

Projet GéNéPi

Granularity of the management levels in crisis context

Appel à projets générique ANR

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Défi : Liberté et sécurité de l'Europe, de ses citoyens et de ses résidents

Axe : Résilience et gestion de crise

The version française est disponible : <http://perso.mines-albi.fr/~benaben/GeNePi/GeNePi-FR.pdf>

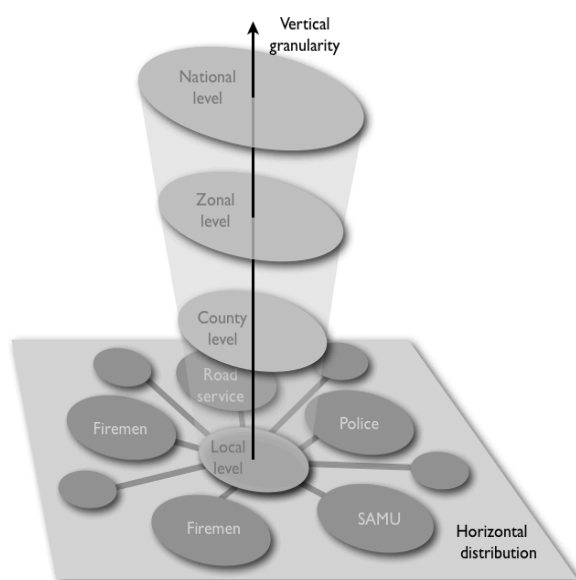
1. Scientific and technological objectives

In France, crisis management is an issue to be managed at a governmental level. Doctrines and governance principles are well defined. Nevertheless, two main statements may be identified: (i) *actors involved in crisis management can generally be considered as fully relevant and capable, however, the **agile coordination** of these actors still remains the weak point of crisis management, and (ii) the digitization of space is an unavoidable feature of the near future, consequently, platforms and systems able to deal with **very large quantities of and flows of data** that will raise from crisis sites are one of the main requirements of next years' crisis management support.*

1.1. Positioning the GéNéPi project

There are several points of view to define crisis management. To position clearly the GéNéPi project, two main dimensions (orthogonal with each other) are considered:

- **The horizontal dimension** (*operational distribution*): functional perimeters (abilities, capacities and missions of actors)
- **The vertical dimension** (*management granularity*): decision levels (local *COS*, regional *Zone*, national *COGIC*, etc.)



Furthermore, a third dimension may be also considered in this framework:

- **Lifecycle dimension** (*time vision*): phases of crisis management (prevention, preparedness, response, recovery).

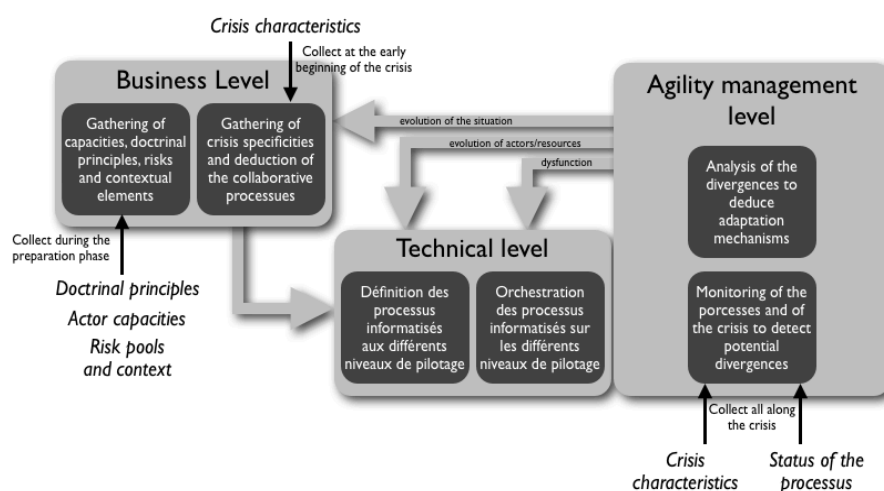
The GéNéPi project aims at defining a methodological and technological support for the **preparedness** and **response** phases. Besides, this support will be dedicated to cover both the **horizontal** and **vertical** dimensions. It should also be compliant and complementary with existing elements (on both methodological and technological points of view). This will concretely implies a strong collaboration with institutional actors in charge of crisis management (covering methodological and technological plans) and a concrete management of interoperability issues (technological plan).

