



EconoMe-Develop – a calculation tool for multi-risk assessment and benefit-cost-analysis

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Motivation

Since 2008, it is required by the Federal Office for the Environment, to assess the effectiveness and the economic efficiency of mitigation projects with the software EconoMe (www.econome.admin.ch). For comparability reasons, calculation factors and object parameters are fixed in EconoMe. EconoMe is adapted to Swiss conditions and can be used for risk assessment of snow avalanches, debris flows, floods, rockfalls and landslides.

In order to allow for risk analyses of all natural hazard processes in Switzerland, the National Platform for Natural Hazards PLANAT have supported the development of a research and development software based on the “Guideline Natural Hazards RIKO” [1] and the operational version EconoMe [2]. The result is the online software EconoMe-Develop.

Setup and functionalities of EconoMe-Develop

EconoMe-Develop can be accessed at www.econome-develop.admin.ch. Login data are provided by the Federal Office for the Environment upon request for projects with a research background and with the potential to gain experience on risk analyses.

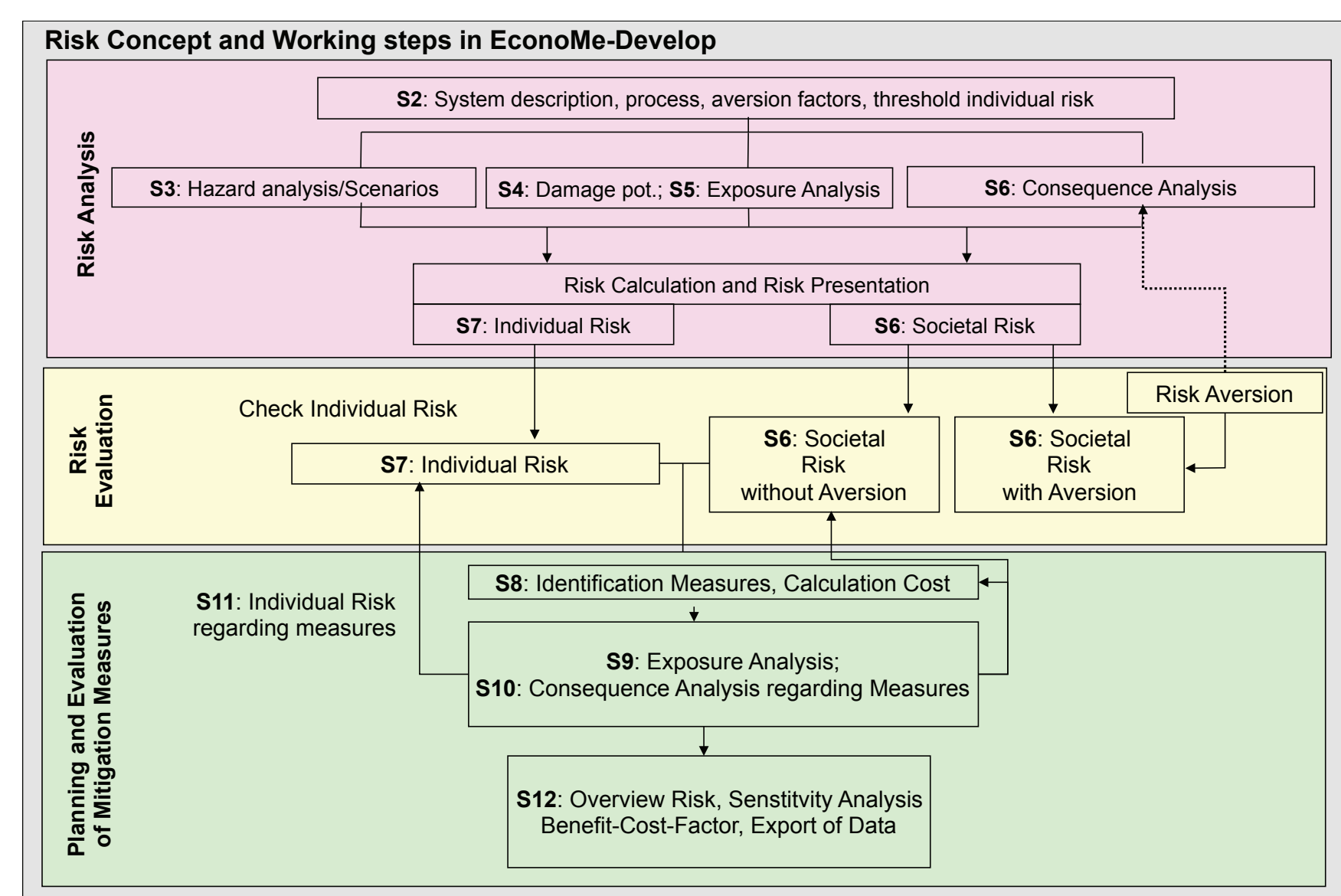


Fig. 1: Components of a risk-based planning. The „S“ followed by a number refers to working steps in the software (see Fig. 3).

Action	Title	Probability of occurrence	pRA	Intensity map	State
Scenario 30	30	1	1	Uebung_Gruppe_1-Br.pdf	✓
Scenario 100	100	1	1	Uebung_Gruppe_1-Br.pdf	✓
Scenario 300	300	1	1	Uebung_Gruppe_1-Br.pdf	✓

Action	Ident.-No.	Title	Number	pRA
+	5	Apartment one-family house (2.24 according Swiss Statistics)	1 Wohneinheit	1
+	6	Apartment one-family house (2.24 according Swiss Statistics)	1 Wohneinheit	1
+	7	Apartment one-family house (2.24 according Swiss Statistics)	1 Wohneinheit	1
+	9	Garage (parking unit incl. vehicles)	1 Stück	1
+	14	Apartment one-family house (2.24 according Swiss Statistics)	1 Wohneinheit	1
+	15	Communal road, width 8m	1 m	1

