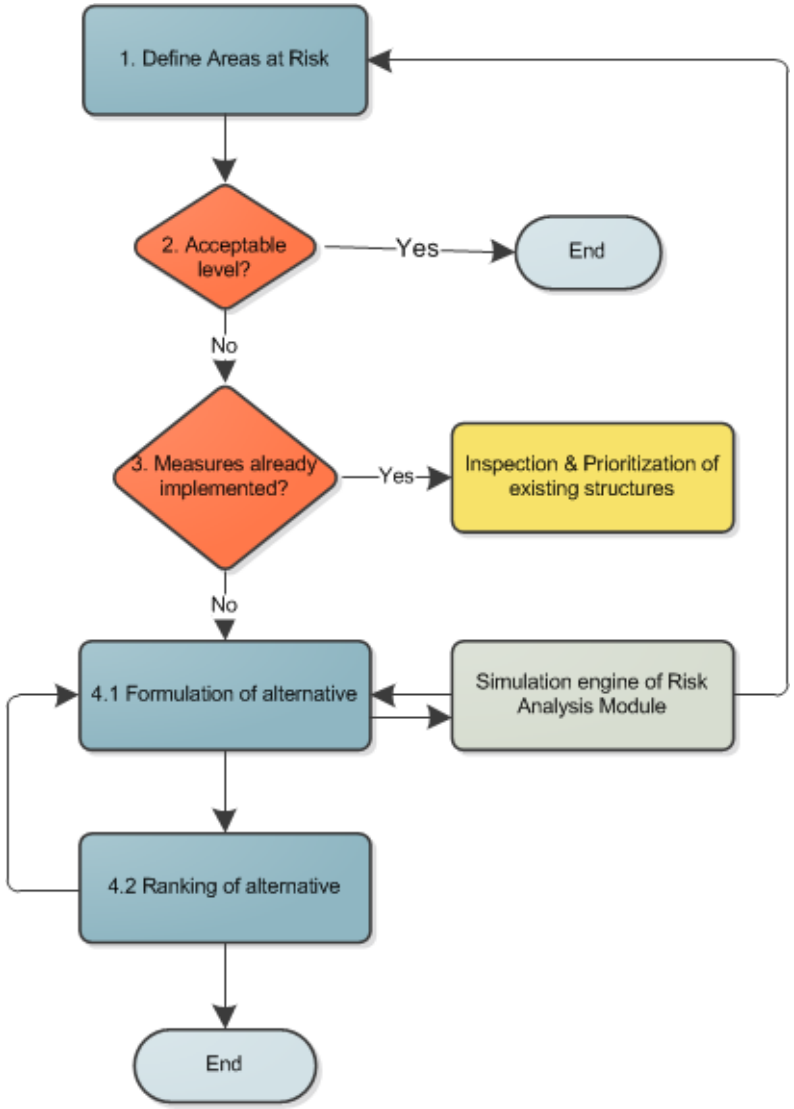
CHANGES Risk=HVA

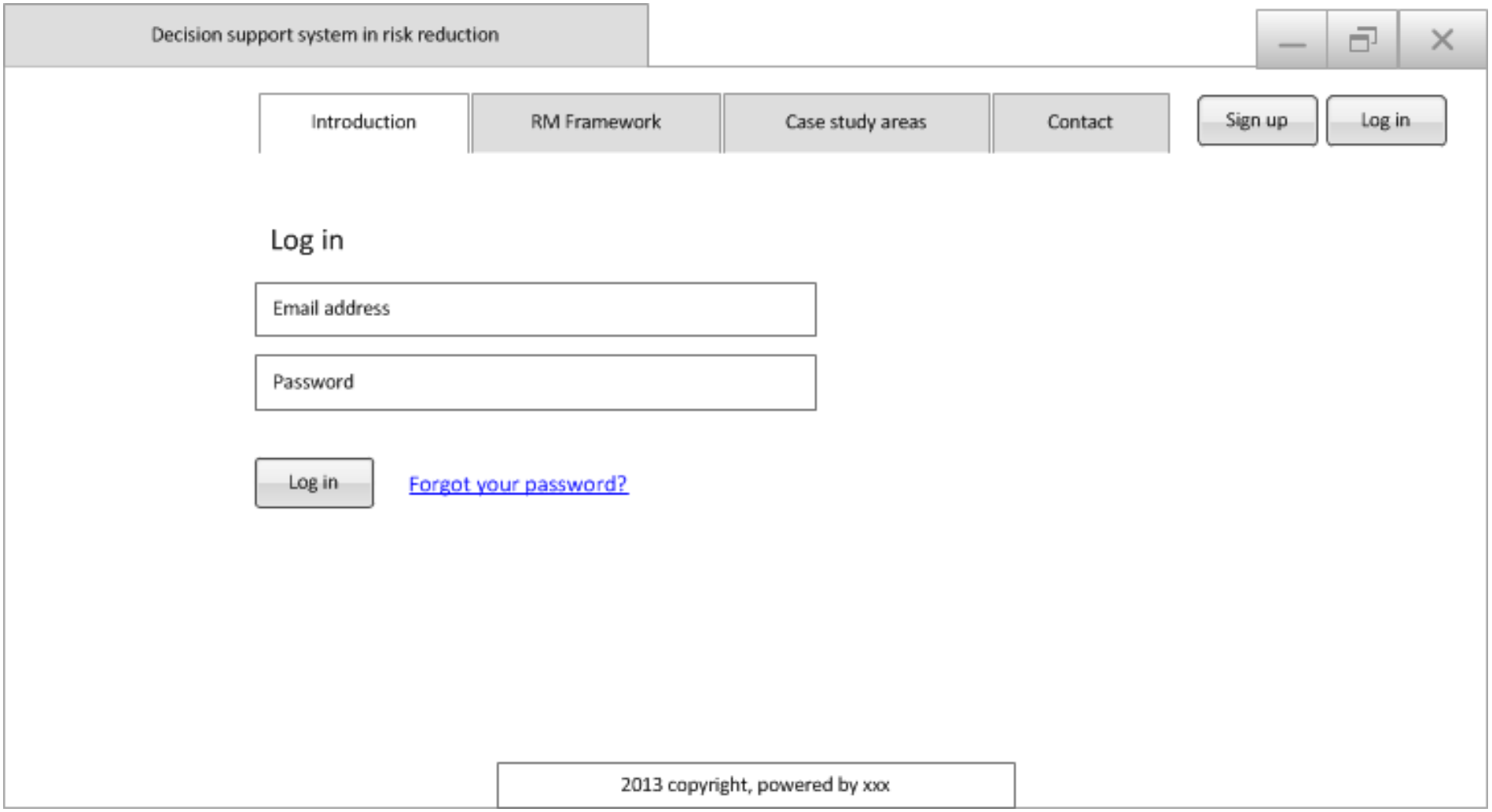
UNIL | Université de Lausanne

User-system interaction



