

A satellite-style map of Europe and the Mediterranean region, showing green landmasses, white clouds, and blue oceans. The map is the background for the text.

A Research Agenda on Knowledge Management for Regional Policies



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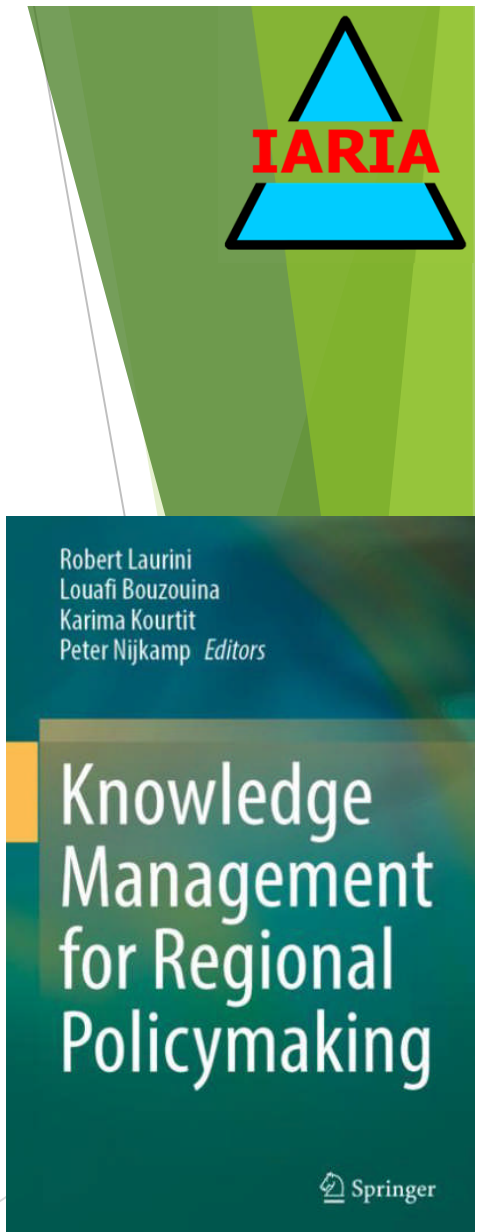
Initial observations

- ▶ Knowledge management is more and more common in businesses
- ▶ Beginning of use in smart cities
- ▶ Nothing at regional level
- ▶ Creation of a European brainstorm workshop to develop a research agenda



Reference

- ▶ LAURINI R., NIJKAMP P., BORDOGNA G., KOURTIT K., DUCHATEAU F., RINALDI A., BOUZOUINA L., MEHAFFY M.E., ANTHONY B. (2022) "Regional Knowledge Management and Sustainable Regional Development: In Quest of a Research and Knowledge Agenda". In LAURINI R., NIJKAMP P., KOURTIT K. BOUZOUINA L. (eds (2022)) "Knowledge Management for Regional Policymaking" Springer Verlag. January 2023



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1 - Origin of the Research Agenda

- ▶ Barriers to overcome:
- ▶ 1: what are the region's boundaries?
- ▶ 2: what is knowledge management?
- ▶ 3: what is the level of with acceptability of local authorities in charge of regional governance?
- ▶ 4: how to introduce space and time issues in logic?



Main differences between smart cities and smart regions

- ▶ Smart cities
 - ▶ Dense habitat, public services, health, education
 - ▶ Urban traffic - metrolines, buslines
 - ▶ Shops, industries
 - ▶ etc.
- ▶ Smart regions
 - ▶ Including several towns and cities
 - ▶ Various density of population
 - ▶ Agriculture, biodiversity
 - ▶ Natural parks
 - ▶ Traffic infrastructures
 - ▶ Etc.



Each region has its own DNA

- ▶ Each region has its own peculiarities;
- ▶ = the set of characteristics which are critical to shape its future (environment, extractive resources, creativity, economic resources, touristic and historical resources, etc.).



