GI Databases and Information Systems
Special Interest Group EMISA

12th International Workshop, University of Luxembourg, Belval (Luxembourg)
June 2-3, 2022

„Enterprise Modelling and Information Systems Architecture“

Business Processes in Disaster Risk Information Management

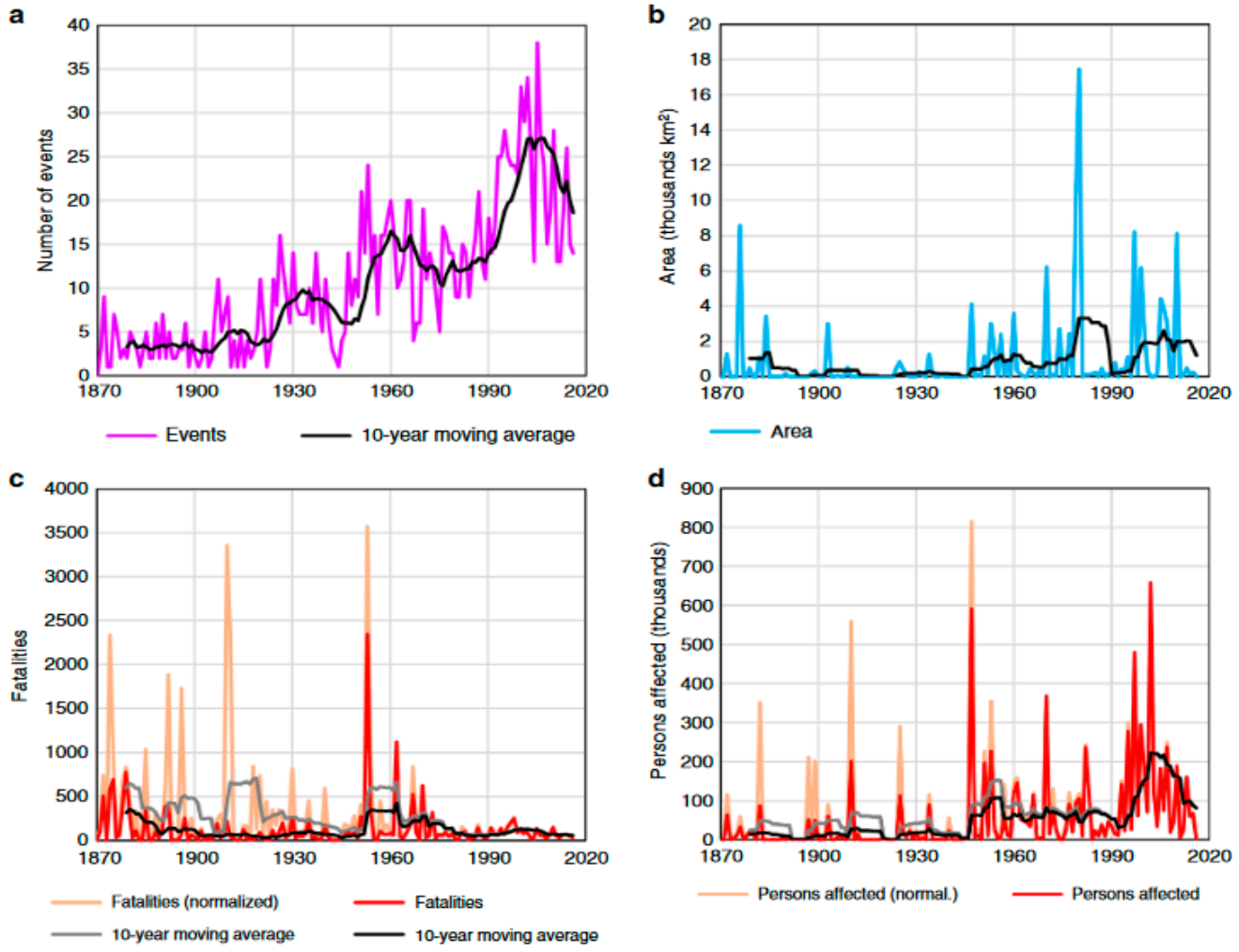
Horst Kremers
CODATA-Germany Secretary General
Engineering Management and Information Sciences, Berlin (Germany)

Structure

1. Situations and Consequences
2. Disaster just-in-time Information Demands (SitRep, SOPs, SLAs)
3. Levels of Granularity
4. RISK Domains Digital Strategies, Roadmaps, Governance
5. What can you do ?

Trends in Flood Losses in Europe

ARTICLE NATURE COMMUNICATIONS | DOI: 10.1038/s41467-018-04253-1



Paprotny, D. et al. : Trends in flood losses in Europe over the past 150 years. Nat Commun 9, 1985 (2018). https://doi.org/10.1038/s41467-018-04253-1

Victims and Damage Data of the 2021 Flood in Germany

• Fatalities, missing persons, injured persons

In Rhineland-Palatinate, 135 people lost their lives (134 people in the district of Ahrweiler, one person in the catchment area of the Trier police headquarters), and two more people are considered missing.
766 people were injured in Rhineland-Palatinate.

