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Spoke 7 – TS3 – Communities' resilience to risks: social, economic, legal and cultural dimensions
WP 7.7 – Legal and Ethical Aspects Prospect
Task 7.7.5 – Profiles of responsibility, compliance, and accountability of the Civil Protection System

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White paper on mitigating decision-makers' responsibilities

From forensic investigation to liability mitigation: the technical-scientific and political systems supporting decision-making in civil protection

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From *forensic investigation* to liability mitigation: the technical-scientific and political systems supporting decision-making in civil protection

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Summary

Abstract

The evolution of civil protection from solidarity assistance to a constitutionalized matter has expanded decision-making responsibilities, intertwining politics and science. This paper explores this relationship, investigating decision support methodologies in complex and high-responsibility contexts. The analysis is based on case law and *forensic investigation tools*, distinguishing between technical and political decisions. The implementation of innovative methods developed in the PNRR RETURN project is presented. Attention is paid to the integration of data into the WikiProcessi platform and the Audit of the Functional Centers for a more sustainable risk governance.

Key words

Keywords: Civil Protection – Responsibility – Decision-Making – Jurisprudence – Risk Governance

Introduction

The evolution of the concept of civil protection – from mere solidarity assistance, to National Service and today to constitutionalization of the matter – has led to an increase in the responsibilities of the subjects involved and this also due to the introduction of decision-making mechanisms characterized by a complex relationship between the political component and the technical-scientific one. The investigation of this report, aimed at understanding the dimension of the decision-maker's responsibility in the field of civil protection, has led us to preliminarily scrutinize the ancillary elements of the decision itself and, therefore, to ask ourselves what is meant by decision-support methodologies and, more specifically, with what tools decisions in the field of civil protection can be supported.

The environment in which we have formulated these questions – and are looking for answers – is that of "*forensic investigation*" and, more precisely, of case law on civil protection events, appreciating not only the legal aspects of judicial review, but also the technical, scientific and social implications. The exercise thus allowed us to deepen the nature and characteristics of decisions on risk governance, as well as on the tools to support the decision itself; distinguishing from the outset the category of technical decisions and evaluations that are based, in a general way, on empirical data and scientific-engineering models, and concern the design, management and optimization of systems, structures or processes, usually hesitating in a series of statistical evaluations[1], from decisions in the political sphere, where the typical rationality of the technical decision fails and a plurality of actors and interests are usually involved, which make the decision-making process more complex, characterized by negotiations and evaluations of opportunities[2].

This contribution – in this context and offering a preliminary rapid examination of the above-mentioned categories of decisions – intends to highlight particular and innovative methods implemented in the PNRR research project (Spoke 7, of the RETURN Foundation) and thus initiate a verification of the same as effective decision-making tools in the field of civil protection; all while aiming at the goal of sustainable responsibility for those called upon to decide in that sector. We will therefore refer to the possibility of integrating, within decision-making processes, jurisprudential data from the database on judicial cases in the field of civil protection called WikiProcesses, as well as the results of the Audit procedure of the decentralized Functional Centers, neuralgic parts of the civil protection alert system.

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[1] B. Leoni, *Nature and Meaning of Political Decisions*, in *Il Politico*, Vol. 22, No. 1, pp. 3-26.

[2] G. Sartori, *La teoria empirica della politica di Carl J. Friedrich*, in *Il Politico*, Vol. 31, No. 1, 1966, pp. 61-73

Brief analysis of decision support systems and their role in public governance

From the point of view of *Decision Support Systems* (hereinafter DSS) of a technical nature, there is a large literature. While there is no single definition, DSS refers to a set of IT tools designed to help decisionmakers collect, analyze, and interpret data in order to make more informed and rational decisions. In

DSS, in fact, information from various sources is combined and analytical models are used to predict scenarios, address semi-structured problems[3] and support decision-making in complex contexts[4]. Over time, decision support systems have been classified in different ways, depending on the criterion used for analysis[4].

As far as the relationship between user and system is concerned, a distinction is made[5] between (i) active *DSSs*, which are able to develop guidelines for solving problems, (ii) passive *DSSs*, which provide support to the decision-making process without elaborating guidelines, and (iii) cooperative *DSSs*, which give the decision-maker the opportunity to make changes to the suggestions provided by the system for reevaluation.

With reference to the support methods, we distinguish[6] instead (i) the *Communications-Driven and Group DSS*, which exploit information technologies and sharing platforms to support work groups, (ii) the *DataDriven DSS*, which mainly deal with the processing of the data collected and transformation into useful information, (iii) the *Document-Driven DSS*, which analyze the information contained in unstructured documents, (iv) *Knowledge-Driven DSS*, used for the creation of automated decision systems, and (v) *ModelDriven DSS*, which develop large-scale simulations.

Based on the purpose for which they are designed, DSSs are divided into (i) *Enterprise-wide DSS*, which support decision-makers with large databases of data, providing them with a complete view, and (ii) *Desktop single-user DSS*, limited to a single user's personal computer[7].

Based on orientation, six main categories can be distinguished[9]: (i) *Text-oriented DSS*, which support decision-making by storing textual data, (ii) *Database-oriented DSS*, which rely on the collection and storage

[3] On the contrary, their use is less common for structured problems, characterized by already defined and recurring solution procedures, and for unstructured problems, where the complexity of the resolution is high and the decision-maker has no previous knowledge on the subject. Thus in *Integrated systems for monitoring, early warning and mitigation of hydrogeological risk along major communication routes - Quaderno 24* - Definition of the intervention model and preparation of the emergency plan, edited by Fabrizio Paoletti and Pasquale Versace, 2014, p. 28.

[4] E. Turban, E. Sharda, D. Delen, *Decision Support and Business Intelligence Systems*, *Pearson*, 2014, pag. 75.