Steps in Decision Making




Decision support system in risk reduction
Introduction
RM Framework
Case study areas
Contact
Sign up
Log in
Log in
Email address
Password
Log in
Forgot your password?
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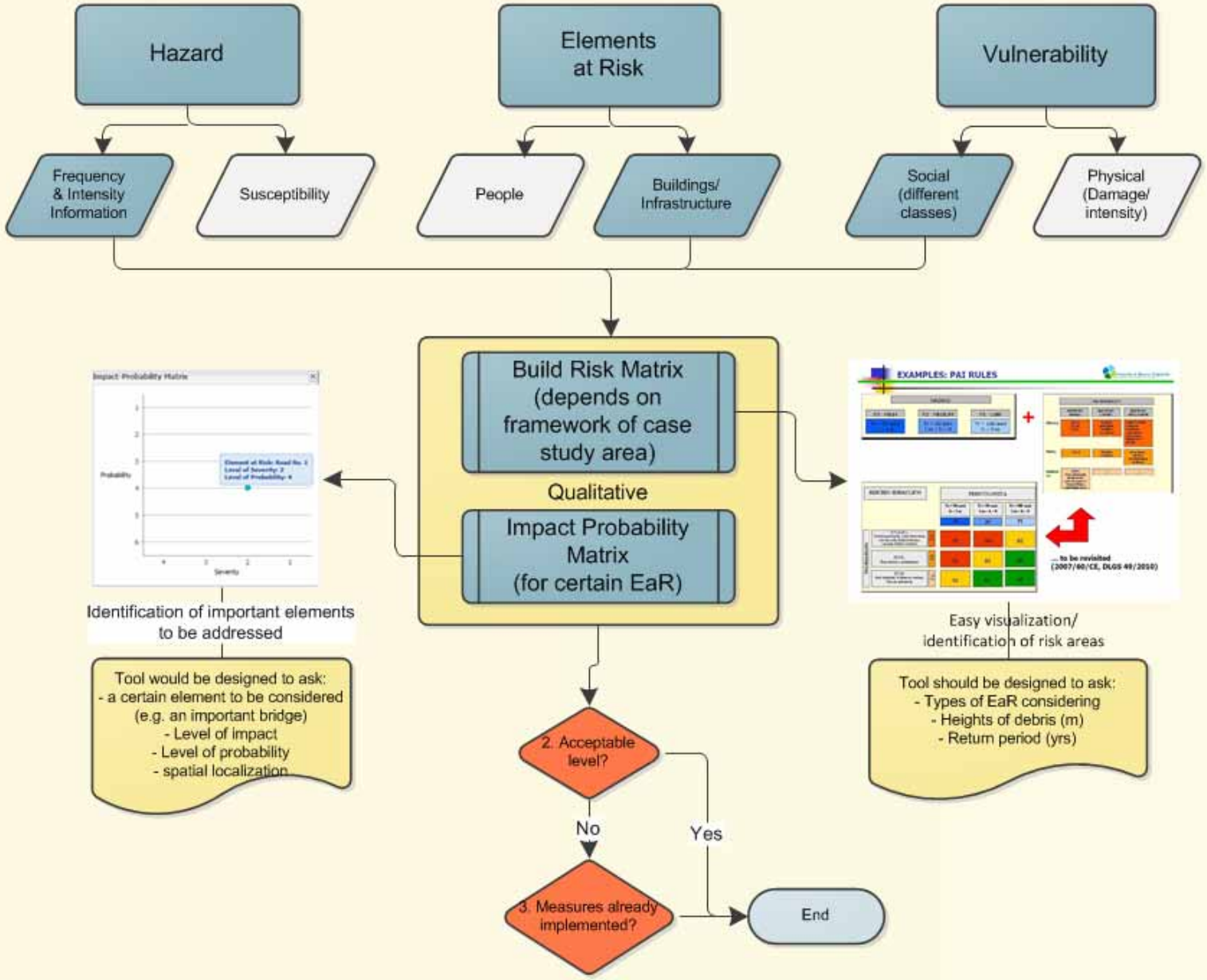
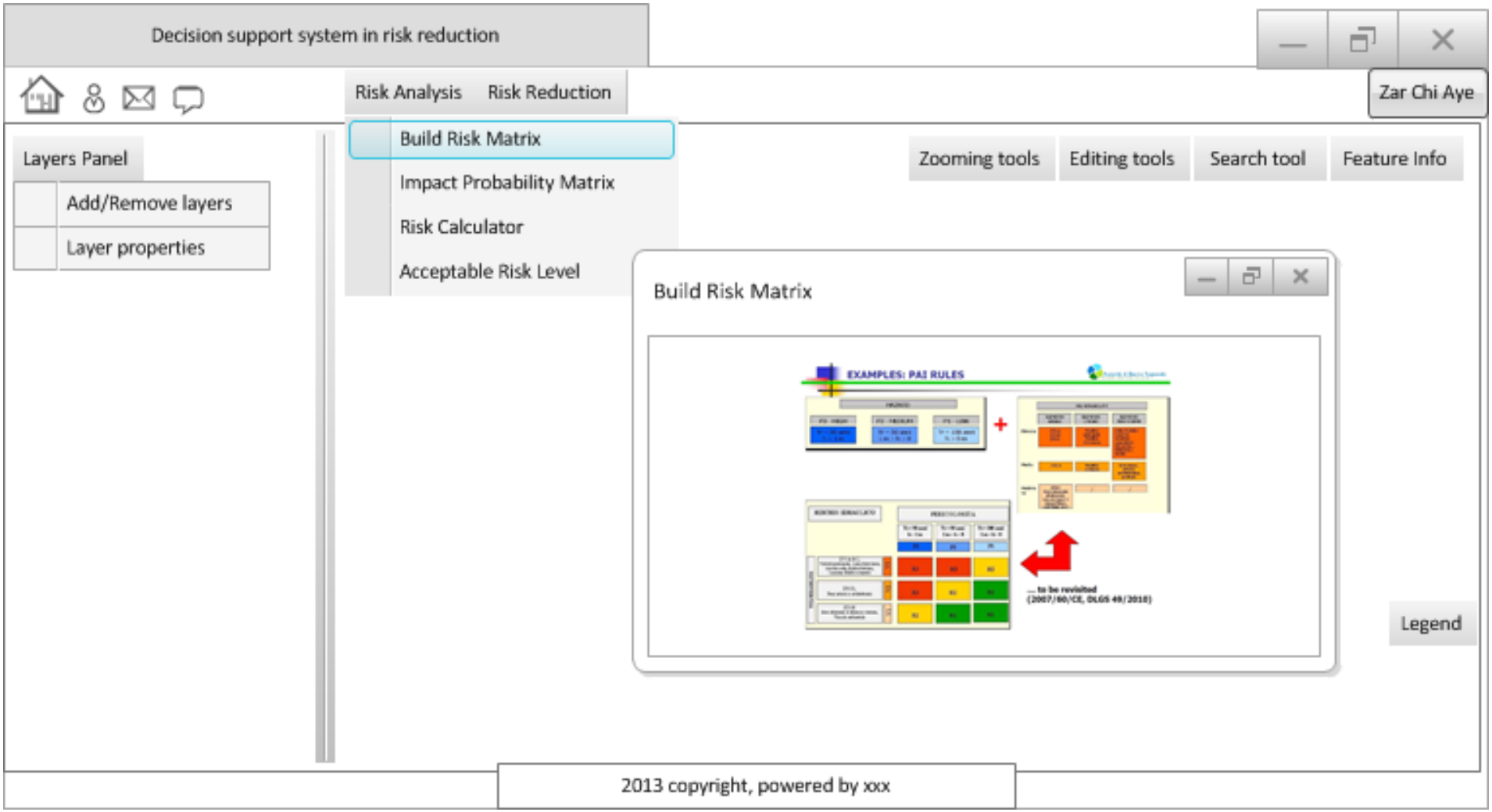
PROBLEM DEFINITION