• Number of people affected

approx. 65,000, of which approx. 42,000 in the district of Ahrweiler

• Damaged/destroyed houses

approx. 8,800 buildings along the Ahr river were destroyed or heavily damaged or had to be demolished

• Destroyed bridges

103 bridges in the Ahr valley (heavily damaged or completely destroyed)

• Destroyed roads (in km)

- statewide, about 106 km of the classified road network (federal, state and district roads) were damaged or destroyed.

• Destroyed railroad lines

Around 85 km in the Eifel region (Rhineland-Palatinate share) and (just under) 30 km on the Ahr were impassable.

• Destroyed schools

17 in the Ahr valley

• Affected hospitals

5 statewide (plus 2 rehabilitation clinics)

• Affected retirement homes

19 nursing homes of which 15 in the district of Ahrweiler were affected by evacuation measures to varying degrees.

• Damages in Euro (estimated)

up to 20 billion. Approximately 15 billion euros were not covered by insurance.

https://www.dkkv.org/fileadmin/user_upload/Anfrage_Opfer-_und_Schadensdaten_der_Flut_2021.pdf

Disasters in Luxembourg (?)

Jun 26, 1807:

Lightning strikes in Luxembourg 1807

‹ PREV DAY | June 26 | NEXT DAY ›

Recommend 30 | Send | g+1 2 | Tweet | 0

On this day in 1807, lightning hits a gunpowder factory in the small European country of Luxembourg, killing more than 300 people. Lightning kills approximately 73 people every year in the United States alone, but victims are almost always killed one at a time. The Luxembourg disaster may have been the most deadly lightning strike in history.

The earth experiences 8 to 9 million lightning strikes every single day. In a typical year, the United States will see about 70,000 thunderstorms somewhere in its territory. This produces approximately 20 million lightning strikes annually. A bolt of lightning can reach 50,000 degrees Fahrenheit in instant heat. There are 100 million volts in an average lightning bolt, which can be as much as five miles long.

In 1807, Luxembourg was occupied by Napoleon's army. The French dictator used the country to stockpile weapons and ammunition. Many underground bunkers were built for this purpose. In the southern Luxembourg city of Kirchberg, a fortress built in 1732 was used as an armory.

When lightning struck the fortress on June 26, the ammunition housed within ignited on contact, causing a massive explosion. Two entire blocks were completely razed by the blast, which caused several other fires to rage nearby. The *London Times* later reported, This city has been plunged into the greatest consternation and distress.

Le Quotidien
INDÉPENDANT LUXEMBOURGEOIS

2018

Annonces Google
Envoyer un commentaire | Pourquoi cette annonce ?

Orages : plus de 200 interventions des secours, Kopstal sous la boue

Dans Police-Justice Mis à jour le 30/04/18 11:51 | Publié le 30/04/18 11:51

Des images impressionnantes du centre de Kopstal, envahi par des coulées de boue. (photo Facebook/Danièle Weyland Ep Nilles)

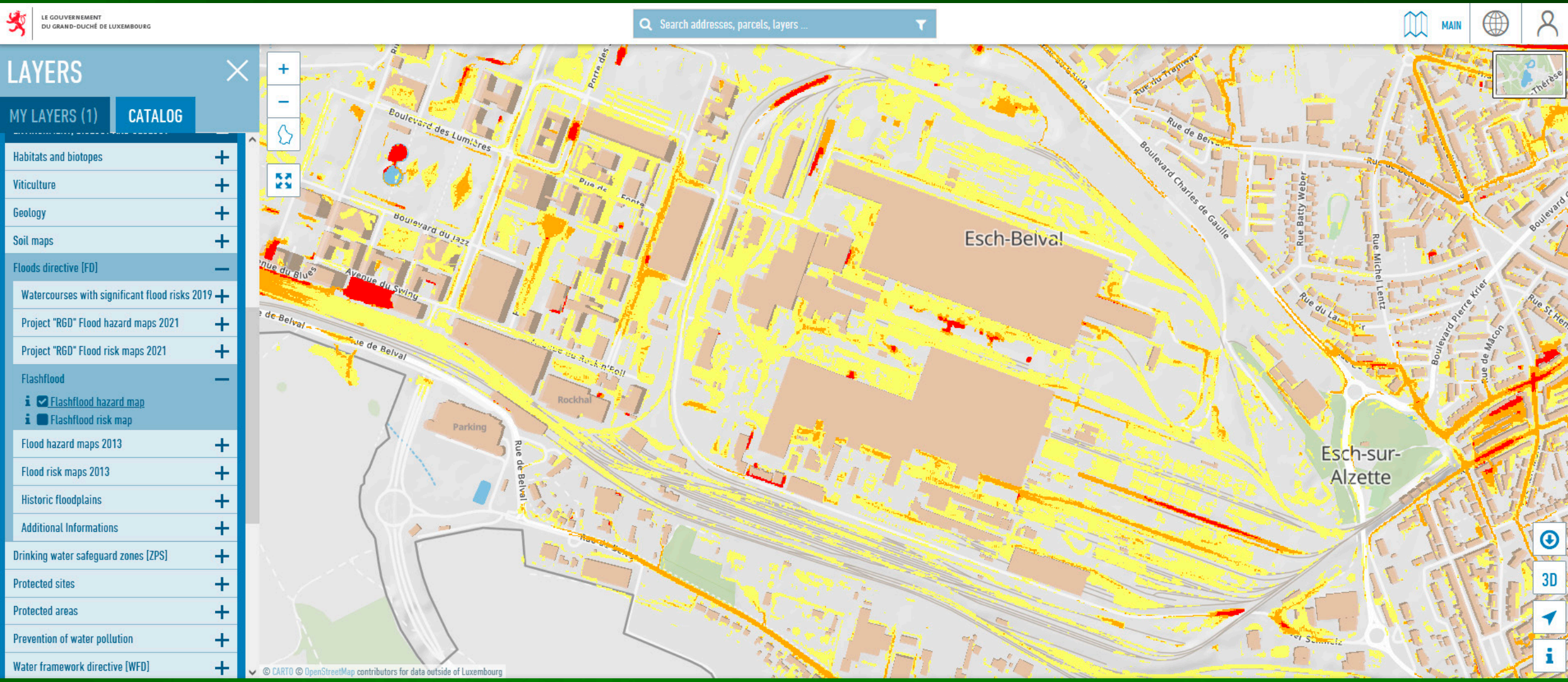
Comme ses voisins, le Luxembourg a essuyé un violent front orageux dans la nuit de dimanche à lundi. Les secours sont intervenus à plus de 200 reprises, et la commune de Kopstal a été sévèrement touchée.