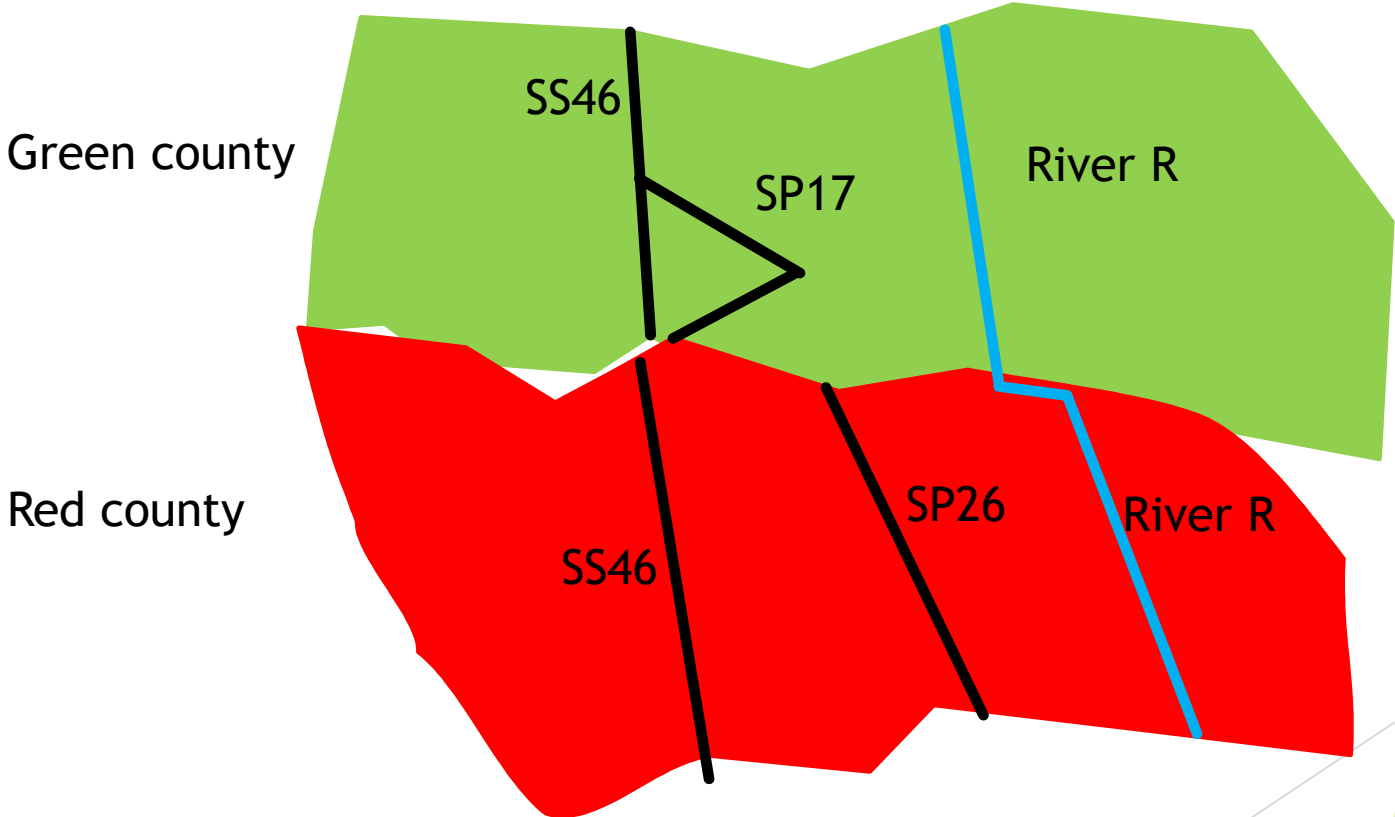
Region boundaries

- ▶ Valley and hill
- ▶ Some regions have known boundaries
- ▶ Some regions have fuzzy boundaries

- ▶ Borders
- ▶ Different surveyors give different coordinates
- ▶ Boundaries do not match!



Examples of geometric problems near borders



- Roads
- Rivers

Definition of regional knowledge

Regional knowledge corresponds to information potentially useful to

- ▶ explain and make understandable its internal dynamics as well as its interactions with other adjoining regions in the same or neighboring countries.
- ▶ manage a region by some local authorities, i.e. by means of some decision-support system, in the spirit of territorial intelligence;
- ▶ monitor its daily development through feedbacks and adaptation;
- ▶ simulate the future, and design novel projects;
- ▶ orient actions for the future.



Why is regional knowledge difficult to be represented?

The existence of several levels of governance and decision (state, region, city, etc.) implies different knowledge bundles, possibly from discrepancies in views to potential or real contradiction.

