Chapter 5
Semantic Analysis of Feedforward Knowledge for Regional Policymaking

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Felix qui potuit rerum conoscere causas exitūsque (After Virgil)

Abstract Knowledge management is now very common in business. But concerning local authorities and in particular regional authorities, unless administrative aspects, few have been done. The goal of this paper is to show the importance of a special case of knowledge, namely knowledge regarding plans and projects. When an objective is defined, decisions can be seen as a consequence of this objective, i.e. objectives are the causes of decisions and actions. Under the name of feedforward knowledge, this paper presents some rules regarding the way projects can emerge in regional planning and tries to capture the semantics behind those rules in order to clarify the concepts before looking to encode this kind of knowledge for automatic treatment. A particular stress is given to the main phases of disaster management.

Keywords Knowledge management · Geographic knowledge · Feedforward knowledge · Regional planning

5.1 Introduction

In the governance realm, mainstream are two adages "To govern is to provide" and "To govern is to choose". When facing routine events, there is no problem for decision-makers, but when an unexpected event occurs, the governance becomes more and more complex essentially based on information, knowledge and intuition.

Felix, qui potuit rerum cognoscere causas" is verse 490 of Book 2 of the "Georgics" (29 BC), by the Latin poet Virgil (70–19 BC). It is literally translated as: "Fortunate, who was able to know the causes of things". I have added the word "*exitūsque*" so that "Fortunate, who was able to know the causes and outcomes of things

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This is the case in regional policymaking when various officials must determine what to do, not only facing a novel problem but overall design mechanisms which could be useful for future similar problems.

Let us take a preliminary example: suppose a city has decided to light street lampposts 10 min before dusk. If somebody captures the times both for lightning and dusk, by applying the principle "causes precede effects", he/she will deduce that street lighting provokes dusk! In reality, this is a feedforward mechanism because, from centuries, dusk data are compiled, and any engineer can automate lighting based on those data. More generally, as soon as a goal is set, actions made to reach this goal are of feedforward nature.

In artificial intelligence, more precisely in knowledge management, rules are very useful and considered as first-class citizens (Graham 2006; Morgan 2008). As preliminary example let us compare two common rules, (i) "if it rains, I get wet", and (ii) "if it rains, I take my umbrella". The first one can be seen as a natural consequence, but the second is totally different. Indeed, knowing that rains can often occur, I can anticipate it by buying or borrowing an umbrella; and when the rain comes, since I have an umbrella, I can use it. In another domain, namely control engineering, two notions are central, feedback and feedforward. Feedback corresponds to (automatic) reactions as rules (i) and (ii), whereas feedforward corresponds to an anticipation, i.e., the rules to be mobilized not only to get the necessary resources, but also to design decisions and actions to make.

In the regional policymaking realm, there are not only persons and institutions in charge of anticipation, but also citizens and activists who can have different visions of the future.

But what could be the interest of using knowledge management in regional policymaking? It will be the role of this paper to try to answer this question.

After giving some key-elements in knowledge management, some preliminary aspects of feedforward rule semantics will be examined, then the different states of a project will be studied in order to define project-oriented knowledge. Those issues will correspond to the primary steps to sketch a computer language to automatically process those knowledge chunks.

5.2 Knowledge Management and Territorial Intelligence

For computer scientists, it is common to distinguish data, information and knowledge. In a very simple way, whereas data are bits, numbers and strings of characters, information corresponds to data with their meaning, and knowledge is defined as information potentially useful to solve a problem. Taking this definition into account, let's mention that "geographic knowledge corresponds to information potentially useful to explain, manage, monitor, understand the past, plan a territory and innovate" (Laurini 2017).

In the perspective of regional knowledge, three directions can be given:

1. to boost knowledge-based economy, that is to provide facilities at regional level to boost start-ups, industries and businesses dealing with any kind of activities;
2. to boost education in order that citizens are more educated, and empowered vis-à-vis societal problems;
3. knowledge and especially spatial knowledge can be the base of new instruments not only to analyze regional activities, but overall to assist policymakers not only in their daily work but also to help anticipate.

In this paper, only the third aspect will be developed, with sometimes some issues coming from public participation, i.e. citizen empowerment.

5.2.1 Rules in Knowledge Management

Joosten et al. (2010) declare that any rule must have a scope, and stakeholders and are verifiable. For Ross (2011), rules can be essentially modeled by IF-THEN fact or IF-THEN action. However, when dealing with geographic and space-oriented rules, other forms are necessary (Laurini 2019) essentially because of the need to use geometry and topology in their expressions.

5.2.2 Origin of Knowledge

Commonly, knowledge has two origins. The first one is coming from experts in the domain; this category includes rules coming from physical laws, legislative laws, standards, good practices, etc. The second origin is based on data mining, data analytics and machine learning.

In applying artificial intelligence to companies, the expression "business intelligence" is very common. However, for space management, several expressions are used such as geographic intelligence, geospatial intelligence and territorial intelligence. Bertacchini (2004) defined territorial intelligence as: "an informational and anthropological, regular and continuous process initiated by local actors, physically present and/or remote, who appropriate some space resources by mobilizing and then transforming the energy of the territorial systems into the figurative project's ability. As such, territorial intelligence can be assimilated to territoriality which results from the phenomenon of appropriation of the resources of a territory and then to transfer responsibilities between local actors from different cultures. The objective of this approach is to ensure, literally as well as figuratively, to equip the territorial level to be developed what we have named the territorial formal capital" (Bertacchini and Bouchet (2016).