ARTICLES LES PLUS RÉCENTS

1. [Karaté] Hoffmann jouera le bronze
2. [Cyclisme] Emilien Jeannière (Vendée U) s'impose à Rumelange et devient leader de la Flèche du Sud
3. Mondial-2022 : jusqu'à 200.000 passagers aériens par jour prévus par le Qatar
4. Corrosion : les yeux tournés vers Cattenom
5. Adhésion à l'Otan : Macron appelle Erdogan à « respecter le choix souverain » de la Finlande et la Suède

9,520 Abonnés
25,516 J'aime

Luxembourg City Floods July 2021 (Part 2)
Abbaye de Neumünster
https://youtu.be/XD0bdef6P8U


LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Search addresses, parcels, layers ...
MAIN
LAYERS
MY LAYERS (1)
CATALOG
Habitats and biotopes
Viticulture
Geology
Soil maps
Floods directive [FD]
Watercourses with significant flood risks 2019
Project "RGD" Flood hazard maps 2021
Project "RGD" Flood risk maps 2021
Flashflood
Flashflood hazard map
Flashflood risk map
Flood hazard maps 2013
Flood risk maps 2013
Historic floodplains
Additional Informations
Drinking water safeguard zones [ZPS]
Protected sites
Protected areas
Prevention of water pollution
Water framework directive [WFD]
Esch-Belval
Esch-sur-Alzette
Rockhal
Parking
Boulevard des Lumières
Boulevard du Jazz
Avenue du Swing
Rue de Belval
Boulevard Charles de Gaulle
Rue Michel Lentz
Rue Batty Weber
Boulevard Pierre Krier
Rue de Mâcon
3D
© CARTO © OpenStreetMap contributors for data outside of Luxembourg