Action	Ident.-No.	Title	Number	pRA
+	1	Apartment one-family house (2.24 according Swiss Statistics)	1 Wohneinheit	1
+	2	Apartment one-family house (2.24 according Swiss Statistics)	1 Wohneinheit	1
+	3	School/Nursery	1 m	1
+	4	Apartment one-family house (2.24 according Swiss Statistics)	1 Wohneinheit	1
+	8	Garage (parking unit incl. vehicles)	1 Stück	1
+	10	Apartment one-family house (2.24 according Swiss Statistics)	1 Wohneinheit	1
+	11	Apartment one-family house (2.24 according Swiss Statistics)	1 Wohneinheit	1
+	12	Apartment one-family house (2.24 according Swiss Statistics)	1 Wohneinheit	1
+	13	Apartment one-family house (2.24 according Swiss Statistics)	1 Wohneinheit	1

Working days (75 %):	0 CHF
Holidays (25 %):	0 CHF

Σ Number of deaths:	2.8
Total sum damage to people:	14 000 000 CHF
Total sum damage material assets:	5 150 000 CHF
Indirect costs:	0 CHF
Damage total without indirect costs:	19 150 000 CHF
Damage total with indirect costs:	19 150 000 CHF

Fig. 6: Consequence analysis: Objects can be attributed to intensity areas and the damage is calculated. Overlays of objects and intensity areas obtained by GIS-analysis can be imported via XML. Damage and risks are calculated.

Action	Ident.-No.	Title	Description	State
+	2	Apartment one-family house (2.24 according Swiss Statistics)	Entfernenhaus	✓

Exposition	Working days (75 %)	Holidays (25 %)	Accumulated expositions (100%)
Scenario 30	0	0	0
Scenario 100	0.050625	0.016875	0.0675
Scenario 300	0.050625	0.016875	0.0675

Action	Ident.-No.	Title	Description	State
+	10	Apartment one-family house (2.24 according Swiss Statistics)	Entfernenhaus	✓
+	11	Apartment one-family house (2.24 according Swiss Statistics)	Entfernenhaus	✓
+	3	School/Nursery	Schulhaus	✓
+	15	Communal road, width 8m	Gemeindestrasse	✓

Fig. 7: Individual risk can be compared to thresholds, which can be defined in the system description by the user. Risks above the threshold are indicated in red, those below are indicated in green. Risks between the upper and the lower thresholds are depicted in yellow.