Step 1-3


Hazard
Elements at Risk
Vulnerability
Frequency & Intensity Information
Susceptibility
People
Buildings/ Infrastructure
Social (different classes)
Physical (Damage/ intensity)
Build Risk Matrix (depends on framework of case study area)
Qualitative
Impact Probability Matrix (for certain EaR)
EXAMPLES: PAI RULES
Identification of important elements to be addressed
Tool would be designed to ask:
- a certain element to be considered (e.g. an important bridge)
- Level of impact
- Level of probability
- spatial localization
Easy visualization/ identification of risk areas
Tool should be designed to ask:
- Types of EaR considering
- Heights of debris (m)
- Return period (yrs)
2. Acceptable level?
No
Yes
3. Measures already implemented?
End


Decision support system in risk reduction
Risk Analysis
Risk Reduction
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Layers Panel
Add/Remove layers
Layer properties
Build Risk Matrix
Impact Probability Matrix
Risk Calculator
Acceptable Risk Level
Zooming tools
Editing tools
Search tool
Feature Info
Build Risk Matrix
EXAMPLES: PAI RULES
Legend
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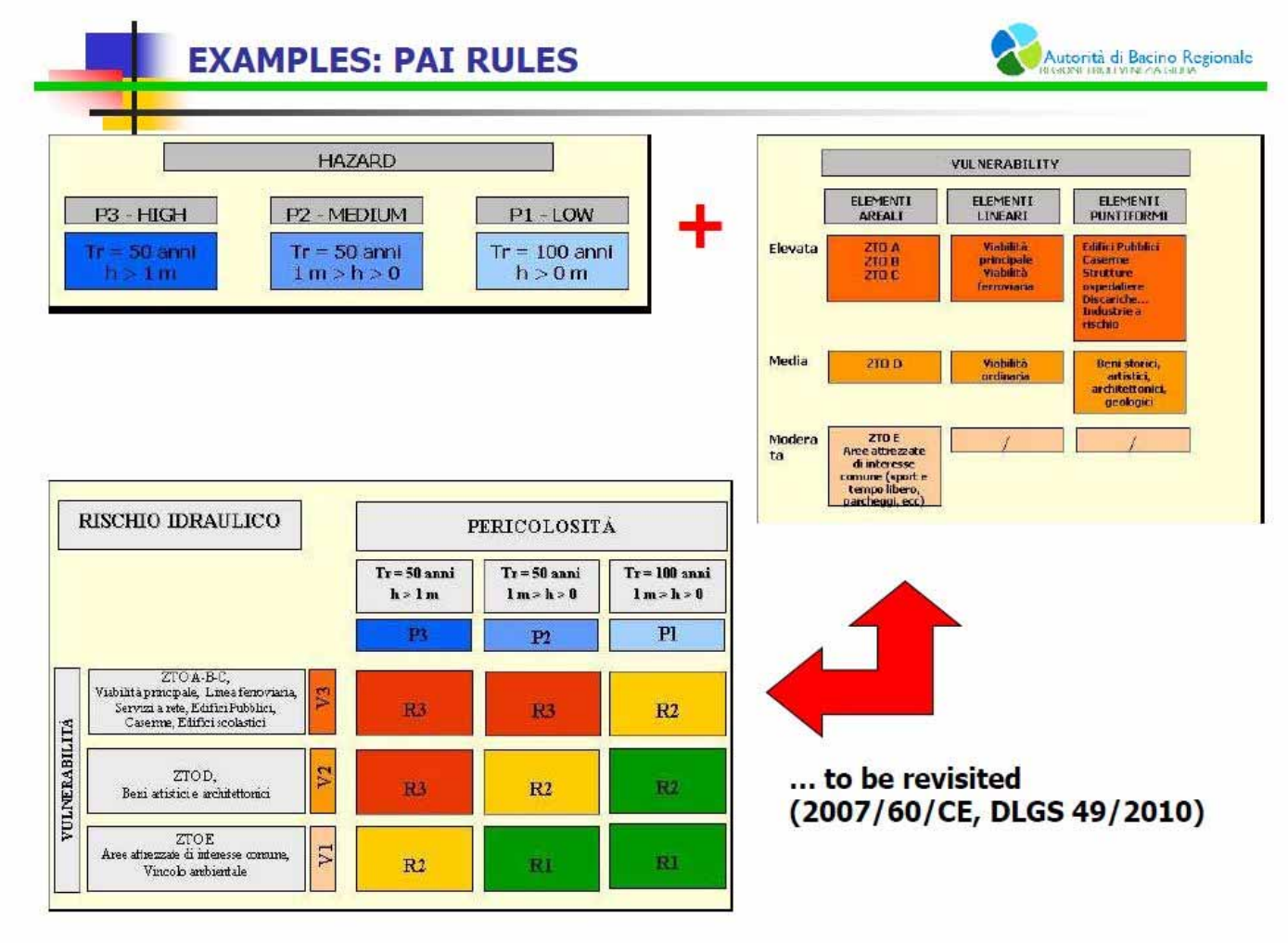
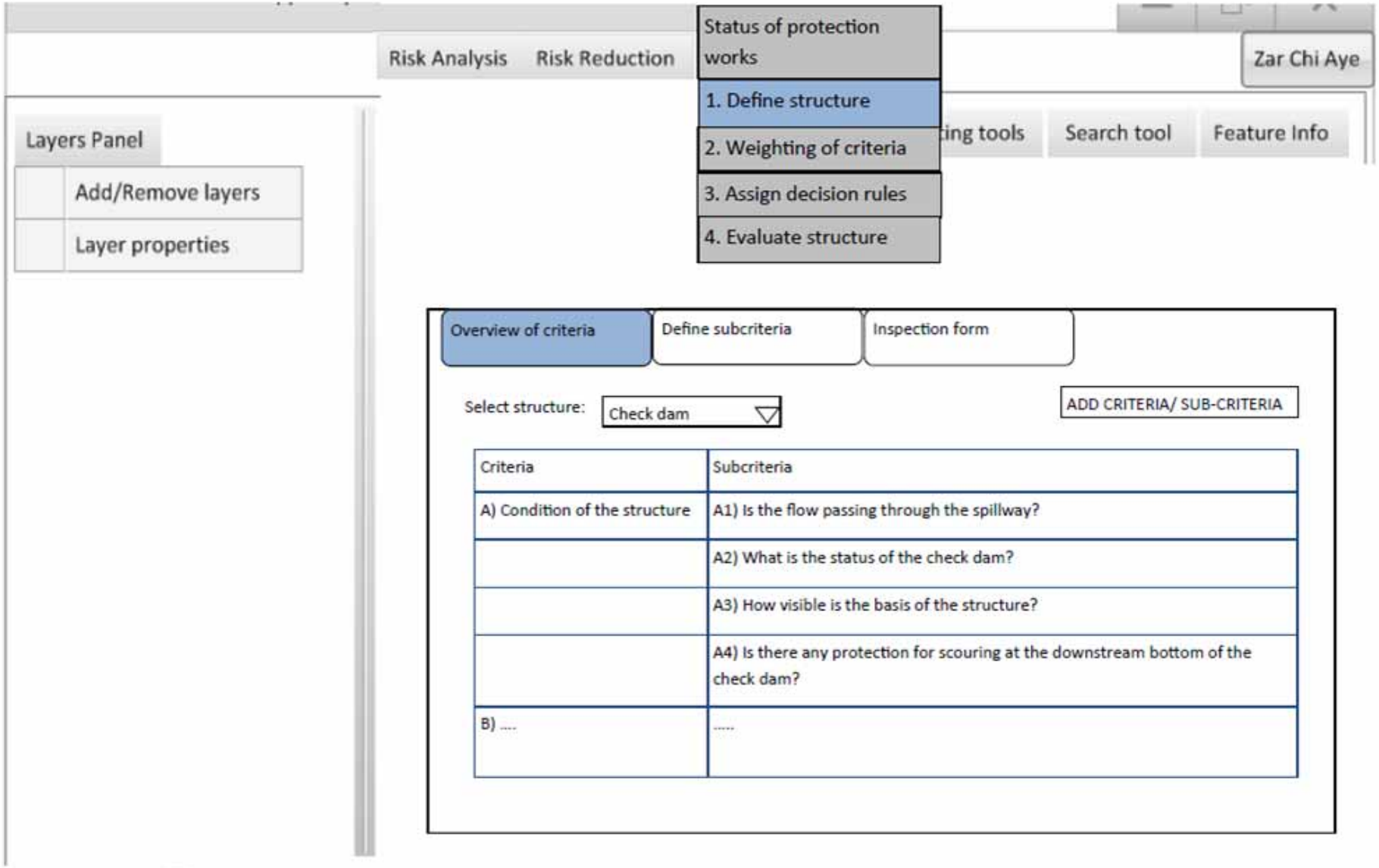
ACCEPTABLE RISK LEVEL

Example: Italian Framework



MEASURES ALREADY IMPLEMENTED?