Figure 1. Horizontal and vertical points of view of crisis management in France

1.2. Identifying the objectives of GéNéPi

From a scientific and technological point of view, the GéNéPi project aims at defining, designing and deploying a **Mediation Information System** (MIS) dedicated to support the collaborative management of crisis situation. Consequently, the GéNéPi project is based on three abstraction levels (embedding scientific contributions and technological components):

- **Business level:** This first level deals with knowledge gathering (regarding the crisis itself, the partners capabilities, the risk pools, the doctrinal elements and rules, etc.) and knowledge management to deduce collaborative processes (dedicated to solve the crisis situation, according to both the mobilizable partners and the specificities of the impacted perimeter).
- **Technical level:** This second level concerns the orchestration and the steering of the collaborative processes defined at business level. The main goal is to orchestrate technically the business collaborative processes (deduced at business level) by (i) connecting with existing IS and tools of the involved partners, and (ii) generating interfaces to support human tasks of the business processes.
- **Agility management level:** This last level concerns the monitoring of both the current crisis situation (to maintain a “picture” of the real status of the system) and the process orchestration (to maintain a “picture” of the expected status of the system). By comparing both these “pictures” and analysing their differences, it is possible to (i) detect any potential need for adaptation and (ii) give advice regarding the required adaptation. Consequently, such an agility principle can deal with the *kinetics* of crisis situation and adaptation of the response to ensure *resilience*.



The structure shown on figure 2 describes the project in terms of abstraction levels, but this figure also introduces the overall methodology of the GENEPI project and the global architecture of the project steering. The work packages and tasks appear naturally. The links, connections, and dependencies of work packages and tasks are also obvious.

Figure 2. Structure and components of the GENEPI project

Consequently, *scientific objectives (SO)* and *technological objectives (TO)* of the GENEPI project are listed in the following table (structure of the project VS. positioning of the project):

| | Preparedness | | Response | |
|-----------|--|---|--|---|
| | Horizontal dimension | Vertical dimension | Horizontal dimension | Vertical dimension |
| Business | SO1-Collect of capacities and risks TO1-Formalizing the gathered knowledge | SO1-Collect of plans, rules and doctrines TO1-Formalizing the gathered knowledge | SO2/TO3-Collect of crisis characteristics and deduction of operational processes | SO2/TO3-Deduction of management processes |
| Technical | TO2-Study of the technical interoperability requirements between IS (specific connectors, format of the shared data, definition of specific interface for human tasks, etc.) | | TO4-Orchestration of response processes (coordination) | TO5-Transmission of objectives and decision |
| Agility | | | TO6-Collect of data regarding situation and processes SO3-Update of models | SO4/TO7-Deduction of adaptation mechanisms |

Table 1. Cartography of the scientific and technological objectives of the GENEPI project

Preparation phase: Schematically, the preparation phase is dedicated to gather, formalize and store the (scientific and technological) knowledge that will to be used during the response phase to ensure the best management of the crisis.

- **SO1** (horizontal and vertical): Gathering of the knowledge regarding the *partners* to mobilize (their capacities and resources), the *context* of the crisis (risk pools, local stakes, dangers) and the *doctrine* elements (plans and rules).
- **TO1** (horizontal and vertical): Formalizing of the knowledge gathered through SO1. The main stake is to continuously feed an *ontological* framework, so that it can remain permanently exploitable.
- **TO2** (horizontal and vertical): Managing interoperability of existing systems within the mediation information system to be deployed.