Regarding city planning and management, the word "smart cities" is commonly employed. In other words, regarding regional policymaking can be seen as an extension of smart cities but with a larger territory to manage.

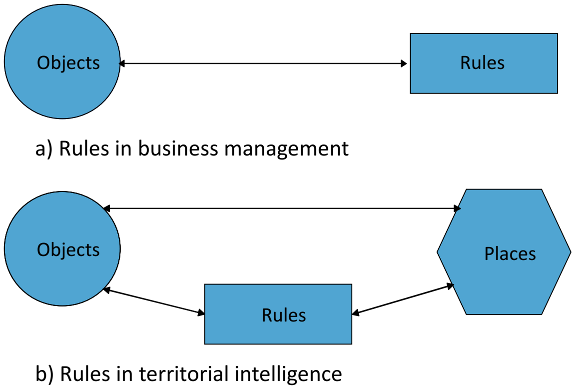

Fig. 5.1 Main differences between rules **a** in business intelligence, **b** in territorial intelligence

Once the language and territory are selected, a geographic knowledge base may include an ontology, a gazetteer, geographic objects and the relationships between these objects, rules and mathematical models, together with external knowledge. Remember that in addition to existing geographic objects, a geographic knowledge base must include (Laurini 2017) the following (See Fig. 5.1):

- Ontologies, as especially geographic ontologies or urban ontologies must not only include feature types, but also spatial relationships between them as explained in Kavouras et al. (2005), Laurini (2012) and Laurini (2014).
- Gazetteers as toponym dictionaries or databases integrate all place-names (see Keßler et al. 2009; Laurini 2015).
- Mathematical models encapsulate some kinds of geographic knowledge in a procedural way, for instance in physical geography; those models can be invoked by geographic rules when necessary.
- Geographic rules must be the key-element of the knowledge base by integrating in their formalism not only geographic objects and relations, but also ontologies, gazetteers and mathematical models. The great difference with business rules is the use of place names, topology and geometry, as illustrated in Fig. 5.2.
- External knowledge which can be useful in geographic reasoning, may come either from the vicinity of the jurisdiction or from other sources. For more details, refer to Laurini and Favetta (2017).
- Current plans and projects; once a project is over, the constituting projected objects become real objects.

5.2.3 *Projects and Plans*

As told in the beginning of this paper, the art of governing is to provide and to choose. In other terms, knowing the reality, its complexity, the problems and claiming a few objectives, a classical way is to formulate projects and plans. A project can be defined

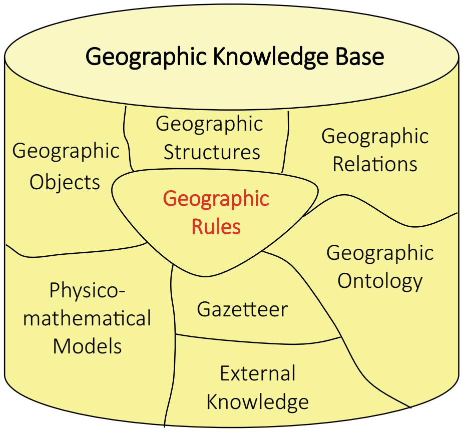

Fig. 5.2 Structure of a geographic knowledge base (Laurini 2017)

as a piece of work or an activity that is intended to achieve a particular purpose whereas a plan corresponds to a set of decisions about how to do something in the future. In our case, a plan can consist of a set of various homogenized projects or only a kind of framework in which several future projects must comply.

In short, projects and plans are components of feedforward. To alleviate the discourse, only the word "project" will be used later on.

Two questions arise:

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.

However, before examining those rules, let us present some small examples which will illustrate the way of encoding rules mathematically.

Among geographic rules, a first category can be called enriching rules in which, due to some conditions, new knowledge is added to the reality of a project.

5.2.4 *Example of Analysis for a Regional Knowledge Bundle*

The Covid-19 crisis can be selected as a good starting point for extending spatial knowledge semantics for several reasons coming from its actuality, its importance to the necessity to mix generic knowledge and geospatial knowledge. Let us first examine some simple rules encoded with the language developed by Laurini (2019) and then more complex examples.

Consider the rule "US have decided to ban European flights during a few weeks except those from UK and Ireland". For each place, we have its name and its geometry. For instance, *Geom* (*USA*). Remember the difference between belonging to a type or a class (set-theoretic point of view) *Paris* ∈ *Cities*, and containing, *Contains* (*France*, *Paris*) which correspond to a geometric point of view.