Inspection and prioritization of existing measures (Juliette)


Risk Analysis
Risk Reduction
Status of protection works
1. Define structure
2. Weighting of criteria
3. Assign decision rules
4. Evaluate structure
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Search tool
Feature Info
Layers Panel
Add/Remove layers
Layer properties
Overview of criteria
Define subcriteria
Inspection form
Select structure:
Check dam
ADD CRITERIA/ SUB-CRITERIA
Criteria
Subcriteria
A) Condition of the structure
A1) Is the flow passing through the spillway?
A2) What is the status of the check dam?
A3) How visible is the basis of the structure?
A4) Is there any protection for scouring at the downstream bottom of the check dam?
B) ....
.....
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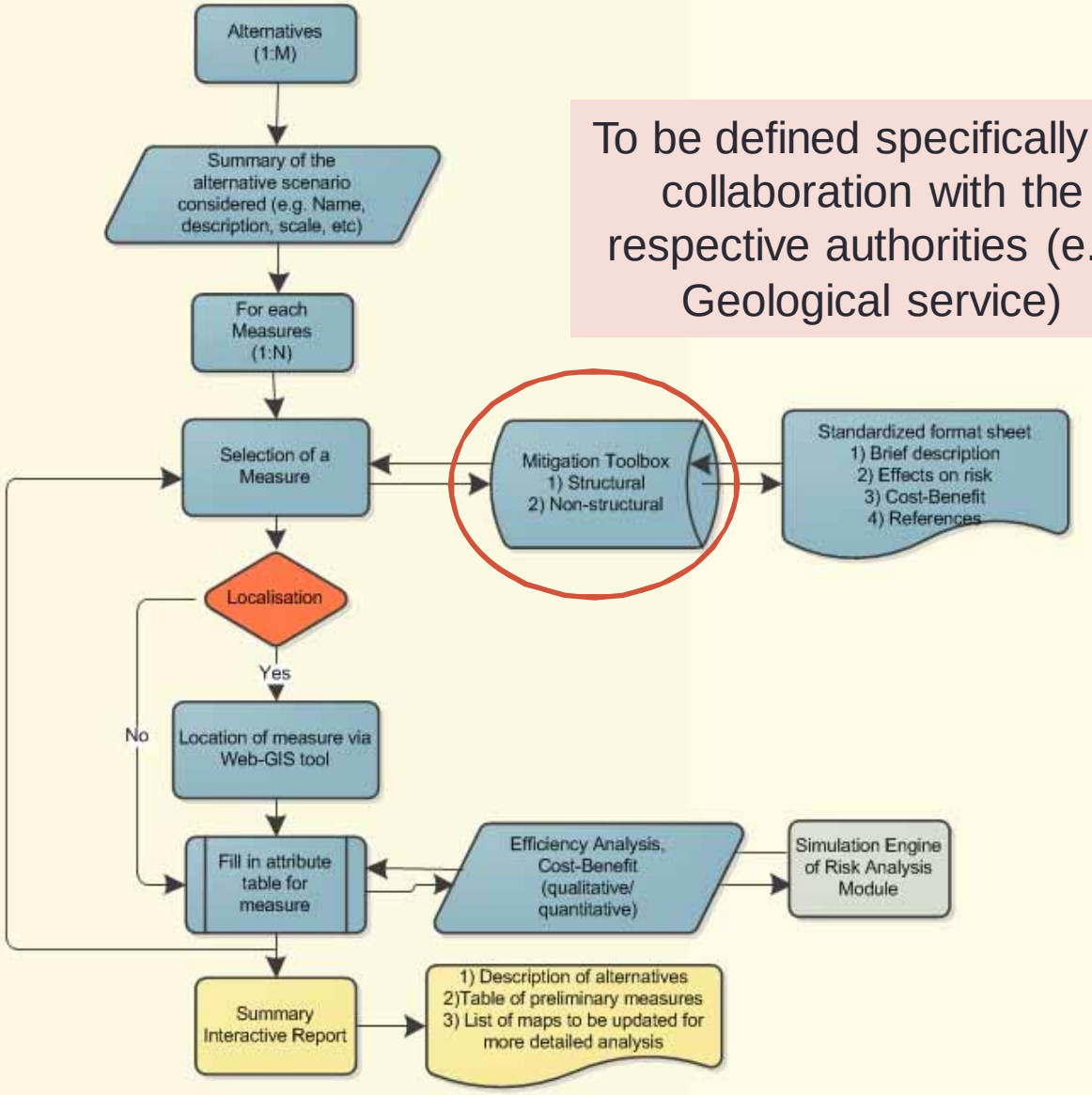
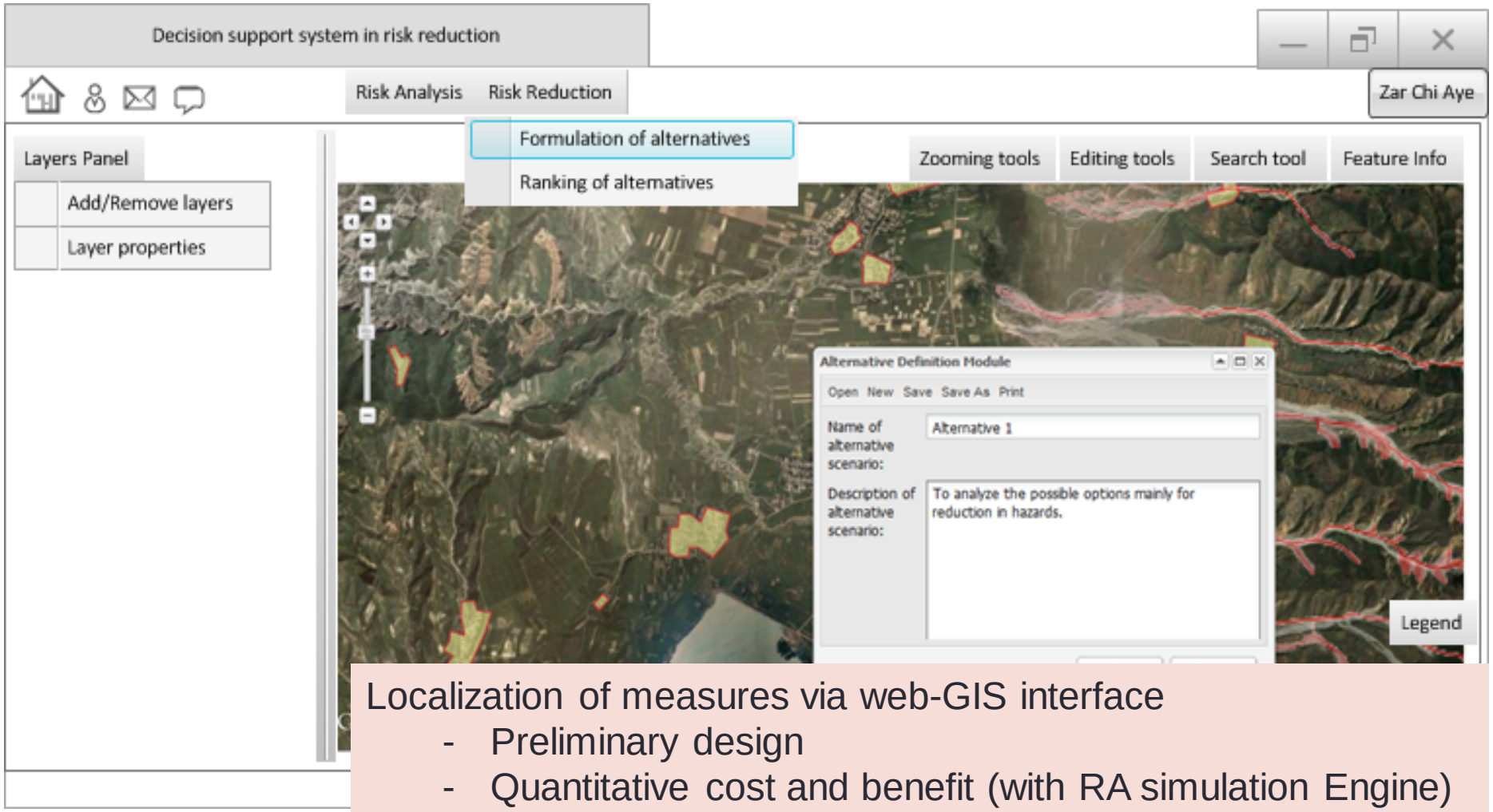
1) FORMULATION OF MEASURES