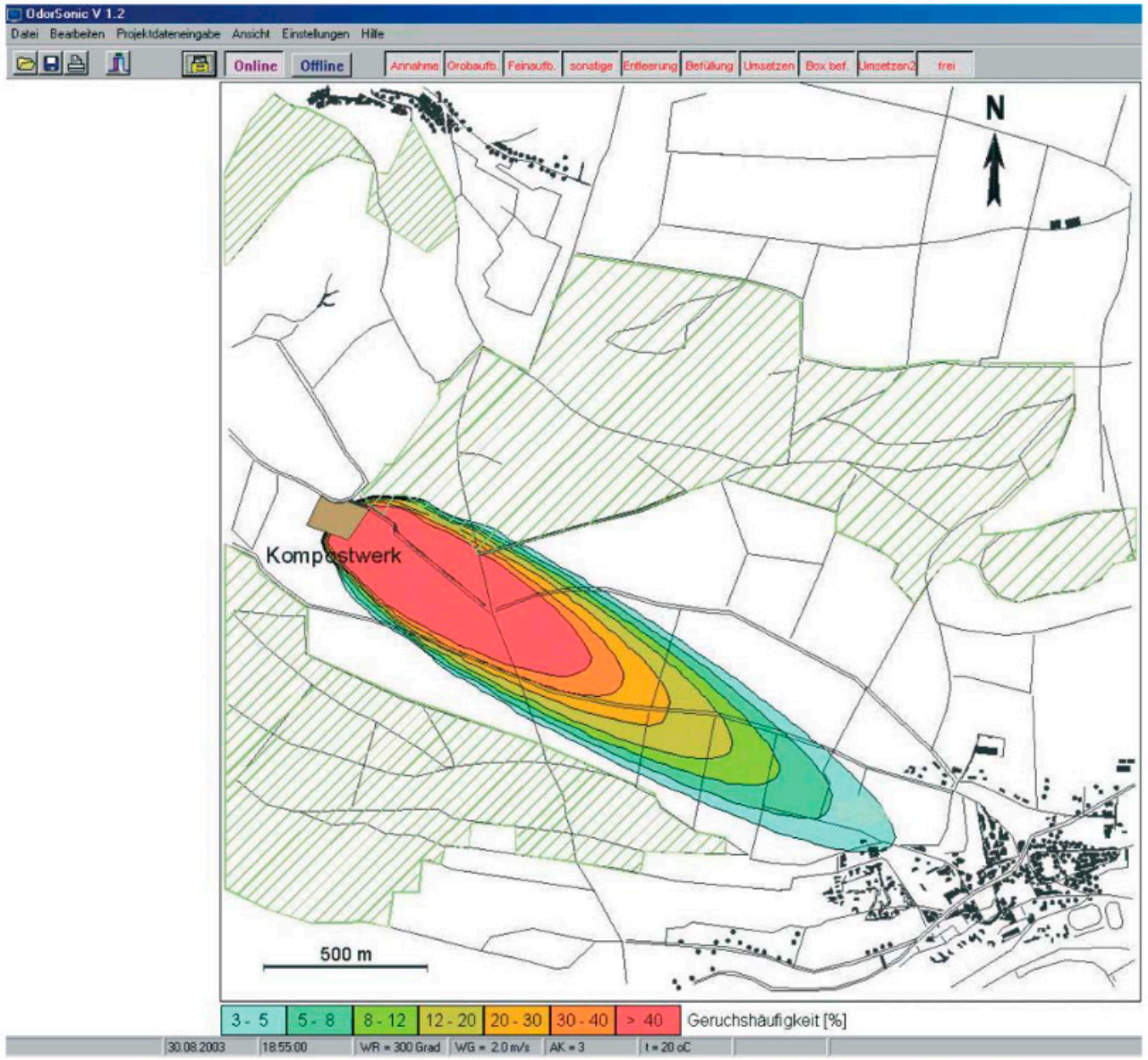
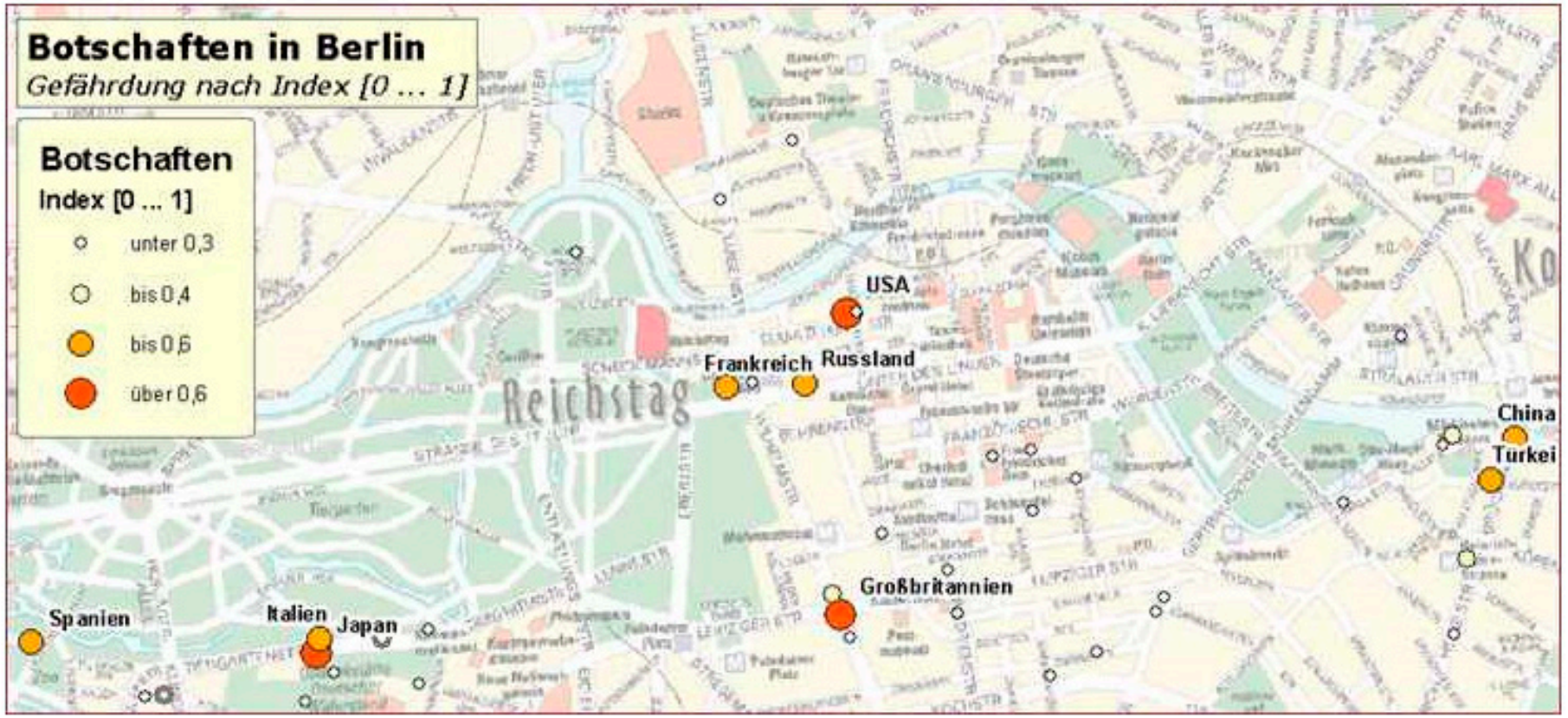