[4] M. J. Aqel, O. A. Nakshabandi, A. Adeniyi*, Decision Support Systems Classification in Industry*, in *Periodicals of Engineering and Natural Sciences*, Vol. 7, No.2, August 2019, p. 784.

[5] M. Varshney, A. K. Srivastava, *Decision Support System in Corporate Intelligence*, in *IJARCCE*, 2017, p. 347.

[6] D. J. Power, *Supporting Decision-Makers: An Expanded Framework*, avaliable in research gate, pag. 432. Sul punto, si veda anche E. Turban, R. Sharda, D. Delen, *Decision Support and Business Intelligence systems*, 9th Edition, 2011, pag. 79.

[7] A. Felsberger, B. Oberegger, G. Reiner, *A review of decision support systems for manufacturing systems*, CEUR Workshop Proceedings, 2017. [9] Classificazione introdotta da Holsapple C. W., Whinston A. B., *Decision Support Systems: A Knowledge-Based Approach. West Pub. Co*, 1996. Sul punto, M.S. Hasana, Z. Ebrahim, W. H. W. Mahmoodb, M. N. Ab Rahman, *Decision support system classification and its application in manufacturing sector: a review*, in *Jurnal Teknologi*, p. 155

of data in multiple locations, (iii) *Rule-oriented DSS*, which leverage artificial intelligence to achieve automated decision-making, (iv) *Solver-oriented DSS*, designed to analyze complex problems and suggest solutions, (v) *Spreadsheet-oriented DSS*, which facilitate knowledge extraction through spreadsheet-based analysis models, and (vi) *Compound-oriented DSS*, which combine different types of DSS examined above into a single application.

From the point of view of the area of interest, some scholars have divided the categories of DSS into three main groups, based on their main focus: *Data focus*, *Model focus* and *Knowledge focus*[8].

DSSs can also be classified according to the type and frequency of the decision-making process[9]: *Institutional DSS*, to make scheduled decisions with a certain regularity; *Ad-hoc DSS*, used in occasional or unforeseen situations.

As for the capabilities of the system, DSSs can be divided into[10]: *Individual DSS*, designed to assist a single decision-maker; *Group DSS*, designed to support collegial bodies.

In addition to the decision support systems examined above, it is possible to distinguish other support methodologies, mainly used in the political field, including the development of regulatory or pararegulatory guidelines and *policy advisor systems*[11].

It is possible to distinguish between advisors inside and outside the decision-making system[12]. In the former - typical of the so-called "Westminster" model - the *policy advisory system* (PAS) has traditionally been regulated by formal procedures that establish precise criteria for the recruitment of experts to be included in the staff of the administration[13]; on the contrary, in countries with a Napoleonic tradition, such as Italy, there is a lack of a clear and determined definition of *advisors*, their professional skills and their relationship with policy-makers[14].

In recent years, both in the former and in the latter, there has been a growing pluralization of the actors involved in policy consultancy[15]: among the different categories of *advisors*, it is possible to distinguish academics or technical experts in the field, who play a key role in the development of policies based on scientific evidence, contributing to the *evidence-based policy making* (LMWH)[16] model; but also international

[8] M. S. Hasan., Z. Ebrahim, W. H. W. Mahmood & M- N- Ab Rahman, *Op. Cit.,* p. 156-157.

[9] J.J. Donovan, S. E. Madnick, *Institutional and ad hoc DSS and their effective use*, in *Database Adv. Inf. Syst.* 8, 1977, p. 81.

[10] M. J. Aqel, O. A. Nakshabandi, Adeniyi A., *Op. Cit.,* p. 782.

[11] The concept of "policy advisory systems" was introduced by Halligan in 1995 to describe and analyze the multiple sources of policy advice used by governments in policy-making processes. On this point: Halligan J., *Policy Advice and the Public Sector. In Governance in a Changing Environment,* Guy Peters B. and Savoie D. T. (eds), 1995, 138–172.

[12] J. Halligan Op. Cit.

[13] *Policy advice in public decisions Phase II*, p. 31.

[14] J. Craft, M. Howlett, *Policy Formulation, Governance Shifts and Policy Influence: Location and Content in Policy Advisory Systems*, in *Journal of Public Policy*, n. 2, 2012, pp. 79-98.

[15] *Policy advice in public decisions Phase II*, p. 18.

[16] S. Blum & V. Pattyn, *How are evidence and policy conceptualised, and how do they connect? A qualitative systematic review of public policy literature.*, Evidence & Policy, 2022, 1-20.

organizations, recognized as a source of *authoritative advice* and *expertise*, capable of directly influencing central administrations.

Additional groups of *advisors* can be public research bodies, private consulting firms, and finally, advice commissions which, depending on the nature and purpose, can be established on a permanent or temporary basis[17].

From this brief examination, therefore, it emerges that *policy advice* is not a univocal practice[18], but a varied set of subjects, structures and tools of analysis and support that transform scientific knowledge into practical knowledge, useful for addressing issues of collective interest[19].

Decision support systems in the field of civil protection

Italian institutions adopt multiple decision support tools to deal with emergencies and protect the population; they allow to optimize crisis management and improve the effectiveness of operational responses[20].

As regards the technical and organizational aspect – and with particular reference to the management of meteo-hydrogeological and hydraulic risk – the monitoring and surveillance activity carried out in the context of the alert system, where the main tools used are meteorological satellites, the national radar network and that relating to meteo-hydropluviometric stations, must be considered; this activity, also thanks to the information from the territorial garrisons, it allows the network of Functional Centres to estimate the presence and intensity of rainfall almost in real time, to predict its evolution in the short to medium term, as well as to measure the variation in river levels[21]. The second part of this paper will deepen the alert system and the network of functional centers.