Step 4.1 Formulation of alternatives



To be defined specifically in collaboration with the respective authorities (e.g. Geological service)

by expert user – e.g. geological services



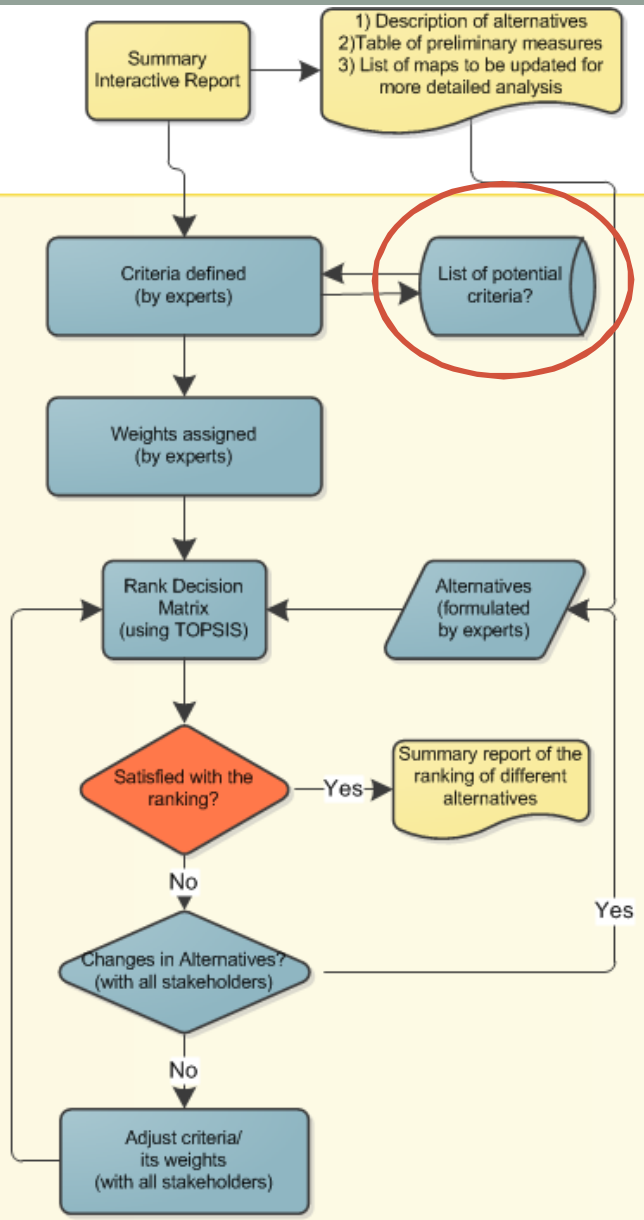
Localization of measures via web-GIS interface

