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Guidelines for integrated climate change and risk reduction management for local authorities

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Risk Management

1. In case of climate change there is a strong necessity to mange the risk due to increasing intensity, magnitude and period of harmful weather phenomena.

2. Risk management means taking deliberate action to shift the odds in your favour – increasing the odds of good outcomes and reducing the odds of bad outcomes[a]

3. One of fundamental goals of risk management is to lower the risk to acceptable level.

a) Dan Borge The book of risk John Wiley & Sons, Inc. New York 2001

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Risk Management

4. The risk should be manged in all four phases of crisis management:
    a. preventive phase – adaptation to future local conditions related to weather scenarios.
    b. preparedness phase – increasing awareness of hazards.
    c. response phase - planning and provision of human and technical resources for foreseeing local scenarios.
    d. recovery phase – planning financial provision related to local scenarios.
5. Cross sector analyses should be considered for all four phases.

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Guideline for integrated climate change and risk reduction management for local authorities. Steps

- ## Step 1. Selection of a core team

- The task is to gather a core team which will consist of local people responsible for security at a local level being able to manage the entire process of risk assessment. The team should consist of a chairman and members who can coordinate risk assessment works and take part in some steps of its assessment. As a starting point creation of timetable and plan of work should be necessary. To facilitate the work, a table above is presented to be discussed and filled in by the group.

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Step 2. Creation of context

- The group should be able to choose and prepare the description of a city/town/village/community.
- **It is important to describe the context considering different characteristics (location, infrastructure, climate, population characteristics, etc.), especially** showing such elements of the city/town/village/community which can be harmful for critical processes and critical infrastructure. The group discusses the most important characteristics and present them in the Table.

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Step 3. Gathering the assessors' team

- That task is about building the team which will evaluate identified critical processes and critical infrastructure. It should include all stakeholders who are experts in particular sector. Firstly, sectors must be identified and then for each sector an expert should be found.

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Step 4. Hazard identification

- Identification of hazards which can cause critical events can be done on the basis of knowledge about the climate change drivers /stressors.
- First, participants discuss and identify climate drivers/stressors (intensive precipitation, extreme temperatures, etc.), then they consider what hazards those drivers can cause.
- Next step is about indicating a possible critical event in the situation of the given hazard and a body responsible for it. Critical event can have a cascade effect resulting in disastrous effects, so it is also worth elaborating as well as a responsible institution/body. Each event requires reaction in different phases on different levels, which should be also considered.

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Step 5. Scenarios development

- After identifying the hazard, the group should describe three possible scenarios: *small* (according to the rule ALARP), *expected* (elaborated based on statistics), *worst* (considering black swan too if it is necessary). Participants must remember that each scenario has one possible uncertainty (small, medium and high). The scenarios include the necessary parameters for assessing consequences. Moreover, there should be considered susceptibility if needed.

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Step 6. Vulnerability analysis

- Knowing the scenarios, the group can conduct vulnerability analysis, i.e. an extent of disturbances, malfunctioning and damages of protected values. They should be estimated within three categories: people, environment and economy, political/social impact. So, each scenario will have such kind of analysis representing the consequences. Participants can present it in the descriptive form or as a table.

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Step 7. Cascade effect description

- To describe a cascade effect the group should have scenarios description, vulnerability analysis and hazard identification. Those elements were elaborated during previous stages. On their basis the group discuss and describe cascade effects in different scenarios. Previously prepared tables can be used.

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Step 8. Risk prioritization

- Participants analysed consequences with different uncertainties (risk matrix). At that stage hierarchization and scenarios selection should be done which will be further analysed form investment cost point of view. They should also create a risk matrix.

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Step 9. Resilience strengthening

- **The participants must** consider actions for each risk in selected scenarios. There are three strategies to invest: invest in adoption, invest in response, invest in rehabilitation. Because each scenario is burdened by different level of uncertainties cost and regret matrices should be constructed.

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Step 10. Activity Selection

- On the basis of the regret matrix, selection of activity should be done by the participants. Usually minimax principle is employed. This decision has many dimensions not only economic. Readiness to subject certain value at risk includes political, social and of course economic circumstances (having regret matrix use minimax rule).

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Step 11. Residual risk description

- At this step, the group estimates/ hierarchizes residual **risk** as: small, medium, high, very high and extreme. They should build a reduced risk matrix.

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Step 12. Residual risk vs risk criteria

- After hierarchization of risks, the group should compare them with risk criteria. The action for further risk reduction should be taken if needed.

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Step 13. Resilience matrix creation

- Participants should estimate effectiveness of risk criteria reachability determining level of confidence using previously created tables. Having residual risk hierarchized and having level of confidence reachability of risk criteria, the resilience matrix that is residual risk vs level of confidence should be constructed.

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Step 14. Resilience acceptability

- The group analyses the resilience matrix and establish the resilience criteria. They should manage the risk reduction activity or lower level of confidence if needed. The task is in the form of discussion.

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Step 15. CCR Monitoring

- In case residual risk meets risk criteria and resilience meets acceptability conditions, the level of climate changes risk should be monitored. The group presents possible options.