As far as data processing and transmission tools are concerned, however, the Dewetra software system and platform can be mentioned, which allows the comparison, integration and synthesis of data and models necessary for the assessment of the meteorological and hydrological situation.

On the basis of this technical-organisational model and instrumental equipment, the forecasting, monitoring and surveillance activity is therefore carried out by each Functional Centre[22], which results in an analysis of the possible risk scenarios for a specific alert area, biunivocally converted into alert levels.

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[17] For further information on this point, see: *Policy advice in public decisions Phase II,* p. 19.

[18] *Policy advice in the Italian central administration. From the Covid emergency towards a progressive institutionalization of decision-making support*, SNA - National School of Administration 2023, p. 5 and 6.

[19] D. Stone, A. Denham,*Think Tanks Traditions: Policy Research and the Politics of Ideas*, 2004, Manchester University Press; Majone G., *Evidence, Argument, & Persuasion in the Policy Process*, 1989, Yale University Press.

[20] L. Palestini, *Emergencies: communication and decision support systems*, 2022.

[21] Civil Protection Site: Monitoring & Surveillance | Civil Protection Department

[22] The Dewetra system is the tool common to all the Functional Centres, including the Central one active at the DPCN. It is the right of each Functional Center to equip itself with additional tools for the in-depth study of the necessary assessments at the local level in greater detail

Downstream of this, the regional administration provides for the transmission of the alert and the adoption of an adequate operational phase to cope with the expected severity of the event.

Broadening the view, there are additional decision support systems, such as the INFORM Risk Index[23], which consists of a global*, open-source* risk assessment of humanitarian crises and disasters[24].

Still in the field of civil protection, there are other forms of decision support that can be qualified as *policy advisors*. In particular, in this context, some bodies and institutions, differently included in the national civil protection system (hereinafter, PC), take on importance.

First of all, art. 14 of Legislative Decree 1/2018 provides that, in the event of emergencies of national importance or in their imminence, the Head of the PC Department convenes the National Operational Committee of Civil Protection, which operates within the Presidency of the Council of Ministers. The composition is mainly political-administrative[25].

Secondly, another category of *advisors* used by the PC system is that of the "academics". It should be noted that, in this particular area and unlike what happens in general, the cognitive contribution of the academy is formalized in art. 19 of Legislative Decree 1/2018: *the scientific community participates in the National Service through the integration of mature knowledge and products deriving from research and innovation activities into civil protection activities* . The same is true for research institutions (art. 21, Legislative Decree 1/2018).

A further group of *advisors* is represented by expert commissions. In the context of the PC, the presence of the Major Risks Commission and the Technical-Scientific Committee should be noted. The first is directly provided for by art. 20 of Legislative Decree 1/2018 and the Prime Ministerial Decree of 16/09/2020, while the second is extraneous to the current PC legislation[26] [27].

[23] This index can support decision-making processes both in terms of prevention and preparedness for possible emergencies, and in the response phase to them. This model – developed by the European Commission – divides risk into three fundamental dimensions: the first, relating to the type of hazards and the degree of exposure of the population to such events (*Hazards & Exposure*); the second relating to the intrinsic susceptibility of communities to the negative effects of hazards (*Vulnerability*) and, finally, the third, relating to any lack of resources, infrastructures or institutional systems capable of mitigating the impact of the event (*Lack of Coping Capacity*)

[24] M. Marin-Ferrer, L. Vernaccini, K. Poljansek, *INFORM Index for Risk Management Concept and Methodology*, Version 2017. Disponibile al seguente INFORM Risk

[25] This body, chaired by the Head of the Civil Protection Department, is composed of three representatives of the Department itself, as well as representatives of the components of the national service.

[26] However, it should be noted that it was established both on the occasion of the shipwreck of the Costa Concordia, for the management of the emergency phase and the recovery and movement phase of the ship, and, in more recent times, for the management of the health risk relating to the Covid-19 pandemic. As far as is of interest here, it should be noted that in the management of the emergency linked to the shipwreck of the Costa Concordia, two different decision-making support systems have intervened for the civil protection system. Thus in F. Gabrielli, *Naufragi e nuovi approdi. From the disaster of the concord ship to the future of civil protection*, Baldini Castoldi, 2022, p. 44.

[27] In particular, in the case of the CTS following the events of the shipwreck of the Costa Concordia, representatives of the Ministry of the Environment and Protection of Land and Sea, the Ministry of Infrastructure and Transport, the National Institute of Health, the Higher Institute for Environmental Protection and Research, the Regional Agency for the Protection of the Environment of Tuscany, From the Italian Naval Register, from the General Command of the Port Authorities, from the Department of Fire Brigades of Public Rescue and Civil Defense and from the Department of Civil Protection

In summary, it should be noted that, in the civil protection sector, the distinction between technical and political decisions is particularly relevant: the former, formed on scientific data and evidence, becomes the necessary prerequisite for the latter, which however is articulated within a broader evaluation horizon, shaped by the necessary balance of institutional, social and economic interests.

The adoption of decision support systems should therefore provide, from the point of view of risk management *accountability*, adequate justification for the conduct of civil protection operators, allowing the action carried out – whether assessment or decision – to be qualified as lawful and adequate. However, examining the case law relating to the ascertainment of liability of civil protection operators, the DSS in the sector have not always ensured a safe haven of legal *compliance* and, sometimes, not even of *best practices*: from the point of view of personal responsibility, the fact of the intertwining of competences is discounted, but also of a certain cumbersomeness of the decision-making process; just as the *vulnus* of the decision-making system itself due to its lack of *transparency*. Aware of the difficulty of positivizing the civil protection decision-making system and wanting to maintain the balance between legal certainty and operational flexibility necessary to respond to the increasing frequency of extreme events with high vulnerability, the research referred to in this contribution aimed to extend and integrate the "traditional"

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decision-making approach based on data and predictive models, with "innovative" factors detected or in any case related to the judicial proceedings affecting the sector.