For defining the geometry of the zone Europe except UK and Ireland, we can write: *Minus* (*Geom* (*Europe*), *Union* (*Geom* (*UK*), *Geom* (*Ireland*))). Let *A* and *B* be cities, *A* in the previous territory and *B* in the USA. Respectively the origin and destination of the flights could be written[1] $A \equiv Origin.Flight$ and $B \equiv Destination.Flight$, So, the rule (Rule 1) can easily be written:

$$\begin{array}{c}
\forall A, B \in Cities, \exists F \in Flights, \\
A \equiv Origin.F, B \equiv Destination.F \\
: \\
Contains\ (USA, B) \wedge \\
Contains\ (Minus\ (Geom\ (Europe), Union\ (Geom\ (UK), Geom\ (Ireland), A) \\
\Rightarrow \\
Status.F \equiv \text{“Forbidden”} \blacksquare
\end{array}$$

Rule 1

Now, consider the rule "Any Covid-19 patient must be taken to the nearest hospital provided it is not saturated". Here we need to consider distances between the location of the patient and the location of the hospital. This distance can be written *Dist* (*Geom* (*Patient.Home*), *Geom* (*Hospital*)).

$$\begin{array}{c}
\forall P \in Patients, \exists H \in Hospitals, \\
Min\ (Dist\ (Geom(P.Home), Geom\ (H)) \\
P.Illness \equiv \text{“Covid-19”} \\
: \\
Status\ (H) = \text{“Not_Saturated”} \\
\Rightarrow \\
AssignTo\ (P, H) \blacksquare
\end{array}$$

Rule 2

Now, consider the rule "If a region A is highly saturated and a region B is lowly saturated, move perhaps a few patients from *A* to *B*." This rule involves using fuzzy set theory, i.e. using fuzzy attributes and numbers (here "*Few*") and fuzzy logic "⇒ (Perhaps)".

$$\begin{array}{c}
\forall P \in Patients, \forall H \in Hospitals, \exists A, B \in Regions, \\
Illness.P \equiv \text{“Covid-19”}, H.P \equiv H.A \\
: \\
H.A = \text{“Highly_Saturated”} \wedge \\
H.B = \text{“Lowly_Saturated”} \\
\Rightarrow (Perhaps) \\
Move\ (Few.P, A, B) \blacksquare
\end{array}$$

Rule 3

Data mining can also exhibit the so-called associative rules which help uncover all such relationships between items from huge databases. Association rules are a class of regularities introduced by [AGR 93] that can be expressed by an implication of the form:

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[1] In mathematics, since the symbol " = " is ambiguous, it was decided to use " = " only as a Boolean comparator, whereas "≡" is used for stating definitions.

$P \Rightarrow Q$ $[s, c]$	Rule 4

where P and Q are a set of items, such that $P \cap Q = \emptyset$, the parameter s, called support, estimates the probability *prob* $(P \cup Q)$, and the parameter c, called confidence, estimates the probability prob $(Q|P)$. In our domain, one very important example is called the co-location rule by which we can define the probability that two geographic items can be neighbors. In a lot of small towns (T), the church (C) is not located far from the town hall (V); this co-location can be written (numbers corresponding to s and c are fictitious):

$\forall\, T \in Towns,\ \exists\, C \in Churches,\ \exists\, V \in TownHalls$: $Contains\ (Geom(T),\ Geom\ (C)) \wedge$ $Contains\ (Geom(T),\ Geom\ (V)) \wedge$ $T.Population < 5000$ $\Rightarrow (c = 90\%,\ c = 80\%)$ $\models Distance\ (Geom\ (C),\ Geom\ (V) < 500$ ■	Rule 5

5.2.5 Feedforward Rules

Let us call feedforward rules all rules which can be able to provide anticipation. In a lot of administrations, there are bodies in charge of this duty such as planning agencies, study centers, meteorologic services, etc. In output, there are projects and plans, but in input, in addition to, there are several sources of information and knowledge which will be examined later.

To illustrate the problem, let us take an example in disaster management, such as for floods, tsunamis, hurricanes, volcano eruption, bridge collapse or nuclear plant explosion, etc.

Disaster management systems are characterized by information and knowledge required to support decision making in all chronological phases of a disaster—mitigation, preparedness, response and recovery. These phases are defined by the Federal Emergency Management Emergency, (FEMA 1998) as follows (Table 5.1).

In other words (Fig. 5.3), Mitigation concerns long term feedforward; Preparedness, short term feedforward; Response, short term feedback; and Recovery, long term feedback. But now, the question is: "what are the information and knowledge necessary to manage those phases?".

In reality, there is a link between recovery to mitigation, because the issue of recovery is to transfer knowledge to better mitigation. Finally, there is a sort of virtuous circle as depicted in Fig. 5.4. However, this is the present situation. Indeed, in the past, we can conjecture that before the arrival of humans, floods or volcano eruptions may happen without consequences on human life. But when humans suffered

Table 5.1 Phases for disaster management systems in cities (FEMA 1998)

Mitigation	Mitigation is the process of taking sustained actions to reduce or eliminate long-term risk to people and property from hazards and their effects
Preparedness	Provide the leadership, policy, financial and technical assistance, training, readiness, and exercise support to strengthen (1) community readiness through preparedness and (2) the professional infrastructure of trained and tested emergency workers, community leaders, and public citizens who can prepare for disasters, mitigate against disasters, respond to a community's needs after a disaster, and launch an effective recovery effort
Response	Response is the process of conducting emergency operations to save lives and property by positioning emergency equipment and supplies, evacuating potential victims, providing food, water, shelter, and medical care to those in need, and restoring critical public services
Recovery	Recovery is the process of rebuilding communities so individuals, businesses, and governments can function on their own, return to normal life, and protect against future hazards