- Preliminary design
- Quantitative cost and benefit (with RA simulation Engine)
- Qualitative cost and benefit (expert judgment/estimation)
- Summary report

2) SELECTION OF MEASURES

Collaborative Platform using TOPSIS (Multi-Criteria Evaluation method)

Step 4.2. Ranking of alternatives



- Social
- Economic
- Environmental

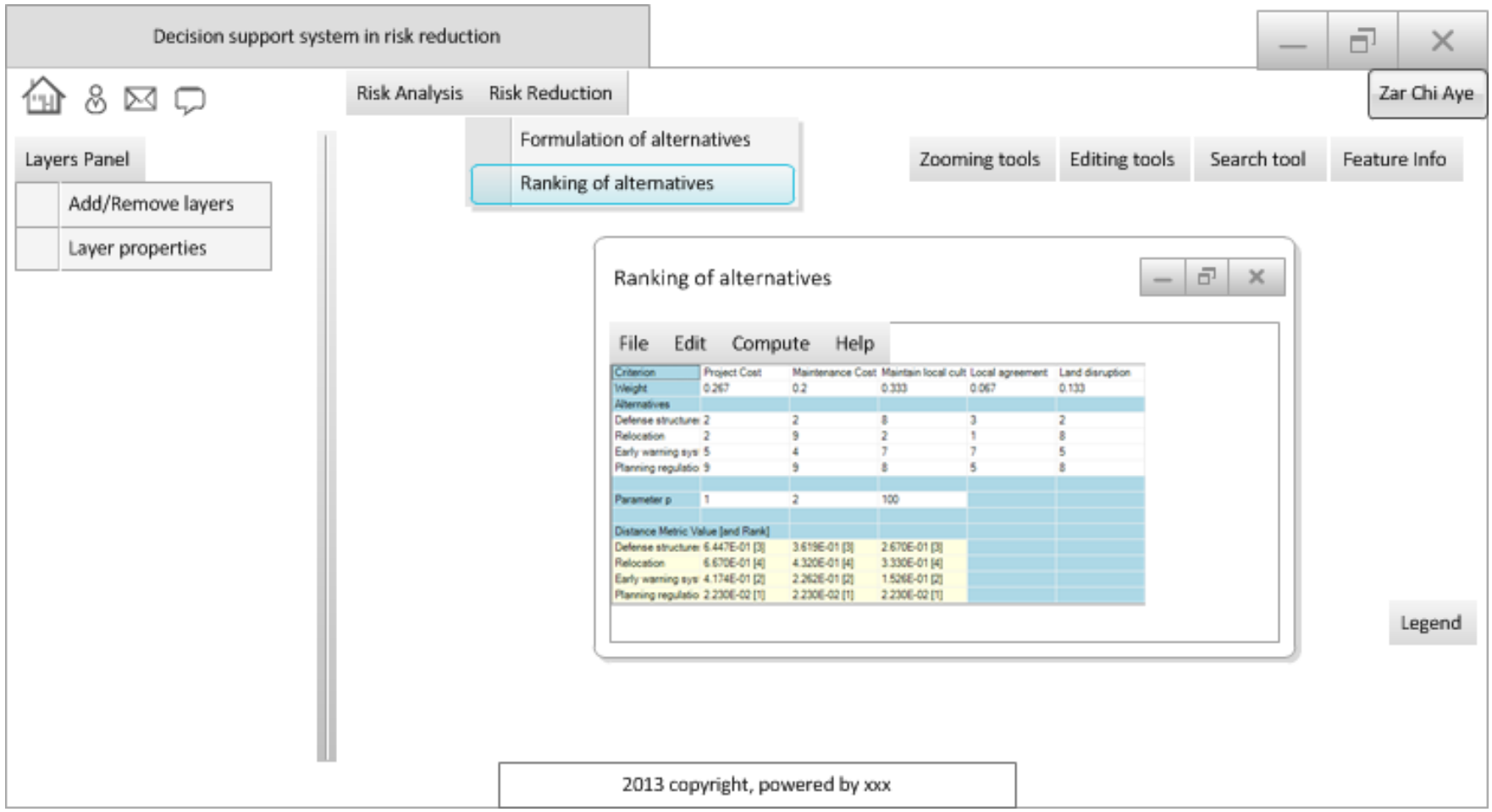
*If there are multiple decision makers, they should agree on the list of final criteria chosen to validate against the alternatives in the decision matrix