In addition, whereas in business intelligence, knowledge is overall represented with logic, we face the difficulty of representing space:

⇒ **this no more logic reasoning, but also 2D and 3D geometric reasoning.**



Origin of regional knowledge (1/2)

- ▶ written documents such as books, expert reports, juridical documents, etc.;
- ▶ historic cartography, maps and images, including satellite images, aerial photos, and more recently, drone-photos and videos;
- ▶ knowledge coming from experts, people, various stakeholders, activists, associations etc. as witnesses or participants recording their contribution in various formats such as forms, videos, audio;
- ▶ data and text mining from various repositories of big data and data streams (e.g., analyzing Twitter messages for obtaining recent event information);

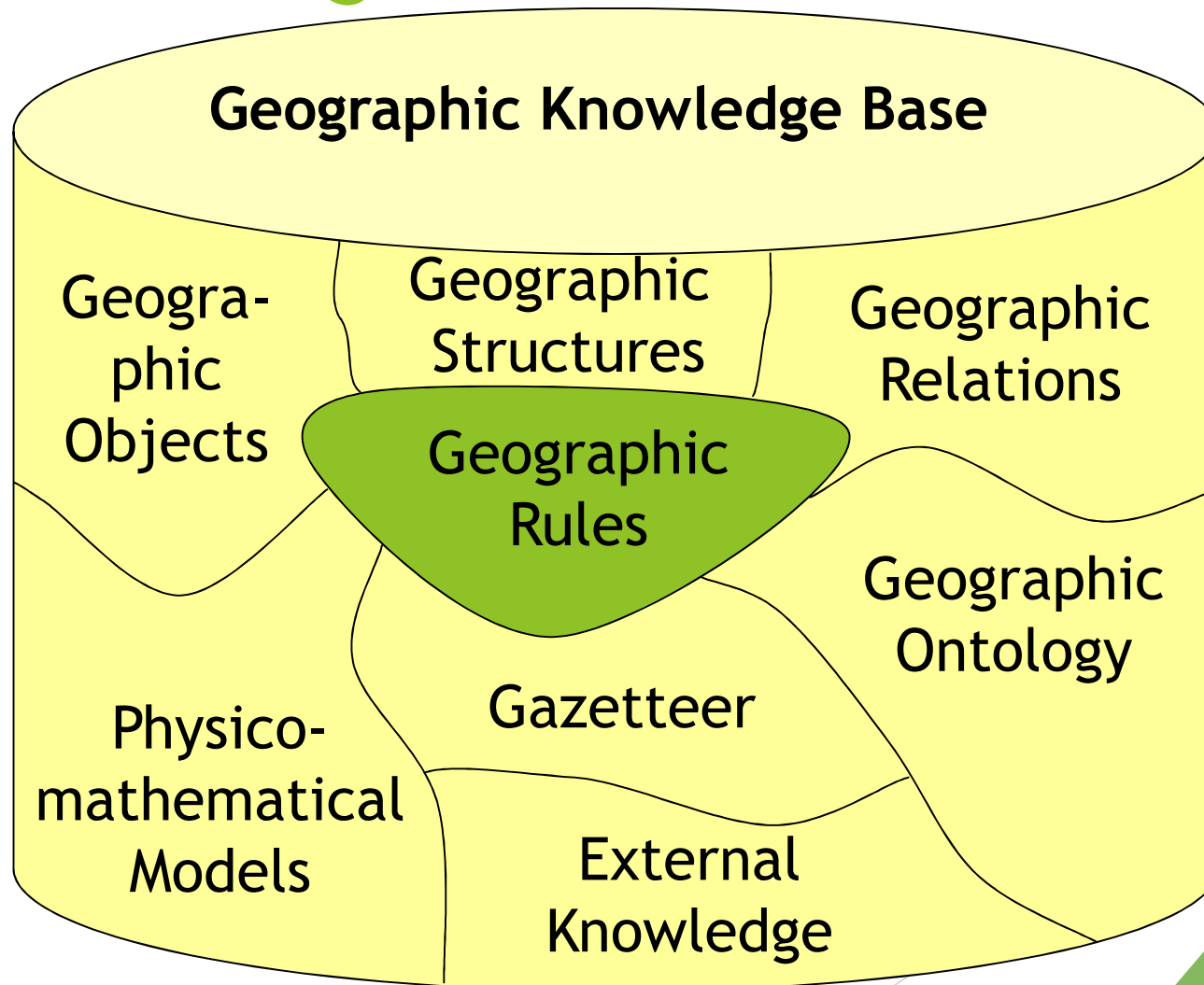


Origin of regional knowledge (2/2)