Abb. 5: Screenshot des Online-Simulationsprogramms OdorSonic. Richtung und Reichweite einer Abluftfahne werden vor dem Hintergrund des Anlagenumfeldes 10minütig aktualisiert und grafisch dargestellt

Ausbreitungsrechnungen und computergesteuerte Anlagenführung
https://ip-lung.de/wp-content/uploads/2018/06/HLUG-03.pdf

- Inventarisierung von Kritischen Infrastrukturen als potentielle Angriffsziele (geographische Lage, strukturelle Vulnerabilität und Attraktivität hinsichtlich terroristischer Angriffe)



Botschaften in Berlin als potentielle terroristische Anschlagsziele

- Risikobewertung durch Verschneidung der Informationen zu Kritischen Infrastrukturen, der Schadenwirkung bestimmter Anschlagsszenarien und der in der Umgebung betroffenen Personen/Sachwerte.

CEDIM Karlsruhe http://www.cedim.de/1019.php

Risk Information Management Domains

https://horizoneurope.apre.it/wp-content/uploads/sites/3/2021/07/CATALANO.pdf

Source: Workshop on GMES / INSCRIT
Information Service in Response to Crises, Disasters & Emergencies
Nov. 7-8.2005, Conclusions by J.-P. Malingreau (JRC)

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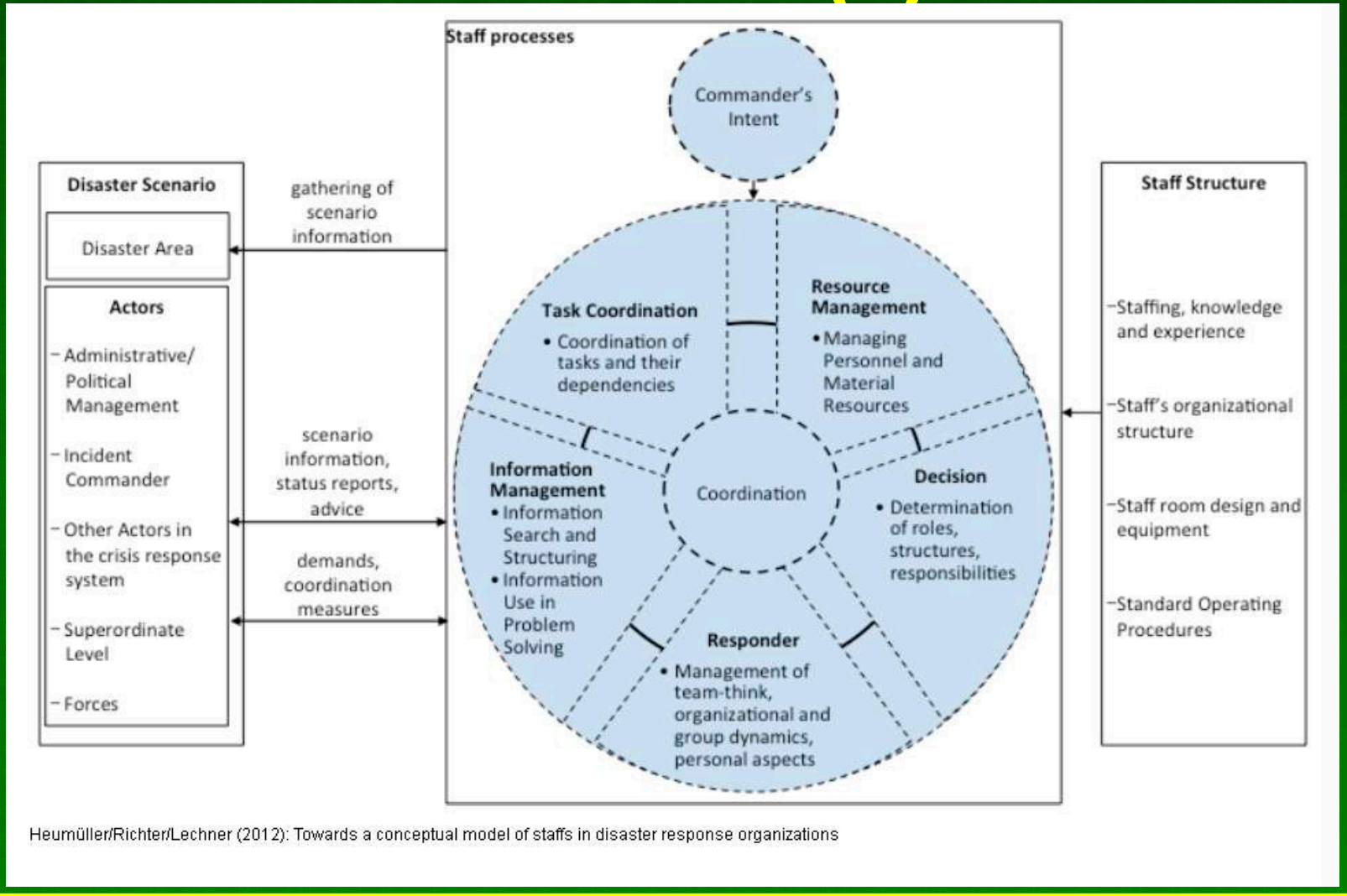
Processes (1)