WikiProcesses as a strategic component of DSS in civil protection

In the context of the increasing complexity of risk management and the need to strengthen the decisions taken by risk managers, understanding the judicial configuration of legal liability in civil protection decisions plays a fundamental role.

In this framework, the WikiProcesses Observatory, developed and managed by the CIMA Foundation on behalf of the National Department of Civil Protection, is configured as a strategic tool for the systematization of case law in this particular field of knowledge.

The WikiProcessi platform was born about twenty years ago, as *a repository* of case law in the field of civil protection. In particular, the intuition of observing and analyzing the judicial proceedings and measures of this particular field of knowledge took initial form within the Faculty of Environmental and Land Engineering of the University Campus of Savona, a decentralized branch of the University of Genoa: in this academic context, some researchers of the CIMA Foundation were engaged in teaching and research activities, under the guidance of Professor Franco Siccardi, founder of the Foundation and then head of the degree course in environmental engineering.

From the very first approaches, it became clear how fruitful the analysis of calamitous events was for students and teachers, not only from a technical-scientific point of view – with particular reference to hydraulics and hydrology – but also from a legal and social point of view, in an integrated perspective that would allow them to grasp the interactions between operational choices, organizational models, technological tools and personal and institutional responsibilities.

From this teaching experience, and from the subsequent scientific elaborations, a path of systematic study of some emblematic events has arisen, which have represented crucial junctions both for engineering and for law (think of the Piedmont flood of 1994, the Sarno landslide of 1998, the Vibo Valentia flood of 2006 and the L'Aquila earthquake of 2009). These cases have offered a privileged terrain for legal investigation, allowing critical questions to be raised on the methods of forecasting, assessing and managing risk, as well as on the adequacy of the regulatory, organizational and technological tools to support the civil protection system at that given historical moment.

Starting from these reflections, the idea of developing a systematic methodological approach to the study of judicial events that, directly or indirectly, involve the civil protection system, both at national and local level, has been consolidated. The objective was not merely reconstructive, but proactive: to understand the process dynamics in order to identify the critical areas and, consequently, to outline possible trajectories for improving and strengthening the system.

A fundamental and essential step for the consolidation of a culture of responsibility in the field of civil protection is represented by the organized collection and analysis of judicial data. Only through the construction of a solid, accessible and shared knowledge base is it possible to promote informed decisionmaking processes, oriented towards prevention and conscious risk management.

For several years, therefore, WikiProcessi has assumed the stature of a dynamic observatory, questionable and potentially able to respond to the need of the public decision-maker to have informed support for his decision. Its evolution - implemented in the aforementioned research project in the context of the PNRR - reflects the ambition to build a prevention-oriented decision support system, while starting from a need to make the responsibility of those involved in civil protection decisions more sustainable. The platform results in analytical products, called Dossiers, Notes to Judgments and Precipitates, which make it able to promote a culture of responsibility based on legal evidence, interdisciplinary analysis and good operational practices. In fact, it makes it possible to represent graphically and verbatim the phases, actors, rules and documents that make up a given judicial process.

Over the years, about 200 cases have been mapped and analyzed, of which 121 concern flooding events. This is a phenomenon that, from the point of view of judicial statistics, is decidedly marginal, but to which significant social consequences are linked if we think of the number of victims that the calamitous events have caused or the extent of the damage recorded after each disaster or, not secondary, the media impact of these events.

As part of the RETURN Project, and in particular within the activities of the RETURN Foundation (*Task 7.7.5 – Profiles of responsibility, compliance, and accountability of the Civil Protection System*), it was necessary to question the qualification of WikiProcessi as a potential tool for *decision support* or *policy advice*. This reflection is not limited to a theoretical distinction, but allows us to highlight the added value that WikiProcessi can offer in highly complex operational contexts, such as that of civil protection, helping to strengthen transparency, traceability and define responsibility in individual and institutional choices. As mentioned above, technical DSS include IT tools designed to help decision-makers collect, analyze and interpret data, in order to make more informed decisions. In this framework, WikiProcessi is not configured as a technical DSS in the strict sense, but can be interpreted as a *document-driven* or *knowledgedriven system*, because it does not process numerical data or forecasting models, but organizes and makes accessible legal and documentary information, offering valuable interpretative support for the understanding of personal and institutional responsibilities. In addition, the Observatory has some characteristics attributable to the *DSS cooperatives*, as it allows users to actively interact with the system through the advanced search function and the dynamic consultation of event sheets, as well as to the *DSS groups*, being designed to support working groups within the administration both in the technical and regulatory choice phase.

This perspective allows us to highlight how the WikiProcesses Observatory is not configured as an alternative to technical DSS, but as a complement to them, helping to fill a methodological and cultural gap: that relating to legal reflection, sustainability and traceability of choices in contexts of high responsibility. In particular, in Functional Centers and Expert Commissions (but also in more local structures such as, for example, Municipal Operations Centers, Operations Rooms or Coordination Centers), where it is necessary to first plan the decision-making process and then make quick and complex decisions, tools such as WikiProcesses can expand not only the amount of information available to the decision-maker, but also the quality of the decision-making process, favoring more conscious, documented choices consistent with the regulatory and jurisprudential framework of reference. However, it should be emphasized that, at least in the current configuration, WikiProcesses does not allow the user to intervene directly on the contents through modification, validation or updating operations. In addition, the platform does not offer additional documentation beyond that collected by researchers and found in the monitored judicial proceedings. Finally, the proposed materials – due to their specialized nature – are difficult to access for users without basic legal training. These limitations, if on the one hand ensure a rigorous methodological adherence, on the other hand reduce their usability, making it necessary to interpret mediation for effective use by the decision-maker-risk manager. Therefore, the platform needs to be integrated into existing DSS systems or in any case capable of amplifying its visibility and making its contents accessible to a wider audience of subjects.