Response phase: This phase concerns the steering and the management of the collaborative behaviour. There are mainly two aspects: (i) coordinating actors of the crisis treatment in order to avoid functional conflicts, and (ii) monitoring the collaborative management of the crisis to ensure continuity and agility.

- **SO2** (horizontal and vertical): Collect of information about the *crisis* and deduction (using also the knowledge gathered from the preparedness phase) of collaborative process models.
- **TO3** (horizontal and vertical): Tooling of the knowledge management (modelling editor, design of rules dedicated to exploit the ontological base) within de MIS.
- **TO4** (horizontal): Orchestration of the collaborative processes (as workflows) among the various existing information systems of operational actors of the crisis management.
- **TO5** (vertical): Choreography of the collaborative cartography of processes, including objectives and decision (received from different decision levels), and also the fractal aspect of imbricated processes.
- **TO6** (horizontal): Definition and design of the technical components in charge of gathering data and information (from the field or from the process execution) to supervise the management of the crisis.
- **SO3** (horizontal): Exploitation of the gathered supervision data to maintain models (through the interpretation of the received data and update of the knowledge bases).
- **SO4** (vertical): Analysis of the knowledge bases to (i) detect potential requirements for agility, and (ii) deduce and define relevant adaptation measures.
- **TO7** (vertical): Definition of a technological structure able to support all the management necessities (orchestration and choreography) and also the agility needs (monitoring, detection and adaptation).

There are also **global** objectives:

- **SO5:** Integration of performance indicators within the approach to ensure an efficient management.
- **SO6:** Management of the kinetics of the crisis through the ability of agility of mediation systems.
- **SO7:** Sociological treatment of the acceptance potential of the overall proposal.

1.3. Scientific contribution and social innovation aspects

One of the main requirements of the GÉNÉPi project is the integration of existing practices (methodological integration) and existing tools (technological integration) to ensure its acceptance. Both these orientations may be found, for the first one, in the collect and formalisation of knowledge (with no overlapping regarding private practices of actors regarding their own business domain) and, for the second one, in the management of technical interoperability.

Regarding scientific contribution and innovation potential, the GÉNÉPi project proves to be innovative as far as multi-level of decision (inter-ministerial) is concerned. Besides, considering both horizontal and vertical dimensions provides a decompartmentalization of roles, responsibilities, information and decisions involved in the management of a crisis.

The main components of *the scientific originality* and of *the potential of application* of the GÉNÉPi project are listed below according to the three levels of the project structure:

- **Business level:** The *scientific originality* mainly concerns the structure of the knowledge base (meta-model and the associated ontology) and the definition of a system of resilience performance indicators that fits with the crisis management domain. The *potential of application* concerns the improved ability of actors to implement more coordinated collective responses that correspond more precisely to the situation (finally a more clever way of applying plans and doctrines).
- **Technical level:** The *scientific originality* concerns interoperability and the management of heterogeneity, confidentiality and efficiency of all the concerned systems. The *potential of application* is about helping partners involved in the management of the crisis to focus only on their core business and to forget about low added-value activities (multiple capture of information, coordination and adjustment of coordination, calculus, etc.).
- **Agility management level:** The scientific originality concerns the merging ability of exploiting multiple available sources of information (sensors, software, devices, etc.) to deploy monitoring principles and deduction mechanisms. The *potential of application* is about providing partners of crisis management with real tools (for decision support, orchestration, knowledge management) to help them to ensure the resilience of the social system.

Finally, the GÉNÉPi project ensures the double challenge of crisis management submitted by the two statements described in the introduction of this first section (coordination issue and difficulty to use and exploit the future very large amount of data that will be generated).