Conclusions

1. EconoMe-Develop supports risk assessments for nearly all types of natural hazards due to the possibility for adapting calculation measures to specific conditions.
2. XML-Interfaces allow the import of own data tables (vulnerability of objects, value of objects) and the import of results from GIS-analyses. This feature greatly reduces the time needed for detailed risk analyses.
3. Since calculation factors (e.g. vulnerability) in risk analyses are adjustable, the influence of uncertainty of import variables on final results can be considered for the interpretation of results.

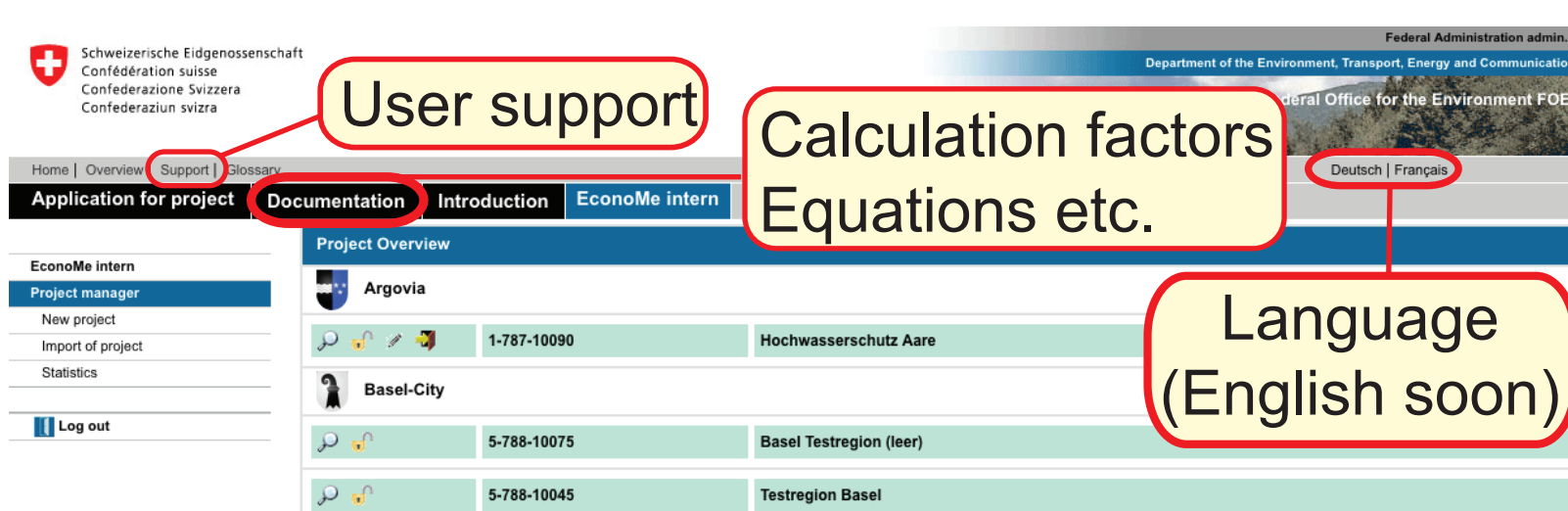


Fig. 2: Start screen after login - List of projects

Action	Ident.-No.	Object	Description	Total value (CHF)
+	1	Apartment one-family house (2.24 according Swiss Statistics)	Entfernenhaus	150000

Category of object	Number	Occupation per unit	Presence factor	Base value (CHF)	Real value (CHF)	Justification of different value	Existing object protection
Buildings	1 Wohneinheit	5	0.8	650000	150000	Angabe Aufgabe	0

Action	Ident.-No.	Object	Description	Total value (CHF)
+	2	Apartment one-family house (2.24 according Swiss Statistics)	Entfernenhaus	85000
+	3	School/Nursery	Schulhaus	500000
+	4	Apartment one-family house (2.24 according Swiss Statistics)	Entfernenhaus	75000

Fig. 5: Input of damage potential data. Users can import their data from GIS via XML. Default object values are equal to those in the operational software EconoMe but can be changed by the user. Changed values are indicated in red.