This function has been consolidated within the RETURN Project, thanks to the joint work of the CIMA Foundation, the Eni Enrico Mattei Foundation (FEEM), the Tor Vergata University and some legal professionals, who have developed a matrix based on *reverse engineering* methods that allows the analysis of cause-effect relationships. This matrix, fed by case law, by the analytical products of WikiProcessi and where, in the continuation of the research, appropriately validated with more numerous case studies, could guide institutional decisions in a preventive key, favoring a more aware, transparent and resilient governance. In any case, the WikiProcessi platform has demonstrated not only the suitability to effectively feed the matrix, but significantly raises its methodological and application potential, applying to transform it into a real multidimensional decision support system.

In fact, it has already been shown that the matrix is capable of integrating legal, social, technical and environmental dimensions in order to guide strategic choices in risk management: its methodological architecture is based on an approach that synergistically enhances both quantitative and qualitative data. The matrix, although still in a basic form, is not limited to representing a merely descriptive analytical model, but assumes a prescriptive and proactive function, because it allows to simulate alternative scenarios and evaluate the effectiveness of the measures adopted; its distinctive element lies in the ability to incorporate the qualitative data from the WikiProcesses Observatory - such as sentences, charges, filings, acquittal formulas and the products contained therein - in order to identify the regulatory, organizational and procedural vulnerabilities that contributed to the occurrence of the harmful events referable to the case study contained in the WikiProcesses and selected for the matrix.

The integration between the matrix and the Observatory takes place by preliminarily addressing a process of counterfactual analysis, which makes it possible to rethink alternative scenarios and formulate concrete recommendations to improve the system's responsiveness; In particular, the analysis of omissive conduct and contested responsibilities in judicial proceedings makes it possible to identify critical areas in territorial planning, alert systems, self-protection strategies and risk communication.

The matrix thus composed is therefore a candidate as a strategic tool for technicians and operators of the civil protection system - including civil protection authorities - but also for territorial planners, offering guidelines based on data also deriving from case law.

In this perspective, the characteristics of a (i) *Document* and *Knowledge-Driven DSS* can be identified, as a system based on the processing of jurisprudential data, made usable through interpretative products and synthetic precipitates; of a (ii) *Compound-Oriented DSS,* since it combines textual functionalities (event sheets, dossiers, notes to judgments), procedural rules (canons of responsibility, standards of *compliance*) and interactive visualization tools (map of proceedings, thematic classifications), offering integrated and adaptable decision support; but also of an (iii) *Institutional DSS*, capable of supporting both recurrent and regulated procedures – such as those relating to territorial planning and risk management – and processes in which it is necessary to adapt decision-making processes to exceptional or non-standardized contexts,

such as in the case of health emergencies or extreme weather events. Finally, it has characteristics that can be traced back to (iv) *Group DSS*, because it is able to support internal working groups within the administration both in the technical and regulatory choice phase.

Ultimately, we believe that it is possible to integrate the qualitative analysis of CP judgments within a decision support system and that this represents a strategic opportunity of great importance in risk management. The judgments, in fact - it seems appropriate to conclude it - not only outline jurisprudential guidelines on the matter in question, but also reflect regulatory tensions, contextual interpretations and institutional and personal responsibilities that directly affect risk governance and emergency management. In this context, WikiProcesses, in the above characterization, can also be read as an *evidence-based policy advice tool*, capable of transforming legal and analytical knowledge into practical knowledge, useful for addressing binding issues of collective interest.

The audit of the Functional Centers

The Functional Centres are a key part of the National Civil Protection Service and represent – like real nodes in a network – structures organised to provide support for the decisions of the competent authorities for alerts and emergency management. These are, in essence, ancillary bodies to the civil protection authorities at various levels, equipped with scientific skills and technical resources such as to constitute the essential apparatus of the national alert system.

This section aims to illustrate the *auditing* tool of the Functional Centres, developed and tested by CIMA Foundation, also in its evolution following the activities carried out as part of the RETURN Project, with particular reference to Task 7.7.5, dedicated to the analysis of regulatory compliance and institutional *accountability* profiles) of the National Civil Protection System. Next, the placement of the audit tool within the categories of Decision Support Systems (DSS), as previously outlined, is explored. The sections are however preceded by a brief introduction dedicated to the nature and tasks of the Functional Centre in the context of the Italian civil protection system.

The meteo-hydro risk warning system, as defined today by Legislative Decree 1/2018 art. 17, originates from the reflections and experiences of the National Group for the Defense from Hydrogeological Catastrophes (G.N.D.C.I.) and takes its first steps – especially on a regional scale – as an effect of disasters such as Stava (1985), Valtellina (1987), the floods in Liguria and Piedmont in 1994, Sarno (1998) and Soverato (2000). The National Civil Protection Service (Law 225/1992) was already in place, with the Directive of the President of the Council of Ministers of 27 February 2004 the "operational guidelines for the organizational and functional management of the national distributed alert system, state and regional, for hydrogeological and hydraulic risk for civil protection purposes" were defined and with Law

100/2012 the alert system became a "full" part of the National Civil Protection Service civil protection (art. 3 bis of Law 225/1992)[28] [29] [30].