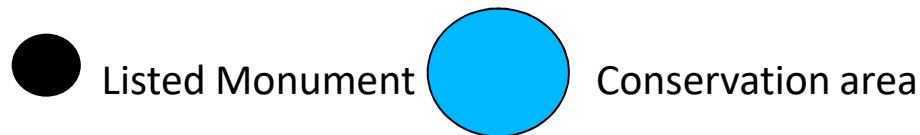
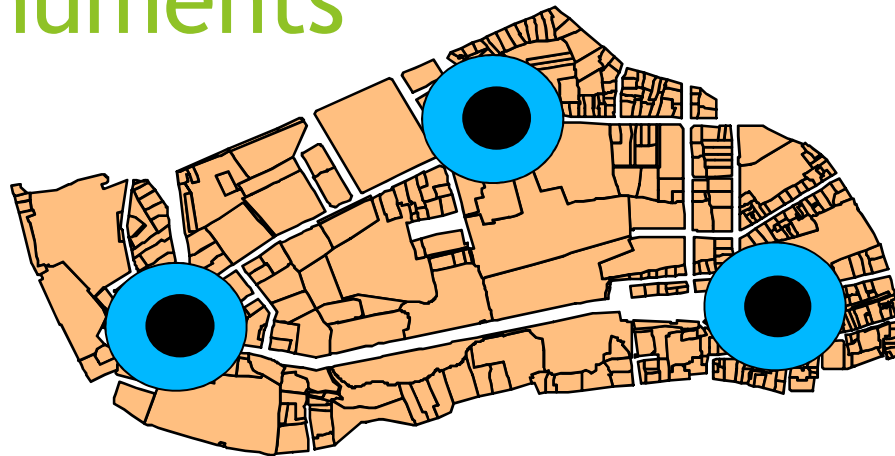
- ▶ IoT data from cellular phones, Wi-Fi connections, and *in situ* sensors for climate and air pollution monitoring, and for traffic monitoring on board public transport and cars;
- ▶ dedicated components of knowledge collected for smart cities;
- ▶ “*Citizens as sensors*”
- ▶ social media data, in many (often unorganized) forms;
- ▶ etc.