Heumüller/Richter/Lechner (2012): Towards a conceptual model of staffs in disaster response organizations

Table 3
Wellington region - planning emergency levels of service[a] - PRELIMINARY FRAMEWORK.

Sector	The first week: self-sufficient for seven days	For the rest of the first month: basic functionality	For the second and third months: moderate functionality	Beyond: significant functionality
Water	Minimum of 3 L per person per day[b], but recommended 20 L per person per day, as stored at homes by individuals	15–20 L of water per person per day[c] within 1 km of the house	80% of supply of potable water to 80% of customers[d]	At least 80% of individuals receive at least 80% of 'BAU' delivery
Roading	Limited road use – only priority 1 routes[e] are open to emergency vehicles. Walking access to local medical centres and to Community Emergency Hubs is available.	Priority 1 routes are open and managed[f], priority 2 roads are open to emergency vehicles. Road access is available between dwellings and local medical centres and Community Emergency Hubs and between water stations and distribution points.	Priority 1 and 2 routes open and managed, and priority 3 and 4 routes open for emergency vehicles only.	At least 80% of individuals receive at least 80% of 'BAU' delivery
Food and LPG (for cooking)	As stored in individual homes, provided by FMCG suppliers who are still operating, or emergency food supply brought in with priority to vulnerable people	Access to a supplied supermarket or distribution point[g] within 2 km[h] following an event for urban areas	Access to a supplied supermarket or distribution point within 2 km in urban areas	At least 80% of individuals receive at least 80% of 'BAU' delivery
Fuel	Strict rationing to priority list of users (e.g. emergency services) using fuel storage in place at time of emergency	Strict rationing to priority list of users (e.g. emergency services) using fuel storage in place at time of emergency and any immediate re-supply	Priority service stations are operating	At least 80% of individuals receive at least 80% of 'BAU' delivery
Power (electricity)	Households use from local sources and response priority sites use own pre-arranged power supply for essential functions.	Households use from local sources and response priority sites use own pre-arranged power supply for essential functions[i]. Ability to charge telecommunications devices (such as phones and tablets) at a location within a local area such as at a local Community Emergency Hub.	Power to response priority sites and key infrastructure sites[j]. Ability to charge phones and tablets at a location within a local area such as a local Community Emergency Hub.	At least 80% of individuals receive at least 80% of 'BAU' delivery
Telecomm-unications	Ability to send and receive texts (albeit with potential delays). Satphone usage where phones are charged.	Access mobile data for minimal functionality at defined locations such as at Community Emergency Hubs.	Access mobile data for almost normal data capability. Priority users have full service.	At least 80% of individuals receive at least 80% of 'BAU' delivery
Broadcast	FM radio – Priority Stations[k]: fully operational[l]	Fully functional for priority radio stations, no TV	Fully functional for priority radio stations, no TV	At least 80% of individuals receive at least 80% of 'BAU' delivery
Sanitation	Self-sufficiency by the community for sanitation needs (long-drops, two buckets or similar (no council service)).	Service, according to the 'two buckets' plan.[m]	Service, according to the 'two buckets' plan.	At least 80% of individuals receive at least 80% of 'BAU' delivery
Shelter	Shelter within own property or with immediate support network or at mass temporary accommodation sites.[n]			

Standard Operating Procedures

The database documents the physical resources of each participating organization. For instance:

The Feeding Support Group enters information related to its resources and capabilities such as:

- Availability of a food pantry.
- Ability to provide meals (hot or cold).
- Availability of a mobile delivery service.
- Number of meals that can be served in one day during a disaster.