2. Relevance and strategic content of the project regarding the orientations of the call

This section follows the three levels structure of the call for projects:

Relevance regarding the call for projects in general: *Plan d'action 2014, Appel à projets générique.*

- The GÉNÉPi project inherits from different research works and funded projects (ANR/CSOSG/ISyCri, PREDIT/SIM-PeTra, EU/ICT/PLAT, ANR/Arpege/SocEDA and around ten running or finished PhDs). This provides the GÉNÉPi project with a certain level of maturity. Furthermore, existing prototypes and realised experimentations can be considered as a technological background, which brings quite a high TRL (Technology Readiness Level).
- Besides, there are a lot of institutional actors involved in the GÉNÉPi project. Such reference partners (in the field of crisis management) considerably improve the credibility of the proposal (cf. section 3).
- Finally, the content of the GÉNÉPi project claims to be coherent with the European Program Horizon 2020, and especially the *Challenge "Security"* and the *Focus Area 11 "Disasters resilience"*.

Relevance regarding the challenge: *Liberté et sécurité de l'Europe, de ses citoyens et de ses résidents.*

- The potential of industrialization of the results of the GÉNÉPi projects is a first point in line with the expectation of the Challenge. The methodological and technological architecture proposed by the project could clearly be considered for an industrialisation and deployment phase (especially within the French "prefectures"). Besides, the involvement of institutional actors (respectively industrial ones) shows the significance of the topic (respectively its potential of industrialisation).
- Furthermore, these industrial perspectives are truly in line with the "livre blanc défense et sécurité nationale" of 2013 (cf. point 12 on the *industrial imperative*). Similarly, the question of an inter-ministerial management and of a multi-level of decision is also in line with that document (cf. point 7 on the renewal of the general strategy).
- Finally, the consortium of partners involved in the GÉNÉPi project is multidisciplinary (from a scientific point of view: ICT, Industrial engineering, sociology) and multi level (from a social point of view: industrial, academic and institutional actors).

Relevance regarding the axis: *Résilience et gestion de crise.*

- The first point to mention concerns the topic of the use-case that will be used as practical support of the GÉNÉPi project: *flood of the Loire river*. This subject is perfectly in line with current works regarding the "Plan Loire" (*Rapport Plan Loire grandeur nature of La Cours des Compte*) and the extension of the specific provision on this topic of the ORSEC plan of the *zone de défense et sécurité de l'Ouest*. The main stakes concern the recovery of networks (water, energy, oil and hydrocarbon). This is obviously a concrete question of *society resilience*. The management of this kind of crisis involves naturally a large amount of actors and implies a deep complexity of their coordination (horizontal dimension). This complexity is one additional constraint for the local, regional or national decision-makers (vertical dimension). Furthermore, this subject also implies to take into account the risk pools (geographical area potentially impacted by one critical phenomenon). Actually, one of the main goals of this use-case is to show that the results of the GÉNÉPi project can be used to ensure the resilience of such risk pools. The methodological and technical results of the project could help the system to assume its expected behaviour in spite of a strong disruption (we talk about *systemic resilience* because of the tight interweaving of the networks).
- The GÉNÉPi project also covers several phases of crisis management. GÉNÉPi deals with both *preparedness* and *response* phases (from both the methodological and technological points of view).

For any risk pool having faced a crisis, a prompt return to normalcy is not an obvious feature. The GÉNÉPi project aims at revealing emerging scientific and technological innovating solutions in charge of improving this resilience feature. In order to achieve this, the GÉNÉPi project aims at tackling the three main causes. First, the methods and practices of crisis management are very compartmentalized (from legal, operational and decisional points of view). Second, crisis complexity continuously increases due to the complexity of the impacted systems, the number of involved actors, the increasing multiplicity of rescue plans, the large amount of available data, the political, social or economical stakes, etc. Third, crisis management implies to take into account the kinetics of the situation (fast, progressive and unstable) and it is not conceivable to deploy tools that would not be flexible, reactive and agile. Consequently, improving the safety of European citizens and residents requires a concrete decompartmentalization of crisis management activities (including steering activities) and also considering the coherence and relevance of each activity (with each other).

Emerging Decision Support Systems (DSS) and Information and Communication Technologies (ICT) for ten years (from a conceptual point of view) and for five years (from a technical point of view) are nowadays ready to reach such ambitious (but finally realistic) goals.