Risk CHF/a	Contribution to risk Scenario 100 in CHF/a	Contribution to risk Scenario 300 in CHF/a	Contribution to risk Scenario 300 in CHF/a	Total
Before measure	77 117	159 300	95 928	332 344
After measure	0	32 842	37 307	70 148
Risk reduction (benefit) CHF/a	77 117	126 458	58 621	262 196

Measure	Risk CHF/a	Risk reduction (benefit) CHF/a	Costs of Measure CHF/a	Ratio benefit/costs
Before measure	332 344			
Massnahme 1 +3	111 611	220 733	274 000	3.8
Massnahme 2+3	70 148	262 196	194 000	1.4
Massnahme 3	165 404	166 940	14 000	11.3
Massnahme 2	69 947	262 398	180 000	1.5
Massnahme 1	111 910	220 834	200 000	1.1

Calculation with uncertainty band

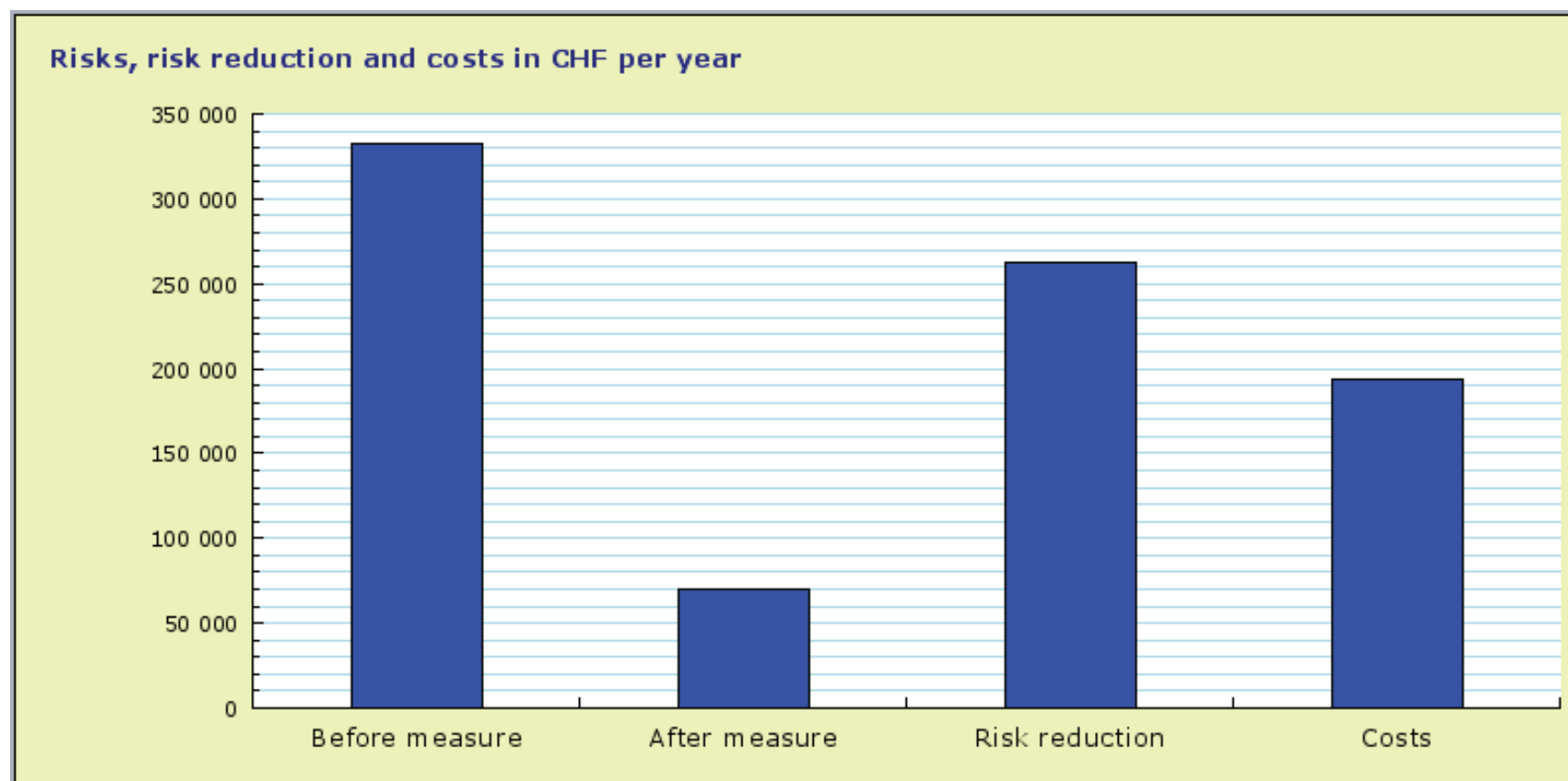


Fig. 8: Results of risk assessment and economic assessment of mitigation measures. Benefit-Cost-Ratio (BCR) of each measure or combination of measures is shown. Measures with a BCR above 1 are considered as economic efficient.