The Shelter Support Group enters information related to its resources and capabilities such as:

- Number of people the space that can be accommodated.
- Availability of volunteers to assist in staffing each shelter.

The Points of Distribution (POD) and Disaster Assistance Center Support (DAC) Groups enter information related to their resources and capabilities such as:

- Availability of site.
- Number of volunteers available to staff each site.

The Warehousing Support Group enters information related to its resources and capabilities such as:

- Dimensions of the space available.

The Volunteer Support Group enters information related to its resources and capabilities such as:

- Number of community volunteers available.
- Whether these volunteers can assist in mitigation activities (shuttering, debris removal).

The Services for the Elderly and Crisis Counseling/Spiritual Care Support Groups enter information related to their resources and capabilities such as:

- Number of volunteers available.
- Area in which these volunteers will serve.

The Mass Communication Support Group enters information related to its resources and capabilities such as:

- Availability of communication networks.
- Type of media used.

By documenting resources and facilitating communications, the M-D C.O.R.E. database assists in the overall collaboration of the disaster relief effort. This will include identifying resource gaps, reducing response time, and increasing the speed of recovery within the community.

Miami-Dade Communities Organized to Respond in Emergencies (M-D C.O.R.E.), Manual – Volume II, Standard Operating Procedures (SOP) 2015 32 p https://www8.miamidade.gov/core/library/manuals/manual-volume-2.pdf

Elementary Sample of Service Level Agreement

Perform below steps before assigning the human task to the potential owner

1. Execute the SLA rule and get the SLA Levels, SLA Duration and Potential owner
2. Calculate the SLA Breach date by adding the current date + SLA Duration
3. Update in the table PROC_SLA
4. Run SLA notification Job scheduler every day
5. Get the records from table PROC_SLA where SLA Breach date is today's date.
6. Get the required request details from request master table if required
7. Trigger the email from a Java mail service with required details.
8. To improve the database performance we can delete the record from table on completion of the process.
9. We can code the scheduler such a way that, it should send a consolidated email to Manager and CEO every day with list of requests which are breached SLA.

Processes (2)

Table 1 Comparison between Business Process Management and Disaster Process Management

Criteria	Business Process Management	Disaster Process Management
Process Management Lifecycle	Planning, Implementation and Monitoring of processes are sequential steps, each taking a lot of time	Planning, Implementation and Monitoring of processes in parallel, no start and end of these steps, highly iterative steps
Modeling	Control-flow oriented: complex routing of information between activities. Processes can be managed in isolation to each other	Temporal dependencies between activities. Processes cannot be managed in isolation to each other
Execution	Frequently, few exceptions, change is seldom	Executed seldom/once, many exceptions, change is the rule
Monitoring	Key performance indicators and business goal violation	Activity status and violation of temporal dependencies
Cross-organizational Aspects	Global definition of inter-organizational processes, few interfaces/interactions between organizations (organization to organization)	No global definition of inter-organizational processes, many interfaces/interactions between organizations (people to people), ad hoc definition of new interfaces/interactions based on personal contacts

Jörn Franke and François Charoy
Proceedings of COOP 2010, Computer Supported Cooperative Work, p. 57-75

Elements/Steps of Service Level Agreement

Template Definition
Offering
Negotiation
Mapping and Translation of Monitoring Metrics
Service Provision
Monitoring
Violation Detection
Violation Prevention
Violation Corrective
Violation Escalation
Termination
Accounting & Billing
Resolution
Archiving
Review

https://www.researchgate.net/publication/308614557_SLA_Object_and_SLA_Process_Modelling_using_WSLA_and_BPM_Notations_Towards_defining_a_Generic_SLA_Orchestrator_Framework

Disaster Impact Analysis

- Appropriate mechanisms for effective information, communication, consultation and cooperation of all stakeholders (information flow, decision support and resources availability)
- Impact assessment must always take account of the **costs of not taking action** and of longer-terms costs and benefits in monetary and qualitative terms
- **Alternatives**
- Disaster Impact Cascades and Consequences
- Need of better ex-post evaluation of adopted and implemented measures

HACCP Hazard Analysis and Critical Control Points Management Principles

- Conduct a hazard analysis
- Identify critical control points
- Establish critical limits for each critical control point
- Establish critical control point monitoring requirements
- Establish corrective actions
- Establish procedures for ensuring the HACCP system is working as intended
- Establish record keeping procedures

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5. What can you do ?