Structure of a geographic knowledge base



Example for listed monuments

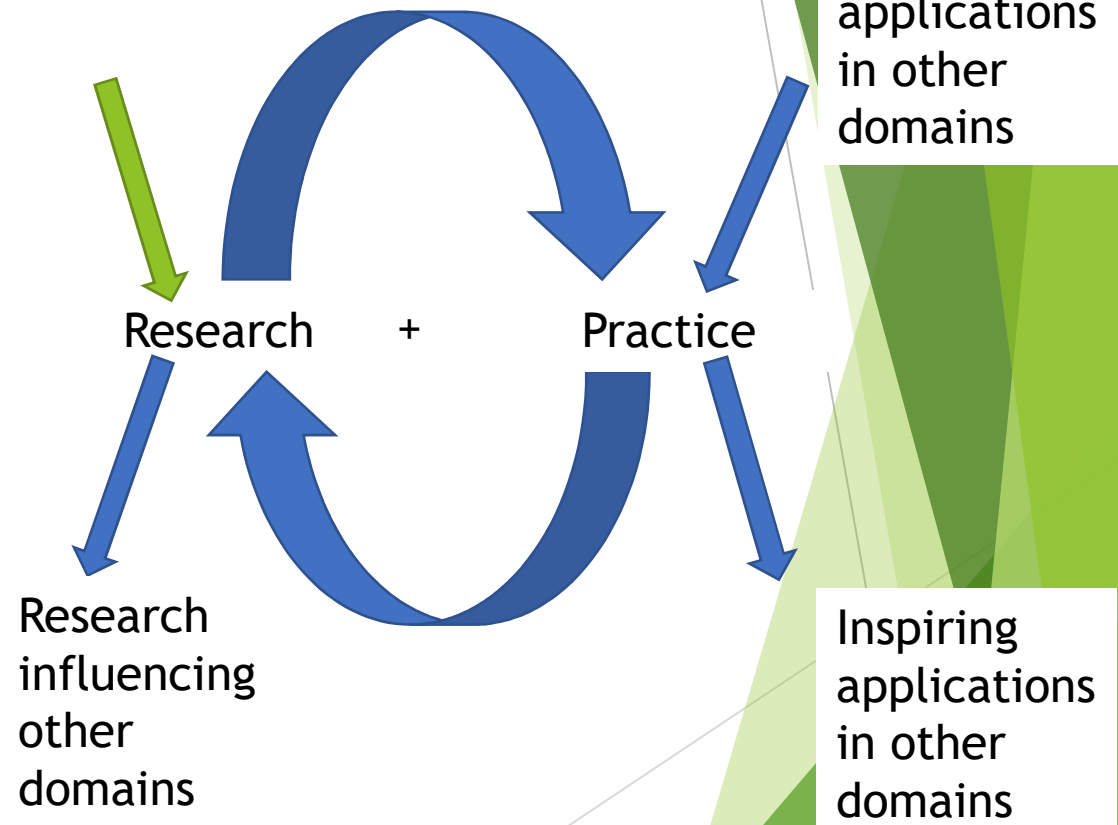
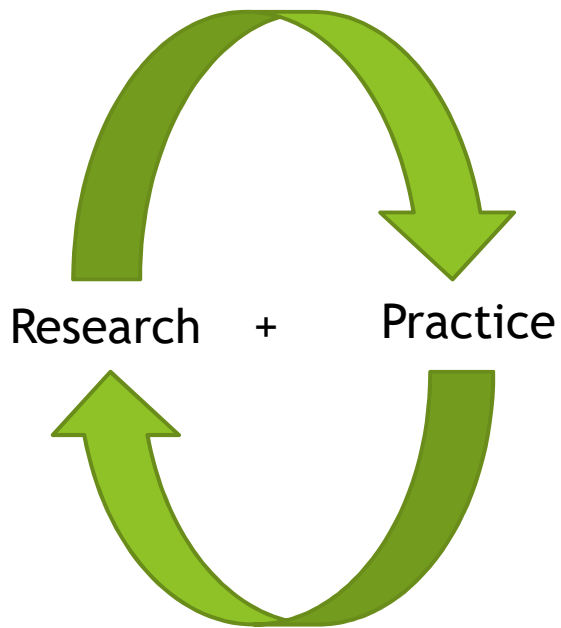


$\forall T \in \text{Earth}, \forall B \in \text{PROJECT}, \exists M \in \text{Geo-Objects},$
 $\Omega\text{-Type}(B) = \text{"Building"},$
 $\Omega\text{-Type}(M) = \text{"Listed_Monument"},$
 $\text{Inside}(\text{Geom}(B), T), \text{Inside}(\text{Geom}(M), T):$
 $\text{Disjoint}(\text{Geom}(B), \text{Union}(\text{Buffer}(\text{Geom}(M), 100)))$
 \Rightarrow
 $\text{State}(B) = \text{"LM_Approved"}$

About external knowledge

<p>A Region</p>	<p>Internal Knowledge</p>	<p>External Neighboring Knowledge</p>	<p>External Outside Knowledge</p>

Research and practice



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Knowledge Management for Regional Policymaking

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Links with 17 Sustainable Development Goals

- ▶ Designed by UN
- ▶ Practically all of them have involvement in regional planning





Sustainable Development Goals	Possible regional levers
Goal 1: No poverty	Yes
Goal 2: Zero hunger	Yes
Goal 3: Good health and well-being	Yes
Goal 5: Gender equality	Practically, not at political level
Goal 6: Clean water and sanitation	Yes
Goal 7: Affordable and clean energy	Yes
Goal 8: Decent work and economic growth	Yes
Goal 9: Industry, Innovation and Infrastructure	Yes
Goal 10: Reduced inequality	Partially
Goal 11: Sustainable cities and communities	Yes, at governance level
Goal 12: Responsible consumption and production	Partially
Goal 13: Climate action	Small possible actions
Goal 14: Life below water	Perhaps for regions bordering seas or oceans
Goal 15: Life on land	Yes
Goal 16: Peace, justice and strong institutions	Beyond regional jurisdiction
Goal 17: Partnership for the goals	Yes

Organization of the agenda



▶ Research lines

- ▶ 39 research lines have been identified
 - ▶ Knowledge management
 - ▶ Political sciences
 - ▶ Sociology

▶ Research questions

- ▶ Around 100 RQ have been identified potentially leading to 100+ PhD theses.