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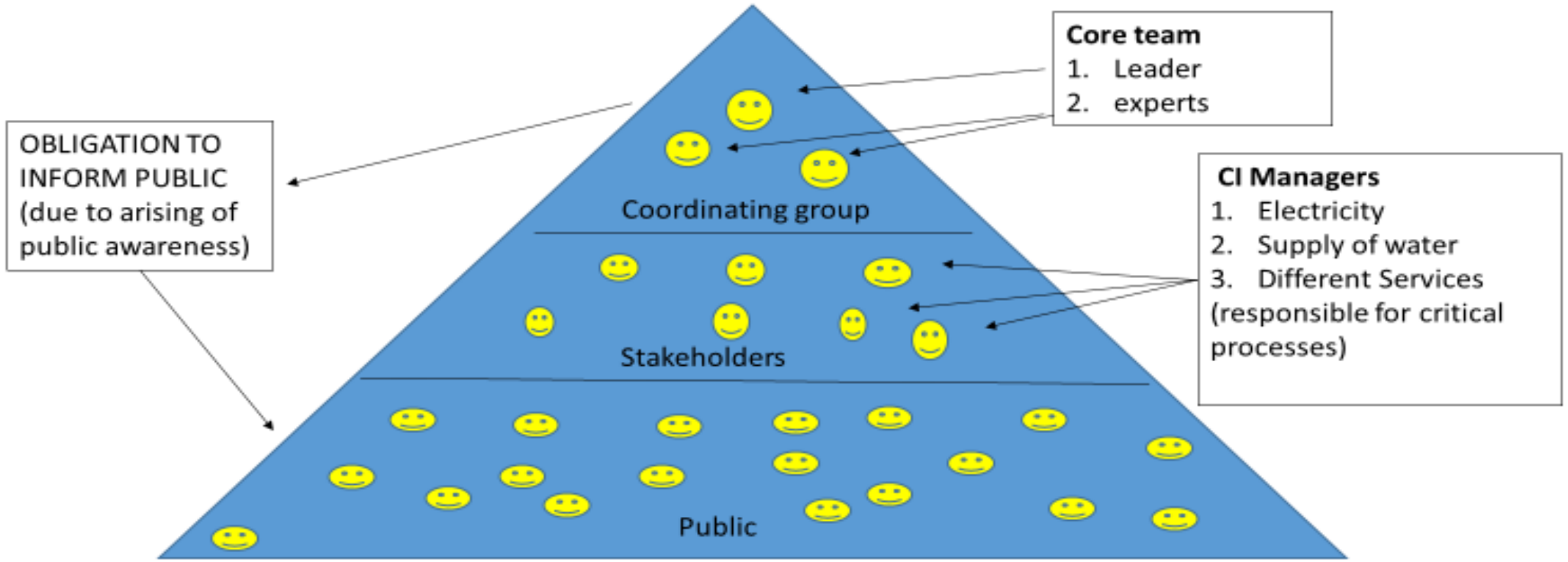
Identification relevant stakeholders



Based on UNEP APELL Awareness and Preparedness for Emergencies at Local Level 2nd EDITION- 2015

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Gathering core and experts teams - example of documentation

No.	Name and Surname	Task	Area of responsibility
1	Xxxxxx Yyyyyyy	Chairman	Manager for process
2	.....	Coordinator	Data collection
3	.....	Coordinator Coordinator	Context description
4	.....		Experts works
5			
6			
7			

Entire process coordinators and risk assessors

	Name and Surname	Area of specialization
1	.....	Agriculture
2	.....	Heritage
3	.....	Energy Technology
4	.....	Hydrology
5	.....	Psychology/ sociology
6		Architecture
7		Land use planning
		Health care provision and so on

Experts estimating costs of investment and CI scenarios

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Creation of context some examples

Description of community (city) indicating these elements of community which can be harmful therein critical processes and critical infrastructure

Country	District, Region, Province	City, community
.....	.....	.....

Climate characteristics	Description
• Precipitation	Frequency and intensity. ..etc.
• Snowing and hail storms	Frequency and intensity. ..etc.
• Seasonal temperature	Average, highest, lowest, frequency...etc.
• Characteristic of wind	Speed, direction, frequency, extreme phenomena (hurricanes, tornados..etc.)
• Other climate characteristics influence crucial local CI	Potable water intake, road blockage, institutions assuring vital function...etc.

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Geographical location	Description
• Type of area • Prone area • Afforestation (type of forest)	Mountainous, lowland, valley ….etc. villages, part of city, crops, pastures….etc. mixed forest, leafy forest, coniferous forest..etc.
Infrastructure characteristics	**Description**
• Water course • Rivers • Roads and their category • Types of transport • Companies • Plants • Other CI for this administrative level	Location…..etc. location ….. Danger goods,… etc. Types of businesses Type of industry Emergence services kind and location……

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Population characteristics	Description
• The number of inhabitants • Age, gender, elder, handicapped, children, marital status, homelessness • Level of risk awareness • Level of education • Communication possibility • Formal and informal links among people • Vital function and processes • Cooperation with neighbours in case of critical event • Another specific characteristics for the area.	• It should be included seasonal increasing of the number of people (tourists, clients etc.) • Most vulnerable groups should be described in more details. • It seems to be necessary to select most effective way of communication. • All types of communication which might be helpful in case of emergency • This is element characterizing resilience (common history and traditions, experience of coping with disaster…etc.) • Description should embrace all critical processes influence daily life functioning and population wellbeing which can be disrupted by critical event.