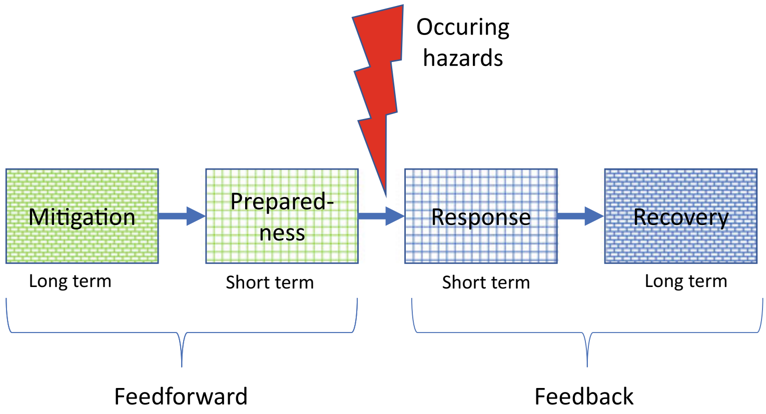

Fig. 5.3 Feedforward and feedback phases in disaster management (FEMA 1998 with modifications)

disasters, there is a good chance that relief actions (i.e. response) were activated. After several issues, humans decided to make actions to mitigate disasters, for instance by constructing dams or levees along rivers. After damages, also recovery actions were launched. But after the advent of ITC technologies, essentially thanks to sensors, it was possible to design preparedness activities.

For an interesting system for Disaster Prediction Knowledge system based on knowledge graphs, see Ge et al. (2022).

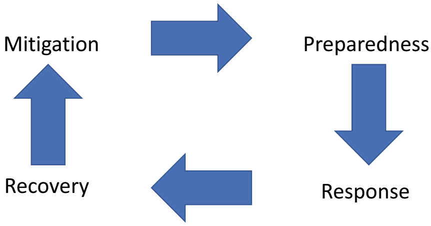

Fig. 5.4 A virtuous circle

5.2.6 *Decisional Rules*

Without entering the decision theory, let us say rapidly that, when facing different projects or plans, sometimes with alternatives, several ways exist to make a selection.

A solution can be to construct a set of criteria to compare the possibilities, models of multi-criteria decision-making processes can help [See for instance Triantaphyllou (2000)]. When an optimum, or a non-dominated solution is clearly identified, the choice is easy, but this case is very rare.

In parallel or independently, a democratic solution is to make a vote to approve or not a project.

Back in our context, we will suppose that there exists a Boolean function such as:

$$\text{Approved(Set\_of\_projects, Selected\_Project, Selection\_Procedure)}.$$

5.2.7 *About Land Opportunities*

The majority of plans and projects at regional level is linked to land opportunities for a lot of actions. Indeed, local authorities have often a set of plots which can be used for the future. In addition to parcels bought years ago or donated, they can use their preemptive rights to buy the plots of ground they have in mind.

In other words, two possibilities:

- Either the local authority has a plot and is looking for its more adequate use;
- Or it has a project and is looking for more adequate pieces of land; in this case, the preemptive right can be activated.

So, whatever is the starting point, some decisional rules may apply to finalize the project.

5.2.8 Harbingers

By definition, a harbinger or a precursor is something that foreshadows a future event or something that gives an anticipatory sign of what is to come. For our concerns, we will consider harbinger knowledge as a kind of feedforward knowledge. The generic model will be as follows:

$$\text{Harbinger}(t) \Rightarrow \text{Effect}(t + \Delta t).$$

And this generic rule can be applied in several domains.

a. For instance, regarding the Covid-19 crisis, Gormley et al. (2020) have shown that traces of the virus can be extracted from wastewater a few days before leading to a higher risk of disease spread.
b. In vulcanology, several instruments are used to get data for measuring seismic activities; the smells of volcanic gases from a volcano are a possible harbinger of an eruption.

Therefore, the harbinger foreshadows the event if nothing is done. Generally, the forecast evolution is not acceptable, and some controlling actions will be set as soon as possible.

5.3 Preliminary Aspects of Feedforward Rule Semantics

Bearing all that in mind, it is possible to draw a diagram (Fig. 5.5) showing anticipation with, in input all the identified possibilities and in output the outcomes, i.e. plans and projects practically always linked to the territory, and more precisely land opportunities.

Remember that the goal of this text is not to provide yet mathematical forms, but only to clarify the more important semantics. One semantics are fully established, mathematical and computing encoding will be possible. Let us examine them.

5.3.1 Knowledge from Local History and Geography

From local history, a lot of knowledge bundles can be extracted varying from ancient and more recent disasters to historical deeds (wars, illustrious people, etc.). Knowledge about ancient disasters and the possible existence of solutions taken perhaps centuries ago can constitute the framework of risk-oriented projects and plans. If any, local historical deeds can be the basis for creating some historical parks in battlefields.

In addition, geographic opportunities can also be the basis for touristic industries (sea, mountain, lake, etc.).

