Standardised support tools for urban resilience

A session by the RESIN project

Peter Bosch
TNO, 27-04-2018
The RESIN project
City issues:

Getting a better overview of vulnerabilities and risks

Choosing the best (climate effective, cost effective) adaptation options

One-stop-shop for all you need in creating an adaptation strategy
The issues:

- Weak connection between infrastructure and city adaptation (DRR vs CCA, involving infrastructure operators, silos in the administration)

- No standardization and hence little comparison between vulnerability and risk maps of cities; and between adaptation options

- Many tools around but little guidance on their use and usefulness
RESIN project outcomes

Practical, applicable, do-able applications from theory

- a common conceptual framework (risk – vulnerability)
- a city typology

- a standardised approach to impact, risk and vulnerability assessment

- a catalogue of adaptation options, with specific work on increasing comparability

- decision support system

- steps towards formal standardisation
Session overview:

Input: Bratislava and Risk assessment (Fraunhofer)

Discussion on standardising vulnerability and risk assessments

Input: Greater Manchester and adaptation planning (TNO)

Discussion on co-creation and standardising climate adaptation strategy making (introduced by Tecnalia)

Conclusion
Integrating climate adaptation in the City of Bratislava

Eva Streberova
Office of the Chief City Architect
Bratislava, Capital City of the Slovak Republic
27 April 2018
Presentation outline

• Climate change hazards in Bratislava
• Adaptation journey of Bratislava City
• From Strategy to Action plan
• Challenges in integrating climate change adaptation
• Using RESIN’s standardised tools for urban resilience – examples from Bratislava
Climate change hazards in Bratislava

Rise in average temperature, more frequent heat waves ... 
- in 2017 there were 4 heatwaves and a new record for a total number of tropical nights in Bratislava (31 in total)

... and periods of droughts
- 2017 was longest since 1981


Bratislava Airport Monitoring Station

Average temperature (°C)

Number of days

Climate change hazards in Bratislava 2016
1.12.2016
18.8.2017

Climate change hazards in Bratislava

... and flash floods from torrential rainfall ... 
- tendency to occur after heatwaves, causing damage in lower areas, areas with higher share of impermeable surfaces.

... temperature extremes. 
- impacts on human health.
EU Cities adapt (2012-2013)

Signing of Covenant of Mayors (2012)

SEAP 2013

Signing of Mayors Adapt (2014)

Strategy for CCA (approved in 2014)

Bratislava is preparing for CC project (2014-2017)

Action plan for CCA 2017-2020 (04/2017)

From Strategy to Action plan

Strategy for adaptation to negative effects of climate change for Bratislava City – adopted in 6/2014

Action plan for adaptation to negative effects of climate change for Bratislava City – adopted in 4/2017

Adaptation measures according to sectors

- QUALITY OF LIFE
- GREEN AND BLUE INFRASTRUCTURE
- URBANIZED AREA
- RAIN WATER MANAGEMENT AND WATER SECURITY
- TRANSPORT
- ENERGY

• From 83 adaptation options to 27 adaptation measures,
• From vision and goals to tasks and milestones,
• 28 municipal, governmental and other stakeholders
Challenges in integrating climate change adaptation

- Governance structure & competencies - among different governance bodies and authorities (the city, its boroughs, its organisations, local authorities)
- Stakeholders & participation
- Design and co-create the new – monitoring and communication framework
- Report back – Mayors Adapt and Covenant of Mayors
- Update the outdated – vulnerability assessment, the sectors and other areas of special attention
Using RESIN´s standardised tools for urban resilience

• **Design and co-create the new Communication and monitoring framework**
  - by using the learning centre of the eGuide
  - in English speaking countries the options of the eGuide can be explored towards developing a strategy using the online environment of the tool

• **Report back** – Mayors Adapt and Covenant of Mayors Bratislava is using the [IVAVIA tool and the Adaptation library](#) to:
  – define indicators for the vulnerability assessment that are reported externally,
  – carry out assessments for the implemented adaptation options and report these (internally and externally)
Using RESIN´s standardised tools for urban resilience

- **Update the outdated – sectors and areas of competence**
  By using the *Adaptation library* to:
  - *to choose* among different adaptation options in specific locations, depending on different criteria
  - *as a tool for the expert public*

- **Update the outdated – vulnerability assessment**
  By using the *IVAVIA tool*:
  - *to increase the city´s resilience during heatwaves, droughts and torrential rainfalls*
  - *to support the participation of the City´s stakeholders*
  - *logical approach* to defining the different elements along a chain (hazard – stressor - impacts - vulnerability – risk)
  - *Its design respects the limited resources* of a resilience officer (time, certain skills)
  - *IVAVIA´s supportive tools* to help with the calculations and producing other outcomes such as spatial visualisations (maps, impact chain diagrams, etc.).
Examples of visualization of results – IVAVIA tool
Examples of visualization of results – IVA VIA tool

Sources for satellite images on this slide: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Thank you for your attention!