The system, defined in its general articulation by national law and regulated at territorial level by regional laws, is organized to activate the National Service, at various levels, before the occurrence of the event: it is ensured by the National Department and by the Regions and Autonomous Provinces through the network of Functional Centres; carries out the task of: i) announcement, monitoring and surveillance of risk scenarios in real time, ii) identification and declaration of expected alert levels, iii) activation of operational phases in relation to the alert issued; it consists of a central Functional Centre and 21 decentralised Functional Centres.

Each Functional Centre is composed of a meteorological area and a hydrogeological and hydraulic area, which operate in close connection. The weather area has the task of carrying out daily forecasts at 24, 36 and 72 hours, also providing numerical data with respect to the expected precipitation, as well as other weather phenomena; On the basis of this forecast, the Idro area carries out a critical assessment. The staff uses numerical forecasting models and tools such as satellites, radars and about 5200 monitoring stations; it also makes use of information collected from the territory through the regional operations rooms and territorial garrisons.

Following the critical assessments carried out by the functional centre and converted biunivocally into alert levels as prescribed by the Operational Indications of the CD-DPCN of February 2016, the PC Authority of the Autonomous Region or Province, the decision-making body, adopts the alert and transmits it to the various local authorities: this determines the activation – at different levels and on the basis of the provisions of the specific Plan – of the operational phases related to it and therefore the civil protection such as, for example, evacuations, school closures, suspension of activities, mobilization of people and vehicles, traffic bans and more[31].

It is undoubtedly an articulated system, which is exposed – with greater frequency in recent years – to a social and judicial union, such as to put the system itself in crisis.

The WikiProcesses Observatory[34], to which you referred above, attests that the charges of crime often concern operators of the "chain" of the alert system[32], with the effect of producing the so-called

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[28] The Warning Directive: twenty years of history - CIMA Research Foundation

[29] Twenty years of the Warning Directive, twenty years of science - CIMA Research Foundation

[30] The effectiveness of the Italian warning system - CIMA Research Foundation

[31] "*The Warning System for Meteo-Hydro Risk*", contribution by A. Gioia, L. Molini, R. Masi and M. Morando at the conference on "*Natural risks between scientific challenges and criminal liability*", Rome 21 June 2024. [34] See the CIMA Foundation website in the "News" section

[32] "*The Criminal Liability of the Operators of the National Civil Protection System in the Studies of the CIMA Foundation*", by L. Ferraris, M. Altamura and F. Munerol, in «Il diritto dell'economia», year 68, n. 109 (3 2022), pp. 519-540.

phenomenon of "defensive civil protection", [33]which, similarly to the much better known phenomenon of "defensive medicine", risks jeopardizing their activities and purposes[34].

In addition, from some criminal proceedings monitored through WikiProcesses, alarming signals have emerged regarding the efficiency and effectiveness of the alert system, with particular reference to the activities carried out by the Functional Centres. For example:

1. the same "experts" appointed by the Judge do not understand the procedures and products rendered by the functional center (ref.: Vibo Valentia 2006 proceedings);
2. The inefficiency of the forecasting service is stigmatized due to a lack of understanding of its own evaluations and the effective communication of the forecasting products and, more generally, of the regional civil protection system to the territories due to the "disconnect" between forecasting, alerting and civil protection measures (ref.: Messina 2009 procedure);
3. the local civil protection system disputes the reliability of the regional forecasting system (ref: Genoa 2011, Genoa 2014 and Parma 2014 proceedings).

The data of the WikiProcess Observatory, together with those descended first from the case study on the work of the Functional Center of the Liguria Region on the occasion of the flood event of 9 October 2014 and, subsequently, from the launch of the Audit project of the Functional Centers which involved, in 2016, the Meteorological Service of the Lombardy Region, together with those descended from the

specific study of some Ligurian[35] judicial processes which, between 2011 and 2019, involved the regional alert system, confronted CIMA Foundation researchers with a series of issues such as: i) operators' awareness of their responsibilities; ii) the ability of operators to give an account of their actions; iii) the provision of tools that make the evaluations and choices made traceable; iv) the aptitude to learn from mistakes; v) the organizational dimension in the context of a complex system; (vi) the role of scientific uncertainty in assessments and decisions; vii) the sustainability of a system that requires excellent performance levels without interruption in the face of a general and chronic undersizing of usable resources.

[33] Volumes of the Series "*Civil Protection and Responsibility*", Ed. ETS, Pisa; organized by the Civil Protection Department of the Presidency of the Council of Ministers and the Cima Foundation. See the speeches at the conferences by M. Altamura, D. Amato, F. D'Alessandro and L. Ferraris.

[34] D. Amato, *Civil protection activities and criminal liability: current criticality and prospects for reform*, Discrimen, 3 September 2018

[35] Ref: judgment of the Trib. Pen. Genoa, Section I, no. 6302/2016; judgment of the Court of Appeal. Genoa, Section II, no. 1100/2019; judgment of the Court of Cass., Section IV, no. 22214/2019; judgment of the Trib. Pen. Genoa, section II, no. 4307/2019; judgment of the Trib. Civ. Genoa, sec. II, no. 3096/2018.

From these considerations, the proposal of a method[36] to map, analyze and evaluate the processes operated and the products provided by the functional centers has arisen, in order to strengthen the awareness of the legal responsibility of the operators, with a view to the efficiency and effectiveness of the National Civil Protection Service, good governance of the same, certainty and adequacy of the legislative and regulatory framework, as well as the dissemination of the culture of civil protection: this method has been given the name "CIMA Foundation Audit of Functional Centres".

The RETURN Project[37] has been an opportunity to operate, on the one hand, the systematization of this method and on the other hand - due to the involvement of additional functional centers and complex structures related to the alert system - to provide an updated representation of the state of the art, so that, in addition to finally giving rise to the necessary critical comparison of the methodology and the results, it was possible to first verify the suitability of an *internal audit* to improve the audited entity in its function, or to be classified as a real decision support system in civil protection.