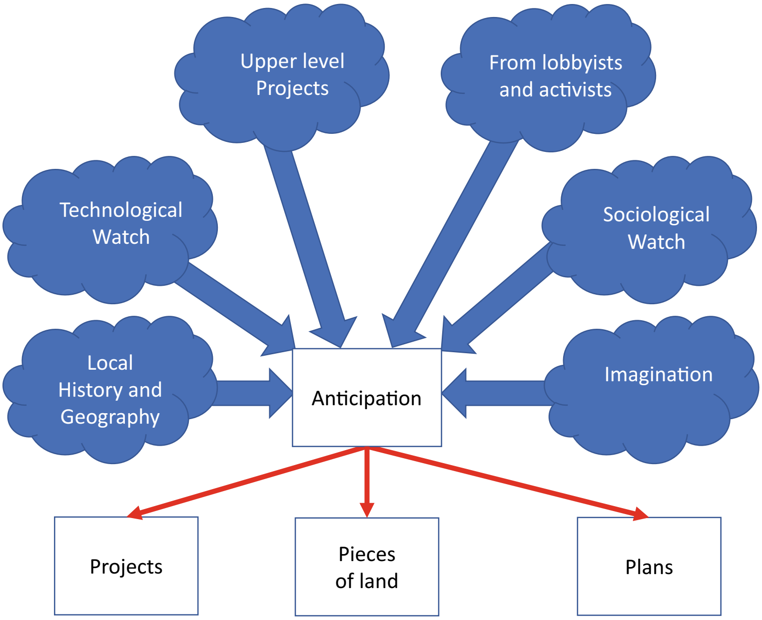

Fig. 5.5 Context of feedforward rules

More recently, with the assistance of telecommunication and sensors, flows of data are collected each day. From data mining and analytics, other knowledge bundles can be identified.

Depending on the location of the region, some recurring events could be discovered, either from experts or from data analytics. For instance, let us examine rapidly the problems linked to snow. In order to facilitate transportation when snow is arriving, in anticipation, the region must procure snow ploughs and salt spreaders, find a place where to park them, instruct drivers to use them, build up a salt reserve according to the size of the roads, and determine some snow emergency roads. The illustration of this mechanism is given in Fig. 5.6.

Finally, an organization must be set up for snow which is a part of regional policymaking. Whereas, when the weather forecast declares that snow will come, the drivers will be requested, and a plan is given to them; those actions are no more at regional policymaking, but at the organizational level.

5.3.2 Technological Watch

Another source of feedforward knowledge can come from technological watch. Each week, companies are providing new equipment which can be useful and there exist journals describing interesting and novel experiences in other regions.

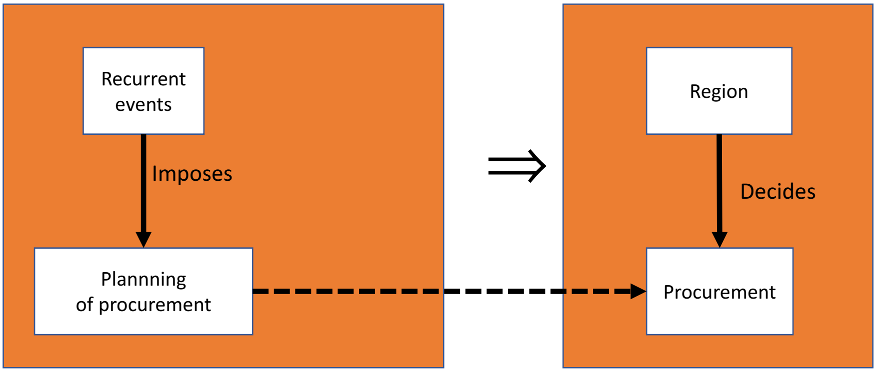

Fig. 5.6 Regional policy facing recurring events

Indeed, the task of the technology watch is to observe, track, filter out and assess potential technologies from a very wide field extending beyond the normal confines of the sector.

For instance, after Araujo Campos (2016), the "humble" lamppost can be transformed into an intelligent sensor for light, air pollution, noise, etc. More generally, a company can sell equipment which can be of interest for a regional project as depicted in Fig. 5.7.

In transportation sectors, a lot of new systems are developed for instance based on scooters, vaporettos, cable-cars, etc.

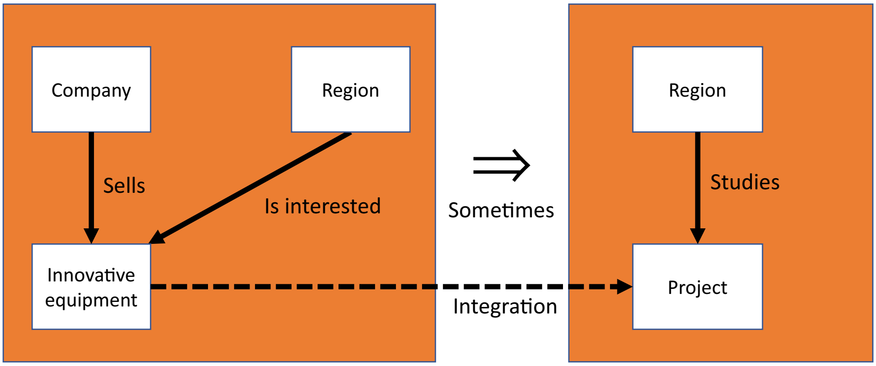

Fig. 5.7 Regional policy facing recurring events. Regional project integrating innovative equipment

5.3.3 Sociological Watching

A complementary aspect is to be aware of novel innovations in other cities and territories also from a sociological aspect. Facing a new transport-on-demand system established in the city *A*, it could be interesting to analyze the outcomes in this city; and based on this analysis, to examine whether this solution can be imported to another city *B*. But overall, a local decision-maker must imagine how this kind of system can be integrated.