Action	Working step	Editor	Date/Time	State
?	1. Inform project manager	Bründl, Michael	02.03.11, 11:59:08	✓
?	2. System description	Bründl, Michael	02.03.11, 12:00:59	✓
?	3. Hazard analysis and scenario definition	Bründl, Michael	02.03.11, 13:41:21	✓
?	4. Damage potential in the perimeter	Bründl, Michael	02.03.11, 13:42:39	✓
?	5. Exposure analysis	Bründl, Michael	02.03.11, 13:52:20	✓
?	6. Consequence analysis	Gutwein, Peter	03.03.11, 13:44:24	✓
?	7. Individual risk	Bründl, Michael	02.03.11, 13:53:21	✓
?	8. Define measure	Bründl, Michael	02.03.11, 13:57:53	✓
?	9. Exposure analysis after measure	Bründl, Michael	02.03.11, 13:59:50	✓
?	10. Consequence analysis after measure	Bründl, Michael	02.03.11, 14:21:59	✓
?	11. Individual risk after measure	Bründl, Michael	02.03.11, 14:23:50	✓
?	12. Overview cost effectiveness	Bründl, Michael	15.04.12, 15:54:18	✓
?	13. Close project			✓

Action	Designation (Index)	Probability of occurrence	pRA	pRA +/-	Intensity map before measure
+	Scenario 30 (1)	30	1	0 %	Uebung_Gruppe_1-Br.pdf
+	Scenario 100 (2)	100	1	0 %	Uebung_Gruppe_1-Br.pdf
+	Scenario 300 (3)	300	1	0 %	Uebung_Gruppe_1-Br.pdf

Action	Designation (Index)	Probability	Description
+	Working days (1)	75 %	
+	Holidays (2)	25 %	

Fig. 3: Working steps in EconoMe-Develop. The user has to follow the workflow. Finished steps are indicated in green, those in progress in yellow and uncompleted steps in red. EconoMe-Develop offers Import and Export via XML (e.g. from GIS systems)

Action	Designation (Index)	Probability of occurrence	pRA	pRA +/-	Intensity map before measure
+	Scenario 30 (1)	30	1	0 %	Uebung_Gruppe_1-Br.pdf
+	Scenario 100 (2)	100	1	0 %	Uebung_Gruppe_1-Br.pdf
+	Scenario 300 (3)	300	1	0 %	Uebung_Gruppe_1-Br.pdf

Action	Designation (Index)	Probability	Description
+	Working days (1)	75 %	
+	Holidays (2)	25 %	

Fig. 4: Hazard analysis and definition of scenarios: Definition of the uncertainty of calculation factors, definition of scenarios and expositions. As hazard basis, intensity maps are required. Exposition scenarios allow for estimating the influence of a changing number of exposed persons to risk. Intensity categories and vulnerability can be adapted by the user to specific situations.

References

- [1] Bründl, M. (Ed.): Risikokonzzept für Naturgefahren. Leitfaden. Nationale Plattform für Naturgefahren PLANAT, Bern, <http://www.planat.ch>.
- [2] Bründl, M., Romang, H. E., Bischof, N., and Rheinberger, C. M. (2009). The risk concept and its application in natural hazard risk management in Switzerland. Nat. Hazards Earth Syst. Sci., 9(3), 801-813.

The development of EconoMe-Develop was supported by PLANAT. The software is maintained by the Federal Office for the Environment (FOEN). We thank for the support of this project.



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Nationale Plattform Naturgefahren PLANAT
Plate-forme nationale „Dangers naturels“
Piattaforma nazionale „Pericoli naturali“
National Platform of Natural Hazards