Before addressing the central question, it is appropriate to briefly recall the premises that guided the *auditing activity* conducted on the functional centers:

1. This activity concerned the bodies responsible for forecasting, monitoring and warning functions at regional level, with particular reference to natural risks and specifically to those of a hydrogeological and hydraulic nature.
2. The audit aimed to verify compliance with the regulatory framework in force, as well as to analyze the existence, quality and effective compliance with the procedures and operating practices adopted by the entities involved. To this end, a comparison with the operational "good practices" in use at other centers of the same level has also been planned, in order to identify any deviations or margins for improvement.
3. The assessment process was divided into several phases, aimed at deepening and clarifying the issue of the legal responsibilities attributed to operators who, at different levels, are called upon to carry out forecasting, monitoring and communication functions of critical issues related to natural risks. These responsibilities are located within the alert system of the National Civil Protection Service, and constitute a crucial node.
4. The entire process was carried out in close collaboration between the auditor (CIMA Foundation) and the body being assessed. On the one hand, the auditor made his multidisciplinary expertise available; on the other hand, the Authority has guaranteed its full willingness to share data,

[36] To whom he owes much that used for the internal audit of Arpa Lombardia and taken into consideration for the activities with the Hydrometeorological Service.

[37] In particolare, le attività dello *Spoke 7 – TS3: Communities' resilience to risks: social, economic, legal and cultural dimensions.*

documents, procedures and practices, as well as the active involvement of the staff directly or indirectly involved in the processes under analysis. The approach adopted was systemic, aimed at promoting greater awareness of the legal responsibilities related to civil protection activities, through a critical reading of the organizational structure and the overall functioning of the structure.

5. Finally: the approach required the involvement of stakeholders external to the audited body, i.e. all those components of the regional civil protection system that interact with the body, providing or receiving products and services. This expansion of the scope of analysis has made it possible to grasp more precisely the operational interdependencies and shared responsibilities that characterize the system.

As for the scheme of the method, it is worth noting the following:

1. The investigations carried out apply a risk-oriented method of process analysis to the set of processes managed by the institution, based on a mixed approach (empirical and *expert-based*), conducted through: *i*) the analysis of the specific context with reference to the entire meteohydrological forecasting process, the organization and the control systems of the risks inherent in the activity; *ii*) the application of a *risk assessment model.*
2. The specific context analysis is conducted through the mapping of the specific activities that contribute to the risk of the overall process. This activity is based on the observation, by CIMA Foundation, of the work of the entity in carrying out its activities and this from the point of view of "professional risk" and, more precisely, with reference to the risk of initiating criminal proceedings for the persons involved in the service in question. It is normally carried out with "*desktop review*" techniques.
3. The set of considerations that derive from this highlights potential critical elements ("*alerts*" highlighted within "risk mapping sheets") which, subsequently and as the start of the *risk assessment* phase, are verified in consultation with the technical staff of the entity. The residual critical issues are then translated into the in-depth questionnaires administered to the staff of the Authority; The results of the operators' responses constitute the last step in defining the levels of significance for each of the risk aspects highlighted ("risk weighting").
4. Finally: at the end of the comparison between the "*desktop review*", the considerations proposed by the managers of the Authority in consultation with the CIMA working group and the targeted insights taken from the pool of operators and possibly of the representatives of functionally contiguous services and offices, the *alerts* are classified as "unfounded", "well-founded with the need for further investigation", or again "founded with the suggestion of reinforcing actions": this is how the "*risk treatment" phase is completed*, which concludes the audit.

The Audit has therefore been consolidated with a structure that includes four main phases: 1) Context *analysis*: regulatory and organizational study to reconstruct tasks, responsibilities and guarantee positions; 2) *Mapping of risk areas*: identification of potential criticalities, with the preparation of risk sheets and dialectical comparison with the institution; 3) *Quantification of risk* exposure: administration of structured questionnaires, construction of a *risk model* and risk classification/weighting; 4) *Risk treatment*: definition of corrective actions, organizational reinforcements and proposals for improvement. A fifth *follow-up* phase can be added – at least two years later – for the analysis of the effectiveness of the actions implemented.

The RETURN Project has allowed the drafting of a lexicon ("Audit Vocabulary") built through the systematic analysis of the technical-operational documentation produced, the comparison with the partners and audited bodies, the detection of the most frequent linguistic ambiguities and the structuring into thematic sections to facilitate consultation. Each item in the Vocabulary is accompanied by a concise and operational definition, an example of use taken from real or simulated situations, a reference to the phase of the audit process in which the term is used and, finally, an explanatory note that clarifies any areas of application or potential semantic ambiguities.

The RETURN Project has also highlighted and proposed hypotheses for improvement, such as the need to intervene on the "risk weighting" phase. The risk weighting phase is a crucial step as it directly affects the quantification of the level of criticality associated with each functional and thematic area, thus determining the overall effectiveness of the diagnosis and the proposed corrective actions. Currently - as already described above - the weighting is carried out by assigning a weight to each of the aspects that contribute to defining the risk - represented by the questions of the "depth questionnaire". The weight, expressed on a scale from 1 (minimum relevance) to 5 (maximum relevance), is attributed jointly by the working group composed of CIMA researchers and the representatives of the audited body, on the basis of mainly qualitative and subjective assessments.

This approach, although based on expert and dialogic consultation, has some limits in terms of objectivity, reproducibility and comparability over time and between different entities. It is therefore necessary to act in a targeted manner to make this phase methodologically more robust, reliable and transparent. With this in mind, it is considered worthy to proceed with two lines of improvement.

The first: development of an objective system of attribution of weights.