The generalization of the biking rental system in several cities can be seen as a result of both technological and sociological watching.

5.3.4 Case-Based Reasoning and Domino Effect

Case-Based Reasoning (CBR) is a subset of knowledge management which tries to solve new problems by retrieving stored 'cases' describing similar prior problem-solving episodes and adapting their solutions or outcomes to fit new needs (for an interesting review in urban planning, see Anthony 2020). This framework can be stated as follows (Rule 6):

(*Description* (*A*) ⇒ *Outcome* (*A*)) ∧ *Resemble* (*Description* (*B*), *Description* (*A*)) ⇒ *Resemble* (*Outcome* (*B*), *Outcome* (*A*))	Rule 6

The general regional rule can be stated as "If a subregion *R1* resembles to subregion *R2* and *R1* has successfully completed a realization, then *R2* may create a project to adapt this realization". See Fig. 5.8.

However, it is necessary to clarify the notion of "resemblance": for this purpose, let us examine a few cases in order to explain what to compare and how to compare.

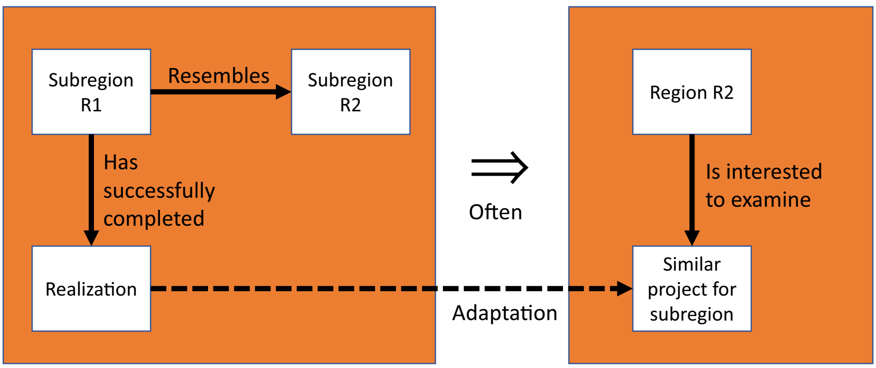

Fig. 5.8 Regional project inspired from an interesting realization elsewhere

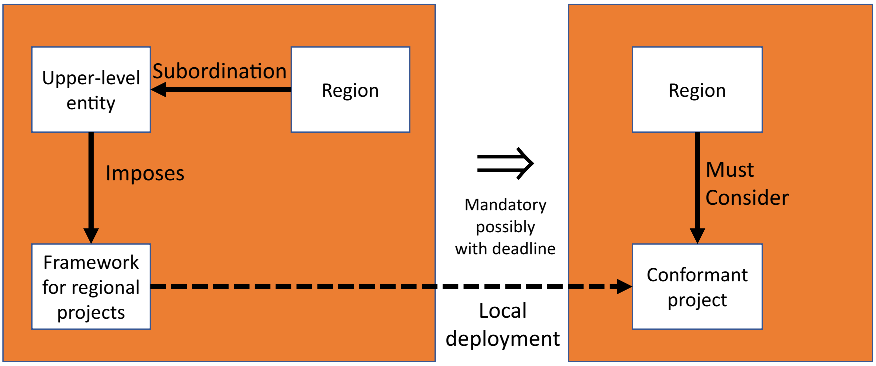

Fig. 5.9 Regional project as local deployment of a national project

- Skiing resort: description of the mountain site (before and after the development), climatic conditions, attraction of potential tourists.
- Bird sanctuary: description of the site (woods, marshes, etc.).
- Enterprise incubator: description of financial resources, existence of higher education institutions.
- Solar farms: description of the site, climatic conditions, land opportunities for panels, for storing electricity.

So, the question is, what to put in the subregion description? Are a few indicators enough? Do we have to extract a few geographic objects, their relationships and their dynamic from the geographic knowledge base?

Another general rule is the domino effect in which an innovation in a region is diffused in neighboring regions.

5.3.5 Upper-Level Project Framework

Regions are subordinated to countries or other upper-level administrations which can have their own politics regarding land use. In this case, usually they create laws or more exactly framework laws which impose regions to design projects in conformance with those framework laws as illustrated in Fig. 5.9.