2 - Contents of the agenda

- ▶ 2.1 Unveiling Characteristics of Regional Knowledge
- ▶ 2.2 Governance and Decision-making Based on Knowledge Management



2.1 Unveiling Characteristics of Regional Knowledge

- ▶ A. The prolegomena of knowledge
 - ▶ Spatio-temporal knowledge
 - ▶ Fuzzy knowledge and rules
 - ▶ Gazetteers and places with fuzzy geometries
 - ▶ Regional ontologies
 - ▶ Rule superseding
 - ▶ Scalability of regional knowledge



Unveiling Characteristics of Regional Knowledge

- ▶ B. The space and time dimension of knowledge
 - ▶ Border effects
 - ▶ Natural continuous phenomena
 - ▶ Locally embodied information
 - ▶ Past rules and actual rules



Unveiling Characteristics of Regional Knowledge

- ▶ C. The exploitation of this knowledge
 - ▶ From urban analytics to regional analytics
 - ▶ Feedforward knowledge
 - ▶ Quality of knowledge
 - ▶ Knowledge visualization and sharing for reasoning
 - ▶ Dashboards for real time monitoring
 - ▶ Case-based reasoning



Unveiling Characteristics of Regional Knowledge

- ▶ Cross-border regional knowledge continuity
- ▶ Cross-border regional knowledge integration
- ▶ Cross-border regional interoperability or seamless interoperability
- ▶ Dedicated inference and reasoning engines
- ▶ Transparency and explicability
- ▶ Extracting knowledge and rules from written documents
- ▶ Regional knowledge and links with SDI
- ▶ Regional knowledge indexing
- ▶ Knowledge curation and removal of “fake knowledge”



2.2 Governance and Decision-making Based on Knowledge Management

- ▶ Data governance - privacy, confidentiality, ownership
- ▶ Jurisdiction and rule inception
- ▶ Combining AI-based collective and knowledge intelligence
- ▶ Formation of a team of professionals
- ▶ Citizen empowerment
- ▶ Decision-making rules



Governance and Decision-making Based on Knowledge Management

- ▶ Lessons learnt from accepted and abandoned projects
- ▶ Digital twins for regions
- ▶ Border effects, unexpected outcomes
- ▶ Use of knowledge to boost economy/innovation
- ▶ Cost of enforcing rules
- ▶ Technological and sociological watching



3 - Analysis of some research lines

- ▶ 3.1 - Superseding of the rules
- ▶ 3.2 - Natural continuous phenomena
- ▶ 3.3 - Case-Based Reasoning
- ▶ 3.4 - Feedforward rules



3.1 - Superseding of the rules

▶ Background

- ▶ In the northern hemisphere, going north is usually colder, but there are exceptions. Moreover, from a legal point of view, what was decided well in one place may be wrong at the higher level or vice versa. In other words, in some places, specific rules may surpass generic rules or vice versa.

▶ Identified research lines

- ▶ Identify applications where superseding is important. What can be the guidelines to manage superseding? What are the connections to the correctness of the rules?

3.2 - Natural continuous phenomena

▶ Background

- ▶ Natural phenomena such as floods, diffusion of pollutants, pressure, winds, lava flows, etc. are mathematically modeled as continuous fields, and in some cases can be modeled by **differential equations**.

▶ Identified research lines

- ▶ How to practically model these phenomena in a given place? What could be the links with knowledge management? How can it be linked to sensor data in real time?



3.3 - Case-Based Reasoning



▶ Background

- ▶ The key problem is how to describe characteristic regional situations; could they be landscape, climatic conditions, population distribution, transport facilities, sustainable energy, sustainable mobility, etc.?
- ▶ It is also a challenge to move solutions that have worked in one region to another.

▶ Identified research lines

- ▶ Propose models to describe the geographic characteristics of the cases. Select criteria to evaluate the actions.

3.4 - Feedforward rules

- ▶ Let's consider two rules
 - ▶ *“If it rains, I get wet”*
 - ▶ Natural consequence
 - ▶ *“If it rains, I take my umbrella”*
 - ▶ Prerequisite: *“Since it often rains, I have bought an umbrella”*
 - ▶ Anticipatory decision
 - ▶ → Feedforward rule

Feedback and feedforward



- ▶ 1. Feedback Control System:
 - ▶ Regulation taking the past into consideration
 - ▶ *Ex post*
- ▶ 2. Feedforward Control System:
 - ▶ Regulation taking the future into consideration
 - ▶ *Ex ante*