Stakeholders (users of the system)*

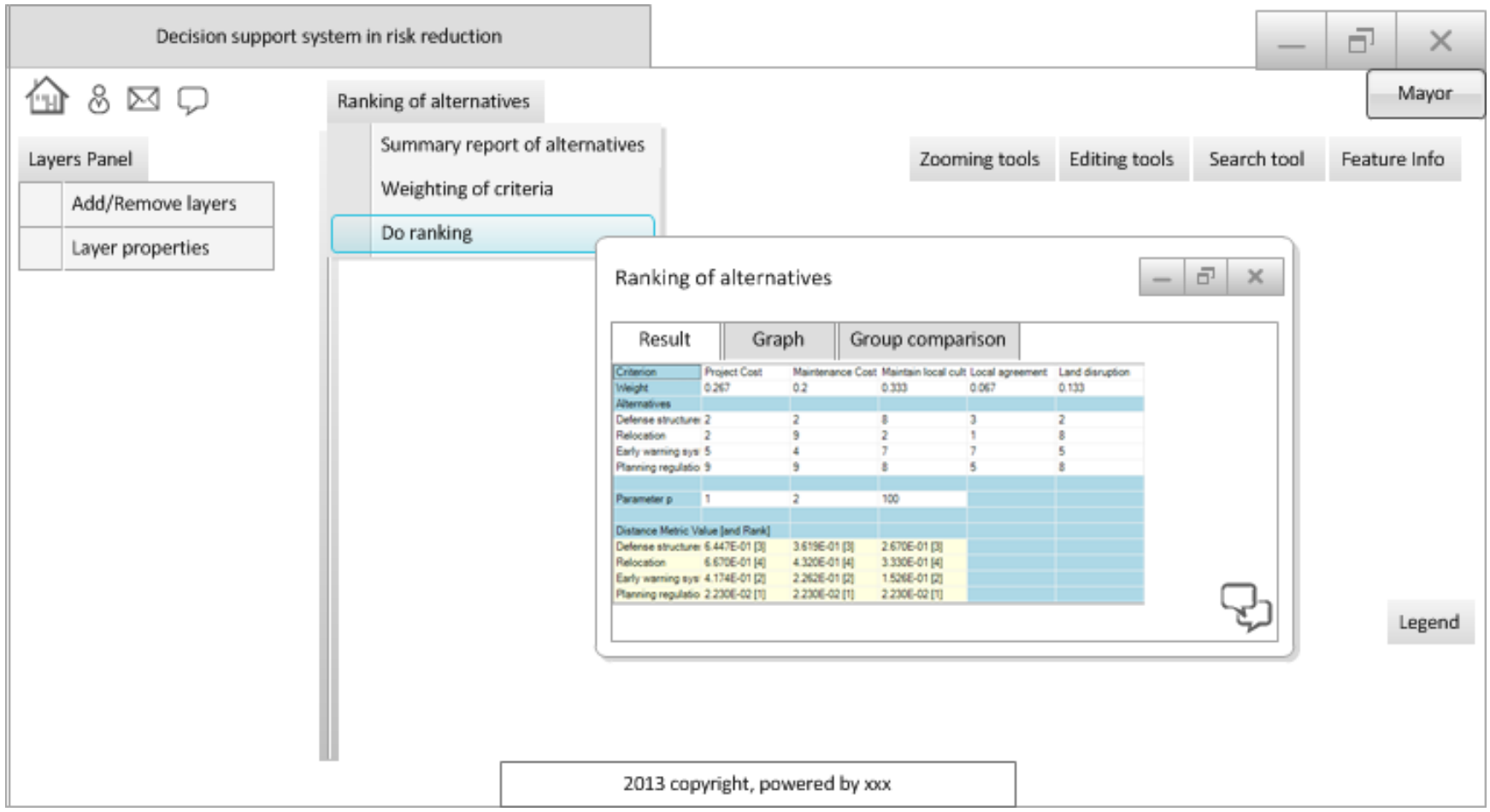
- Low-level DMs (Experts)
  - Geological Survey
  - Forestry Services
  - Environmentalists
- High-level DMs
  - Regional Civil Protection
  - FVG Basin Authority
  - High Adriatic River Basin Authority Venezia
- Public
  - Major of Municipality
  - Local voluntary fire brigades
  - Local committee for safety
  - Representative of local residents

* Differs according to the case study area

User: Low-level Expert



User: High-level DM



TOPSIS method (Hwang & Yoon, 1981)

- Inputs (a mixture of qualitative/quantitative possible)
  - Agree upon the chosen criteria
  - Collect different weights for criteria
  - Fill in the decision matrix (Alternatives Vs Criteria)
- Convert qualitative terms into numbers using fuzzy sets
- Normalization of the decision matrix
- Weighted normalization of the decision matrix
- Choose Positive Ideal Solution (PIS) and Negative Ideal Solution (NIS)
- Calculate Euclidean distance
- Rank the alternatives using relative closeness

- All involved stakeholders in decision making process
- Only the low-level users (expert – Geological service)

Example: Decision Matrix

Criteria	Economic		Social		Environmental
Alternatives	Project Cost	Maintenance Cost	Local Culture	Local Agreement	Land disruption
Defense structures	2	2	8	3	2
Relocation	2	9	2	1	8
Early warning + stabilization works	5	4	7	7	5
Planning regulations	9	9	8	5	8
Weights (of High-level authority)	4	3	5	1	2

Criteria	Economic		Social		Environmental
Alternatives	Project Cost	Maintenance Cost	Local Culture	Local Agreement	Land disruption
Defense structures	(				07252441
Relocation	(				49093445
Early warning + stabilization works	(				27894003
Planning regulations	(				49093445
Weights (of a High-level authority)	0.266666667	0.2	0.333333333	0.066666667	0.133333333
Best Value (V+)	0.146031746	0.078632479	0.111111111	0.030188679	0.049093445
Worst Value (V-)	0.020634921	0.011111111	0.016414141	0.003773585	0.007252441

	S+	S-	Closeness C*	Ranking
Defense structures	0.14958115	0.095031	0.388497823	3
Relocation	0.15934126	0.079434	0.332673437	4
EW+stabilization works	0.08586669	0.105461	0.551206348	2
Planning regulations	0.00922432	0.17691	0.950442721	1

* Ranking of alternatives could be different according to the different weights of stakeholders

Participatory decision making

Alternatives

Decision matrix

Criteria	Economic		Social		Environmental
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- Iterative process to reach the agreed weights on the criteria to produce only a single ranking matrix?
- Using collaborative platform
  - Provide communication facilities to send mail, vote and provide feedback on the criteria, alternatives and ranking

Follow-up activities

- Case study (Flood plain area) and stakeholders' engagement with Alert Solutions
- Design of Questionnaires/interviews for decision matrix (Alternatives-Criteria)
- Draft prototype at Dec 2013
- First version till end of Aug 2014
- Two workshops (User evaluation)
  - May 2014
  - September 2014