5.3.6 From Electoral Promises to Regional Project

Regularly in regions, there are elections for presidents or governors. The candidates, including the incumbent, usually present some electoral promises. Out of those people, one is elected and will try to realize the promises often under the

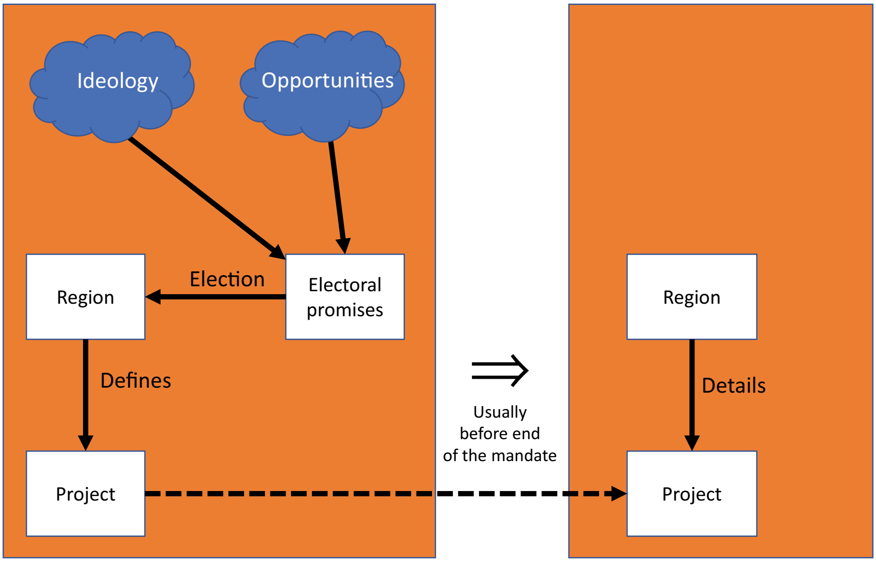

Fig. 5.10 Regional project issued from electoral promises

form of a project as depicted in Fig. 5.10. But where do the promises come from? Maybe from several origins varying from political or philosophical ideology to local opportunities.

5.3.7 Modification or Cancelation of Projects

In a lot of cases, especially when the level of public participation is very low, some activist groups can organize manifestations against a project. The consequences can lead to the modification, or the cancelation of this project as depicted in Fig. 5.11.

5.4 States of a Project

From the pure idea to the opening ceremony, a project can follow several steps. Although the complete procedure depends on the culture and juridical contexts, some key-steps can be identified. Let us examine them.

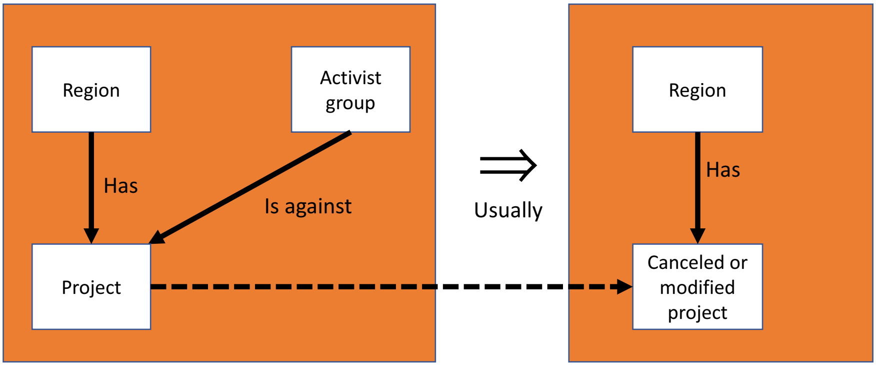

Fig. 5.11 Cancelation or modification of a project as a consequence of activism

5.4.1 From Pure Idea to Decision-Making

A schematic process is illustrated in Fig. 5.12. Once the pure idea of a project is shared by several institutions, green light is given to deepen it and a preliminary project is elaborated often with several alternatives. Among one is usually selected to be presented for approbation.

At this level, during the design phase, we need two repositories for knowledge, the first one is of course the local knowledge base, but we need a second as a kind of temporary repository the characteristics of which are as follows.

a. It is temporary as long as the project is not implemented. If it is not implemented, it could be discarded unless some aspects could be kept for re-utilization.
b. Its structure is similar to the local knowledge base, but this is a kind of projected reality we must deal with. It regroups projected geographic objects, their mutual relationships between them and the existing objects; maybe several additional rules can be saved; maybe new toponyms could be considered, whereas ontologies and external knowledge could be not directly concerned.
c. When the decision is made and the construction begins, gradually some newly-built objects can pass from the projected repository to the local knowledge base.
d. Since it is common during the construction itself, for instance, to preserve road traffic, some transient structures could be made and removed when finished.

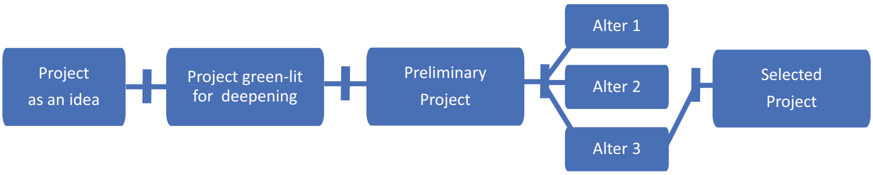

Fig. 5.12 From pure idea to approbation

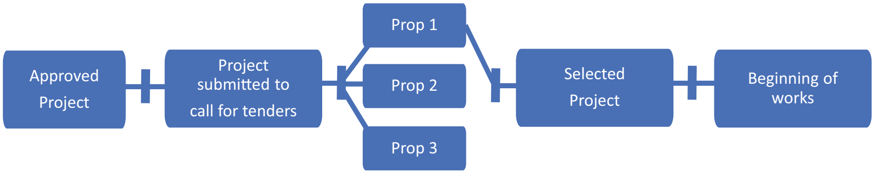

Fig. 5.13 From approbation to beginning of the works

Where must this kind of structure be stored, in the temporary repository or the local base since they will exist for a limited time?

e. Designing projects also means managing alternatives. In other words, under a project, it will be necessary to define alternatives that may appear as sub-projects, with their own objects, their relationships, etc.