Importance of feedforward knowledge for regional policymaking

- ▶ 1 - to boost knowledge-based economy
- ▶ 2 - to boost education in order that citizens are more educated, and empowered vis-à-vis societal problems;
- ▶ 3 - to assist policymakers not only in their daily work but also to help anticipate.
- ▶ 4 - disaster management

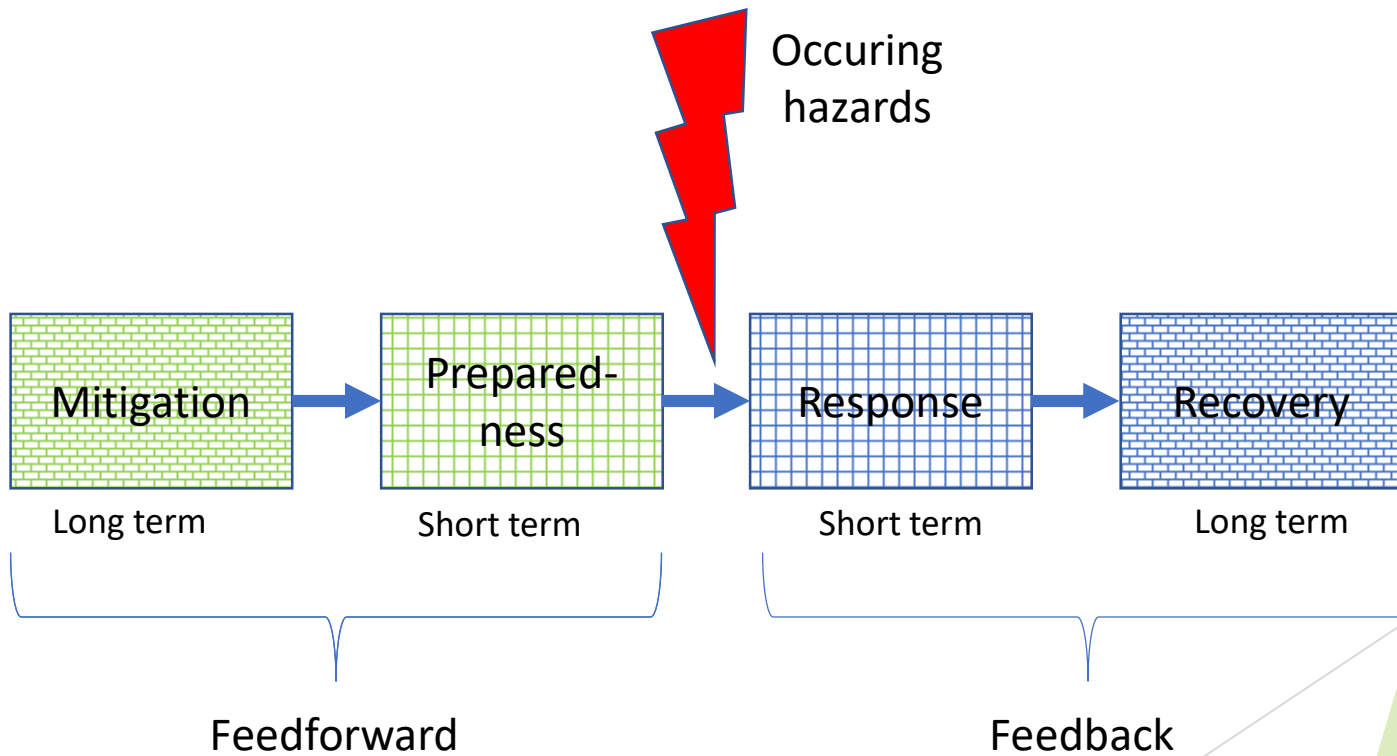
- ▶ RQ: can feedforward rules dedicated to regional policymaking be identified and semantically characterized?



Projects and plans are components of feedforward

- ▶ 1) What are the rules able to be activated to identify problems and objectives, and to create projects? Those rules will be called feedforward rules.
- ▶ 2) What are the rules for decision-making between several projects? They will be called “decisional rules”.

An interesting case: Disaster management



4 - Conclusions

- ▶ Importance of regional planning
- ▶ Role of knowledge management
- ▶ Designing of a research agenda
 - ▶ Around 40 research lines
 - ▶ Around 100+ PhD subject identified
- ▶ For the PhD tutors interested by knowing more about this agenda and the outcomes, they are welcome to contact the authors





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