Office of the Chief City Architect
architekt@bratislava.sk
Risk-oriented vulnerability assessment for climate change

A standardised, modular approach for cities and infrastructures

Dr. Daniel Lückerath
Researcher, Fraunhofer IAIS
2018-04-27
Motivation

• Provide a standardised process
  – for conducting a risk-oriented assessment of climate change impacts and vulnerabilities
  – for urban areas and infrastructures
  – that can be adapted to local conditions
  – is supported by guidance and tools
# How does it work?

<table>
<thead>
<tr>
<th>Qualitative stages</th>
<th>Quantitative stages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which hazards and drivers are relevant to my city?</td>
<td>How do I start the assessment process?</td>
</tr>
<tr>
<td>M0 Selecting Hazards and Drivers</td>
<td>M1 Preparing for Vulnerability Assessment (VA)</td>
</tr>
<tr>
<td>M2 Developing Impact Chains</td>
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<tr>
<td>What are the cause-effect relationships relevant to my city?</td>
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<tr>
<td>M3 Identifying Indicators and Data Acquisition</td>
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<tr>
<td>How do I combine the gathered data?</td>
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<tr>
<td>M4 Normalisation, Weighting, and Aggregation of Indicators</td>
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<tr>
<td>How do I want to measure influencing factors and what data do I have available?</td>
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<tr>
<td>M5 Aggregating Vulnerability Components to Risk</td>
<td></td>
</tr>
<tr>
<td>How do I assess vulnerability/risk?</td>
<td></td>
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<tr>
<td>M6 Presenting the Outcome of Your VA to the Stakeholders</td>
<td></td>
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<tr>
<td>How do I present the results?</td>
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</table>
Developing Impact Chains
Developing Impact Chains

- Heat waves
  - Global warming
    - Average monthly temperatures
    - Annual highest temperatures
    - Tropical days per year
  - Land use change
  - Demographic change
    - Green area
    - Share of age groups
  - Healthcare
    - Number of sick days
    - Thermal pollution
    - Concentration of organic carbon
    - Increased mortality
    - Mortality rate per 1k inhabitants

- Quality of Life
  - Capacity of social care facilities
  - Capacity per 1k inhabitants
  - No. Health care workers
  - km² green infrastructure
  - km² water areas

- Built-up area
  - Children accepted to kindergarten
  - Population under 7
  - Population over 65
  - Homeless population

- Vulnerable population
  - km² built-up area
Developing Impact Chains

→ Qualitative, structured assessment of alleviating / intensifying factors and potential impacts

• Highly valuable for
  – building a common understanding
  – communicating cause-effect relationships
  – identifying relevant areas where actions could be taken
  – identifying further stakeholders that might be helpful during the assessment
Data acquisition

- Data for all identified indicators has to be acquired. Requires
  - interaction with multiple departments, external institutions, open source frameworks
  - analysis and clean-up of data

→ Easily the most resource intensive / time consuming step
• Indicator data is aggregated to composite scores for sensitivity, coping capacity, and vulnerability

• Impacts and probabilities are estimated using historical data of indicators and/or damage functions, combined with vulnerability score
Vulnerability / Risk

• Classify impacts and probabilities using discrete, ordinal classes
• Impact/probability pairs are assigned to risk classes using a risk matrix
• National/regional standards or guidelines exist

ISO 31000: Risk matrices

Source: German Federal Office of Civil Protection and Disaster Assistance: Method of Risk Analysis for Civil Protection. Wissenschaftsforum, Volume 8. 2011

Results

Coping Capacity

Sensitivity

Vulnerability

Sources for satellite images on this slide: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Results

Sources for satellite images on this slide: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Conclusions

- **Standardized, modular process** for conducting a risk-oriented assessment of impacts and vulnerabilities
- Qualitative stage: Only limited resources available or quantitative assessment previously conducted
  - Impact Chains for qualitative, structured assessment of alleviating / intensifying factors and potential impacts
- Quantitative stage: Resources available or no quantitative assessment previously conducted
  - Maps to identify areas most at risk for further adaptation planning
- Presenting the results: Objective and target audience are key!
Thank you!

resin@iais.fraunhofer.de
daniel.lueckerath@iais.fraunhofer.de
Discussion questions 1th round

• Why is it important to standardize vulnerability and risk assessments?

• What are your experiences in using standardised guidelines/tools for vulnerability and risk assessments?

• What do you think of the RESIN approach? Useful? Replicable in other continents?
Standardising City Adaptation Strategies – an impossible dream?