5.4.2 Approbation

Several cases can be observed to get an approved project. In some countries, public inquiries can be the core of approbation in which several people or groups can propose modifications. So, several of them can be accepted to modify the project. At the end, generally the regional council will approve it.

5.4.3 From Approbation to Opening Ceremony

Here again, several steps can be identified in which the call for tenders and the selection of one consortium is the main phase. Finally, the works begin, sometimes with a chaotic evolution due to several reasons (Fig. 5.13).

5.4.4 About Contestation

It is common to face contestation in front of a project. From the formal opposition in the regional council, to violent manifestations such as riots, there are several ways and consequences leading to big modifications to the abandonment of the project.

Practically never, economists estimate a priori the costs linked to contestation perhaps including wages of policemen, costs of damage (not only on the public side, but also on the private side) and of course the cost of designing the abandoned project.

5.5 Organization of Project-Oriented Knowledge

Now that some feedforward rules have been identified, the question arises for the management of project-oriented knowledge. Indeed, one of the questions is: will it be interesting to mix already acquired knowledge chunks and those linked to specific projects? A solution could be to distinguish those chunks. Remind that the structure of a geographic knowledge base has been presented in Fig. 5.2; we will study the consequences for projects under development, realized and abandoned projects.

The first thing we have to structure is a suite of modules for project-oriented knowledge management. In addition to managing each project, it must keep the list of feedforward rules (Fig. 5.14).

5.5.1 *Ongoing Projects*

As previously mentioned, the ongoing projects are the more important since they must mobilize existing knowledge chunks and derive novel knowledge.

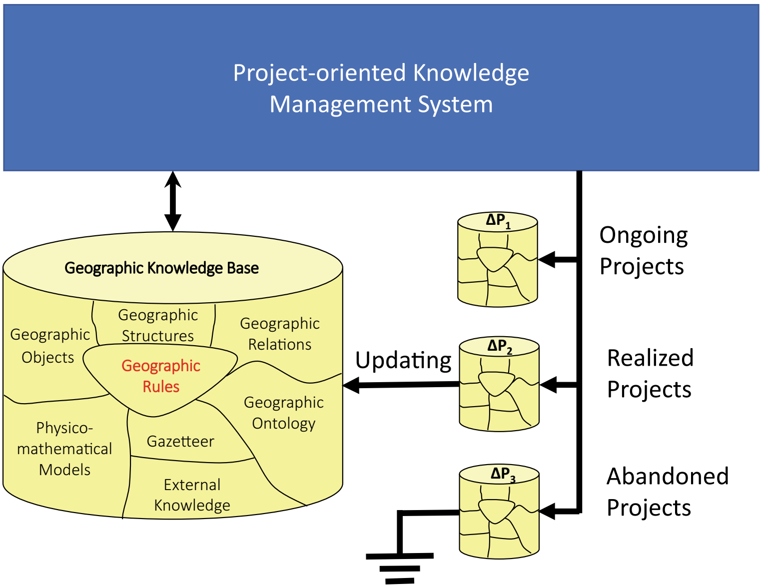

Fig. 5.14 Project-oriented knowledge management system

5.5.2 Realized Projects

Once a project is realized, it becomes reality. Consequently, the geographic knowledge base must be updated for instance when the project is totally implemented. However, since the knowledge base must mimic the reality, here comes a problem: if the project takes a long time, for example, several years, does the knowledge base have to be continually updated? For instance, if a drone regularly takes pictures of the ongoing construction, updating will be necessary for consistency.

5.5.3 Abandoned Projects

For the abandoned projects (ΔP_3), do we have to remove them or keep them? The solution to keeping them is interesting for several reasons. Indeed, often abandoned projects are reconsidered years after and anyway, some abandoned projects can have generated some knowledge chunks which can be of interest for the future. Sometimes, the site of the project is moved, or another project is designed on the vacant site.

5.6 Conclusions

The goal of this paper was to try to clarify feedforward rules at the regional level. A few have been identified, but some others may be discovered. Of course, some are not specifically regional but can also be used at upper- or lower-level of local authorities.

In their paper (White et al. 2001) concerning hazard management, the authors declare that there are “four possible explanations (1) knowledge continues to be flawed by areas of ignorance; (2) knowledge is available but not used effectively; (3) knowledge is used effectively but takes a long time to have effect; and (4) knowledge is used effectively in some respects but is overwhelmed by increases in vulnerability and in population, wealth, and poverty”. Regarding feedforward knowledge for regional policymaking, those remarks still stand and will limit future actions. From the point of view concerning the automatic processing of knowledge, those remarks can lead to unsuccessful results.

Facing the ultimate goal which is to encode those rules with a computer language, several steps must be considered in order to be activated in some reasoning engine. The first one is to capture the whole semantics of those rules and then propose the structure of a mathematical formalism. This analysis has shown that temporal logic and fuzzy logic can be of interest.

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