It is a matter of introducing objective criteria to guide the assignment of weights to the different aspects of risk. These criteria could be based on measurable and comparable dimensions, such as: *i*) the presence of stringent regulatory obligations; *ii*) the degree of exposure to legal responsibilities (both personal and institutional); *iii*) the frequency and severity of impacts observed in previous experiences; *iv*) the level of

attention that the issue receives at the level of national or international guidelines; *v*) the potential reputational or communicative impact in the event of inefficiencies or omissions.

The codification of these criteria would make it possible to attribute weights in a systematic and verifiable way, minimizing the influence of individual subjectivities and enhancing the experiential component gained in previous audits.

The second: overcoming the weighing logic and transitioning to a conformity assessment system. As an alternative or in parallel to the first guideline, a more radical transformation of the weighting phase could be considered, abandoning the system of weights in favour of a model that directly assesses the level of compliance of the answers given in the questionnaires. The current system provides for a simple tripartition (10 for conforming response, 5 for uncertain response, 0 for non-conforming response), which, however, does not allow a fine representation of the degree of maturity or approximation of the processes analyzed.

During the discussions with various subjects related to the Project - operators of functional centers and stakeholders - the adoption of a more granular evaluation scale was proposed, divided for example into five levels: 1) Lack of compliance; 2) Poor compliance; 3) Medium conformity; 4) Good compliance; 5) Excellent compliance. For each level, clear and verifiable descriptive parameters would be defined, allowing a more balanced assessment, oriented towards learning and organizational growth. This approach could be further enriched by drawing on the corpus of responses and case studies collected in previous audits, from which to extract reference models or qualitative thresholds.

An evolution in this sense would have the double advantage of increasing methodological consistency between different audits conducted over time or on different territories and enhancing the Audit process as a tool not only for control, but also for accompanying and capacitating the structures assessed, and this precisely in a logic of better support for the civil protection decision.

To this end, given the large number of samples so far subject to the application of the audit, a line of development involves the use of artificial intelligence tools for the massive analysis of the results and the determination of multi-parametric and objectified weighting systems.

Finally, the RETURN Project has laid the foundations[38] for a transformative approach to control, not only overcoming the classic conception of mere inspection in favor of that of a strategic lever for transparency, legitimation and innovation, but also considering said control in the perspective of organizational learning through case studies, error analysis, *just culture*[39] and the comparison of other organizational models. Thus, measurement in the audit becomes a virtuous opportunity to act on: *i)*

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[38] In line with the "strategic perspective" of the Italian Civil Protection, with reference to the contribution of D. Mangano, S. Russo and A. Clemente, in chapter 11 of the publication (April 2025) edited by the National School of Administration, "*Towards the Italian ecosystem of strategic foresight*".

[39] See the intervention of P.A. Serena, in Vol. 3 "*The responsibility of the System and of the different actors in the perspectives of legislative reform*" of the cit. Series: "Civil Protection in the Risk Society".

organizational resilience, understood as the ability to absorb shocks and regenerate; *(ii)* integrated sustainability, in its environmental, social and *governance dimensions*: *iii)* technological and managerial innovation, as a proactive response to complexity; *iv) multilevel accountability*, towards judicial review and civil society.

In conclusion, it can be said that the audit of the functional centers as emerged at the end of the activities carried out in the Project:

1. confirms the adequacy of the method with reference to the original purposes of *compliance, accountability, traceability* in favour of the operator and performance in favour of the civil protection decision-maker in the alert system;
2. calls for a comprehensive and adaptive methodology, capable of intercepting latent vulnerabilities and anticipating risk trajectories, integrating environmental, social, technological and organisational dimensions; such that it must necessarily be based on multidisciplinary analysis tools, predictive indicators and verification capable of combining evaluation rigor and operational flexibility;
3. urges the urgent need to introduce a governance of the entire non-structural civil protection prevention, capable of inseparably holding early warning and planning together and extending to the latter the "support" of such an audit designed for the former.

The audit activity conducted by CIMA Foundation can therefore be interpreted both as a form of *Decision Support System* and as a *policy advice* tool, depending on the function it performs and the context in which it is applied. This dual reading makes it possible to enhance the role of audit not only as a verification tool, but also as a strategic orientation device for risk *governance*.

From the point of view of DSS, the audit is close to *knowledge-driven* and *model-driven models*, as the audit collects, organizes and interprets regulatory, operational and organizational knowledge, offering the decision-maker an interpretative support based on legal evidence and documented practices; moreover, the audit is divided into phases that simulate and analyze the functioning of the functional centers, contributing to a systemic reading of the decision-making processes and to the understanding of the

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responsibilities distributed. In this sense, the audit integrates the technical DSS in the part of the traceability of choices in high-responsibility contexts.

In parallel, the audit can be considered a form of *evidence-based policy advice*. CIMA Foundation acts as *an external advisor* to the decision-making system, providing multidisciplinary expertise that does not impose decisions, but strengthens their quality, legitimacy and sustainability. In some cases, the audit takes the form of a *temporary advisory commission*, activated in project or extraordinary verification contexts, capable of producing operational recommendations and strategic reflections. In this framework, the audit

contributes to the *evidence-based policy making model*, transforming data, practices and standards into practical knowledge, useful for addressing both issues of collective interest and for strengthening the sustainability of the responsibilities of operators and the entity called upon to play the role of decision support.

In summary, the CIMA Foundation audit is placed in an intermediate and complementary position between DSS and *policy advice*: on the one hand, it supports the decision-making process through systemic and interpretative analyses; on the other, it orients public policies towards greater regulatory awareness and a more solid culture of responsibility.

In contexts such as civil protection, where decisions must be rapid, complex and legally based, tools such as this can represent an essential contribution to the institutional quality and transparency of public action.