9th Global Forum on Urban Resilience and Adaptation:

Standardised support tools for urban resilience, integrating resilience planning into local decision-making

Matt Ellis (Climate Resilience Officer, GMCA)
• **City Adaptation Strategies** – standardised processes, **not** standard products / documents

• **Greater Manchester’s experience** – co-creating its adaptation planning process

• **Critical challenges** - the 3 linked C’s: complexity, capacity and consistency

• **The opportunity for cities** - using standardised approaches (and co-creation/collaboration) more widely
Climate Adaptation Strategies

Standardised processes not standard products
Greater Manchester’s experience

coco-creating our adaptation planning process
Working with Transport for Greater Manchester (TfGM)

Specific Actions from GM’s Climate Change and Low Emissions Strategy (2017):

- A12: **Identify key risks to transport infrastructure** posed by increased incidence of flooding and heat as part of Transport Strategy and Planning.

- A13: **Integrate requirements for shelter from extreme weather and heat** into building design and transport systems as part of a sustainable design guide.
Impact chain: Pluvial flooding to major arterial roads in Greater Manchester

- **Sensitivity**: Demographic characteristics
- **Coping Capacity**: Availability of different transport modes

**Hazard**: Major arterial road exposed to flooding

**Climate Change**: increased Pluvial flooding

**Stressors**: Growing demand on roads

**Impacts**: Road closure

**Primary**: Road users, Network managers

**Secondary**: Recovery costs, service delivery

Source: University of Manchester and GMCA (RESIN Project, 2017)
A GM transport flood risk assessment
Implementing adaptation options
Critical challenges and opportunities

3 linked C’s: complexity, capacity and consistency....

But a real opportunity for cities
Standardisation of the development of a climate adaptation strategy

Possibilities, limitations and practical example

Albert Nieuwenhuijs
Senior Researcher at TNO
27/04/2018
Contents

• Standardisation of the adaptation process
  – Aim
  – Context
  – Practical limitations

• RESIN e-Guide
  – Offered support
  – Approach to limitations in standardization

• Relation to other platforms
Standardisation aim

• Uniformity in:
  – Quality of decision process and results (walking the right path, doing the right things)
  – Considered aspects (looking at the right things)
  – Level of detail considered (zooming in to the right level)
Standardisation limitations

• Process:
  – One complete process iteration is long and complex
  – By nature iterative, therefore any step within process is likely to be visited more than once
  – Urban, multi-stakeholder, political context and due to long throughput time: changing opportunities and circumstances ➔ limited control over sequence of steps
  – Usually combined effort of multiple people focusing on various topics related to climate adaptation ➔ several tracks of climate adaptation in parallel, hard to keep efforts aligned

• Conclusion: strict sequential process unpractical or impossible
Standardisation
limitations

• Outcomes:
  – Various ways (tools, methods) to complete any step in process, not always compatible, not always same quality / level of detail
  – Not every approach suited for every situation
  – Interdependency on choices for approaches ==> choose approach x in early step ==> no longer possible to choose approach y in later step
  – Need for guidance to produce consistent results, fitting the requirements of the city <> not always most detailed is best

• Conclusion: flexibility is needed, but comes at the cost of strict compatibility of results
RESIN e-Guide
Support for uniform process

Flexibility in sequence process requires good overview and collaboration tools.

- Overview all steps ➔ know what's coming
- Structure allows for starting and stopping at any step, but with informed consequences: prerequisites to finish each step successfully, consequences for following steps*
- Functionality to:
  - Coordinate activities between various employees
  - Store results of adaptation process and make them available centrally
  - Monitor progress over the entire adaptation process

*optional: Restrict progress to allowing only starting steps for which all preconditions have been fulfilled
RESIN e-Guide
Support for uniform process

• Example overview steps

Assess climate risk
- Scoping
- Awareness
- Role definition
- Risk assessment
- Goal definition
- Baseline
- Commitment
- Communication

Develop adaptation options
- Role definition
- Exploration of adaptation approaches
- Select adaptation approaches
- Commitment
- Communication

Prioritize adaptation options
- Role definition
- Generate options for adaptation approaches
- Prioritising adaptation options
  - Choose methodology and criteria
  - Assess adaptation options
  - Check for compliance with requirements
  - Identify interactions
- Select adaptation options
- Commitment
- Communication

Develop implementation plan
- Role definition
- Implementation plan
- Monitoring and evaluation plan
- Commitment
- Communication
RESIN e-Guide
Support for uniform process

• Example step description preconditions

**Climate Threat.**

**Goal of this aspect**

Having identified a problem in Problem definition, this aspect concerns the exploration of the underlying causes of this problem and gaining preliminary insight in their severity. With regards to climate change in Europe, five climate threats can be distinguished:

- heat waves/stress,
- pluvial flooding,
- fluvial flooding,
- coastal flooding and
- drought.