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Hazard Identification an example

Climate drivers (stressors)	Hazards	Possible CE	Respons. Body	Cascade Effect	Respons. Body	Possible action		
						adaptation	response	recovery
intensive precipitation	- flood - flash flood	- Electricity Plant -Roads blockage	Owner Local, provincial adm.	-Health care provision disturbing -transport blockage -no services	Local administration Operator loc, adm.	+ + - -	+ + - -	+ + +
Extreme temperature	Heat waves	Blackout	Electricity technology administrator	-health care malfunctioning -transport disturbances -fuel maintains disruption	Local adm. Roads adm. Fuel operator	-	-	-

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Some remarks

1. All previous mentioned activities need investing.
2. Decisions related to investing should be taken today but they are connected with future local scenarios which might not happen.
3. There is a risk that money can be wasted because of another scenario might be realized.
4. Always in such decisions there is a value of investment which is under the risk. This value is defined as Value at Risk - **VaR.**

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Some remarks

So, Value at Risk is the potential loss of monetary value that you could suffer within a given time period with no more than given probability.

1.In CCRA we don’t know the probability of future scenario. This is because of uncertainties of future state of nature.
2. So, making climate change risk reduction decision of investment we play with nature.

The problem is that not knowing future state of nature and making a financial decision today we don’t know how to invest minimizing possible losses.

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Knowing hazard – develop scenarios

In case of its realization materialization), one should describe three possible scenarios just picturing them: *small* (according to the rule ALARP), *expected* (elaborated based on statistics); *worst scenario* (consider black swan too if you find it necessary).

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Scenarios development

- After identifying the hazard, the group should describe three possible scenarios: *small* (according to the rule ALARP), *expected* (elaborated based on statistics), *worst* (considering black swan too if it is necessary). Participants must remember that each scenario has one possible uncertainty (small, medium and high). The scenarios include the necessary parameters for assessing consequences. Moreover, there should be considered susceptibility if needed.

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Scenario and related consequences

a

b

Prediction: after extreme precipitation flash flood had occurred. The extent of consequences is recognised.

Threatened objects:

1. people evacuated, wounded possible fatalities
2. Property vs losses

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Frequency Estimation

1. Assume that historical data show that such extreme precipitation and flood as its consequences occur less than once in 10 years. (routine phenomenon – “usual” scenario.

- 2. Because of climate changes two another scenarios should be taken into account. It is foreseen that expected (medium scenario) frequency of such extreme precipitation will occur more than once in 10 years.
- 3. Then worst scenario is needed to be considered. Frequency rises more than once a year.

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Investment

To make the investment we should:

- define horizon of time.
- consider the VaR we are ready to contribute.
- analyse VaR if it is enough to reduce risk to acceptable level.
- make estimation of costs for different actions of risk reduction.
- make estimation of losses if our investment in a selected action is wrong.
- make a selection of action of minimalizing losses if decision was wrong.

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Cost Matrix

Local scenarios → / Action ↓	Negligible changes	Small changes	Expected (average) changes	Worst scenario
Do nothing (routine activities)	10	20	40	70
Small intervention	11	20	45	71
Medium intervention	13	21	38	65
Large intervention	21	24	37	57

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Regret Matrix

Action	State of nature (possible local scenarios)			
	Negligible changes	Small changes	Expected (average) changes	Worst scenario (black swan)
Do nothing	0	0	3	13
Small intervention	1	0	8	14
Medium intervention	3	1	1	**8**
Large intervention	11	4	0	0

Regret Matrix illustrates maximum losses for particular action. Amongst them minimum loss should be selected. MINIMAX rule.

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Conclusion

Because of many uncertainties there is a very high probability that investment decision will be wrong. Employing illustrated above tool possible highest losses are minimised.

If the decision is wrong regret of losses is minimised.

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Resilience Matrix - the concept

- After investment risk is reduced to acceptable level.
- However, there is another side of coin. Admittedly, risk is at acceptable level but there are still uncertainties of its realization (especially scenario realization).
- Moreover, the question is if protection system existing in our region (city) is effective enough to cope with this risk when it realises.
- The next thing we know is that no 100% effectivity of systems – it might be call systems reliability.
- Knowing assessed residual risk and knowing the systems effectiveness Resilience Matrix can be constructed.

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Resilience Matrix

"Effectiveness of system after investment" (%)	Residual Risk				
	small	medium	high	Very high	Extreme
100		routine			
80	routine	Strong resilience	Tolerable resilience		Immediate action needed
60		Some actions		Intolerable Resilience (action needed)	
40	Acceptable resilience				
20					

Thank you!

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