Finally, might the GÉNÉPi proposal be evaluated according to the public action point of view, one should consider that such a project, on the one hand, provides a concrete exploitation of the notion of “risk pool” (decompartmentalization and interoperability) and on the other hand, improves the efficiency and reactivity of the crisis response (improving resilience).

3. Overview of the consortium

The consortium is based on public, private and institutional partners (members of a steering committee). Such a complementarity covers the full competencies spectrum (at least the provisional ones) required for this project (business competency BC, scientific competencies SC and technological competencies TC).

| | | Business | Science | Technology |
|-----------------------------------|--------------|---|--|---|
| Public partners | ARMINES /CGI | BC1- Knowledge on crisis of a local size | SC1- Model-driven engineering SC2- Knowledge management SC3- Agility in crisis management and resilience | TC1- Ontologies TC2- Event-Driven Architecture Service-Oriented Architecture TC3- Interoperability TC4- Mediation Information System design |
| | CEREMA /DTO | BC2- Regional flood plan | SC4- Networks and their dependencies | |
| | UT1 /IRIT | | SC5- Collaboration theory | TC5- Inter-Organisational Workflows TC6- Hierarchized Workflows |
| | UT1 /IDETCOM | | SC6- Risk sociology SC7- Management of complex territorial systems | |
| Private partners | InteropSys | | | TC7- Design and orchestration of collaborative processes TC3- Interoperability |
| Steering committee (institutions) | CRICR Ouest | BC3- Road networks and road crisis management | | |
| | EMIZ | BC4- Knowledge on the whole decision chain BC5- knowledge on interministerial crisis | | |
| | DREAL | BC2- Regional flood plan BC6- Local risk pools | | |
| | SDSIE | BC7- National vision of crisis management | | TC8- Connection to existing IS and tools for crisis management |

Table 2. Competencies of partners required for the project

Finally the main involved people are the following:

| | Actors | Main connection with the needs of the GÉNÉPi project |
|-------------|--------------------------|--|
| ARMINES/CGI | Frédéric Bénaben | Associate Professor (leader of the projects: ANR/ISyCri and PREDIT/SIM-PeTra) |
| | Matthieu Luras | Associate Professor (involved on the projects: ISyCri, SIM-PeTra, PLAY and SocEDA) |
| | Sébastien Truptil | Assistant Professor (involved in the projects: ISyCri, SIM-PeTra, PLAY and SocEDA) |
| UT1/IRIT | Chihab Hanachi | Full-Time Professor (involved in the project: ISyCri) |
| UT1/IDETCOM | Jerôme Ferret | Associate Professor (leader of a project: ANR PREDIT 3) |
| CEREMA/DTO | Hélène Dolidon | Engineer (involved in the project: SIM-PeTra) |
| InteropSys | Nicolas Boissel-Dallier | R&D Director, his PhD was on collaborative process orchestration |
| | Aurélien Codet de Boisse | President, lead an IT project dedicated to safety of storekeeper networks |
| CRICR Ouest | Lionel Lilas | Head of the transport division- CRICR Ouest (involved in the project: SIM-PeTra) |
| EMIZ | Col. Daniel Hautemanière | Head of the staff (Chef d'état-major) – Préfecture de la zone de défense Ouest |
| DREAL | Thierry Herbaux | “Adjoint sécurité défense au délégué ministériel de zone” |
| SDSIE | Robert Unterner | Head of the mission “protection against civilian risks” |

Table 3. People involved in the GÉNÉPi project

Two reference publications:

Luras M., Truptil S., Bénaben, F., (2013) - *Towards better Management of Complex Emergencies through Crisis Management Metamodeling. Disasters (DISA)*, Wiley, 2013.

Mu W., Bénaben, F., Pingaud H., (2012) - *Collaborative Business Process Deduction in a Model-Driven BPM Approach. Enterprise Information System (EIS)*, Taylor&Francis, 2013.