**Preconditions**

Having a clear Problem definition is essential for this step, as this determines what climate changes relate to the problem. Climate changes can be labelled a threat or not, depending on the defined problem at hand. Identifying the climate threats that might impact the city or asset requires an understanding of local circumstances such as geography, past extreme events and local/regional climate projections. This information needs to be available to successfully finish this step.

**Results**

The outcome is a list of climate threats that could potentially affect the city or asset, including a description of local historical events (frequency and severity) and a first insight in future occurrences (likelihood and potential impact), resulting in a first indication of the risk of a threat.

**Guidance on performing this aspect**
RESIN e-Guide
Support for uniform process

• Use of projects: Multiple users
RESIN e-Guide
Support for uniform process

• Use of projects: Store information
RESIN e-Guide
Support for uniform process

• Use of projects: Status overview

<table>
<thead>
<tr>
<th>Details</th>
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<tbody>
<tr>
<td><strong>Project name:</strong> test project Resilient cities</td>
</tr>
<tr>
<td><strong>Created:</strong> 20/04/2018</td>
</tr>
<tr>
<td><strong>Team members:</strong> Albert Nieuwenhuijs, Peter Bosch, Tara Geerdink, Vera Rovers</td>
</tr>
<tr>
<td><strong>Completed:</strong></td>
</tr>
</tbody>
</table>

**Phase 1**
- Step 1.1: completed
- Step 1.2: started
- Step 1.3: not started yet
- Step 1.4
- Step 1.5
- Step 1.6
- Step 1.7
- Step 1.8
RESIN e-Guide
Support for uniform process

• Use of projects: complete status report in pdf

Did a calculation for the number of tropical days expected for 2050. Report is attached
KEA-180425115524.pdf:
dev.itti.com.pl/api/anonymous/attachments/c691847d-053b-44d1-be29-69f26a9850fa
RESIN e-Guide
Support for uniform outcomes

• Overview available methods and tools, both RESIN and external, when to apply, where to apply
• In each step, we provide general guidance how to perform the step and what tools might be suited to what situations (including heads-up for consequences down the line)
• Also each step, list of existing and new (RESIN) available tools and concrete instructions how to use them to get relevant and good results for finishing the step
• Forms for each step provide details and uniform structure to answers independently use used tools
• Use of uniform framework / terminology
RESIN e-Guide
Support for uniform outcomes

- Overview of tools
  - Categorised in topics
  - Indexed on practical indicators
  - Short textual remarks with practical pointers
RESIN e-Guide
Support for uniform outcomes

• Concrete instruction when and how to use tool for any step in process

Climate Threat

Goal of this aspect

Having identified a problem in Problem definition, this aspect concerns the exploration of the underlying causes of this problem and gaining preliminary insight in their severity. With regards to climate change in Europe, five climate threats can be distinguished:

- heat stress / heat waves,
- pluviast flooding,
RESIN e-Guide
Support for uniform outcomes

• Consistent framework of terms
  – Definition appears when hovering over term in text

Why stakeholder involvement in climate adaptation?

Climate and resilience literature indicates that adequate stakeholder involvement is essential for the development and implementation of adaptation strategies. Adaptation strategies require actions that, for the short-medium term and for longer, provide valuable contributions in risk reduction. Such strategy development can be seen as a complex and ambiguous risk management process, but can only be carried out effectively in close consultation of and collaboration with the stakeholders involved. Developing strategies and implementations aligned to cope with such a complex challenge has a higher chance of success if stakeholders account for all interests and involving all relevant stakeholders.

Why is it a key challenge?

Planning for successful climate change adaptation strategies requires involvement of many different stakeholders. There are many different stakeholders, and even more persons involved with different interests, perspectives, disciplines, knowledge and experiences. Furthermore, collaboration between the stakeholders (public and private) with different interests and responsibilities is needed. The involvement of stakeholders in the climate adaptation planning process is experienced by many European cities as one of the key challenges in climate adaptation, such as the cities of Paris, Bratislava, Manchester, Bilbao and Almada. The question is who to involve, when to involve, and how to do this?
RESIN e-Guide
Support for uniform outcomes

• Guidance in required information by use forms
RESIN e-Guide
relation to existing platforms

• Results lined up with UAST and Mayors Adapt reporting tool

• Looking for possibilities for further integration of our solutions on existing platforms (EU-ClimateAdapt, Covenant of Mayors)
Questions?
Discussion questions 2nd round

• How can cities set-up a co-creation process and who should they involve?

• Why would you want to use standardized approaches for climate adaptation planning?

• An impossible dream--Any experiences?

• What are limitations of such standardized approaches?

• What do you think of the RESIN approach? Useful? Replicable in other continents?
This project is funded by the Horizon 2020 Framework Programme of the European Union.