Multiple Representations, Hierarchies, Generalisation, Abstractions

- Location, Geometry
- Emergence of Order
- Cognition, Patterns
- Change and its dynamics including macroscopic effects
- Time, time structure and its relevance to Action Structures
- Behavior Representation,
- Complex Social Systems
- Singularities (of action space)
- Black and white views as a generalization principle, Contrast
- Symbolization, Categorization, Abstraction, Model Building
- Ontology, Multiple Representations, Representation Change / Transition
- Information Mining
- Dimensionality reduction, Clustering
- Trend analysis and application, Periodicity, use of transforms (Fourier transform / frequency space / attribute spaces, action spaces)
- Uncertainty propagation in Generalization
- Continuous vs. Step-by-Step Generalization
- Algebraic Properties of Generalization Transforms (recursiveness, inverse properties, invariants etc.)
- Generalization of dynamic 3+ -dimensional phenomena e.g. of Movement Patterns
- Context Generalization

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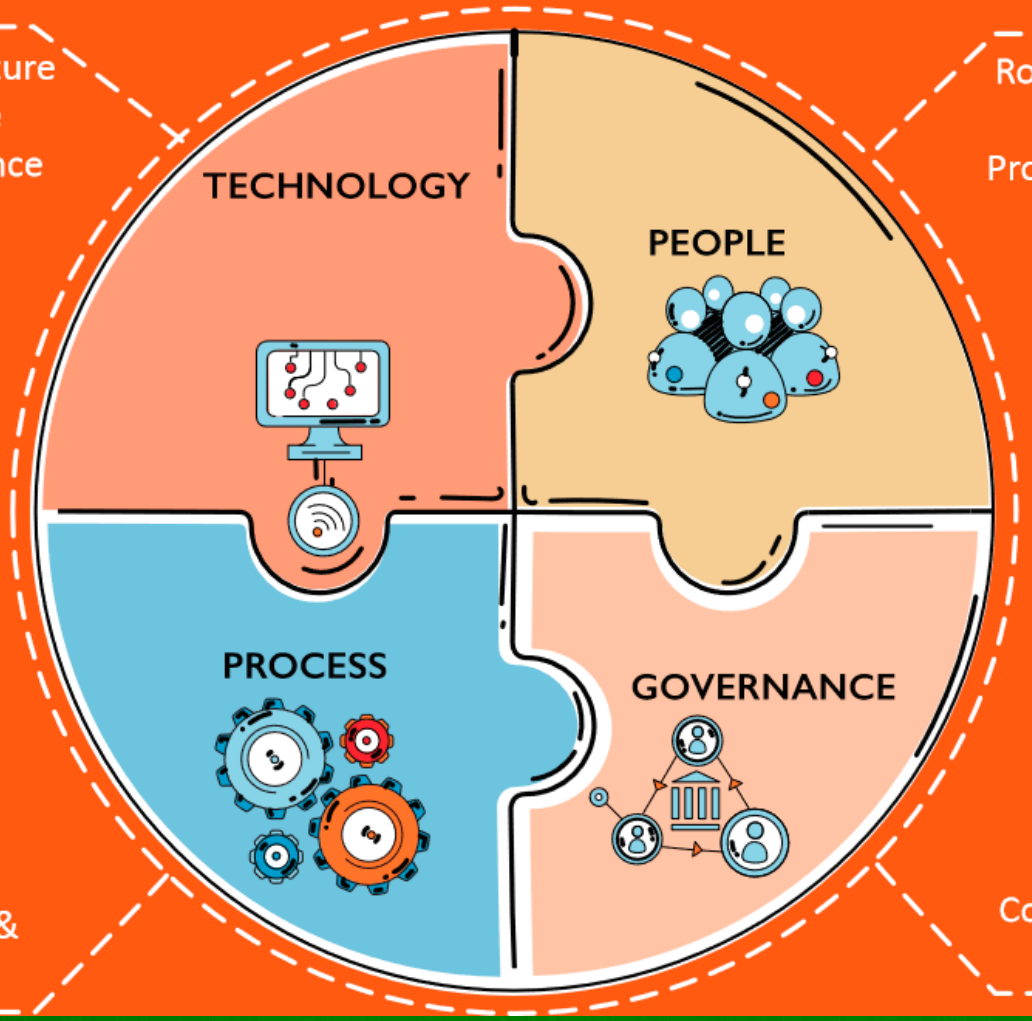
All four IG components are vital to establish good practice.

Information Architecture
Hardware & Software
Security & Maintenance



Roles and Responsibilities
Capacity and Capability
Professional Development

Business needs and Quality
Discovery & Access
Procedures, Training & Support

Leadership Support
Strategy, Policies and Alignment
Compliance, Monitoring and Evaluation

2

Information Governance (IG) is a critical enabler

- IG is the organisational structures and frameworks to institutionalise and operationalise information as an asset.
- IG is a part of organisational governance, and a scalable opportunity to address complex information challenges.
- IG promotes appropriate resources and accountability to establish good practice for disaster information.

Information Governance for Disaster Risk Reduction, 2021
https://www.gidrm.net/user/pages/get-started/resources/files/GIDRM_InformationGovernance_4DRR.pdf

Basic Management Principles

- critical thinking
- gaps and deficits analysis
- decision, action, and control cycle support
- transparent analysis
- control and extensive reporting obligations
- compliance to regulations and other boundary conditions
- consider phases and techniques in enabling of retrace
- include detailed financial structures, budgets and the use of financial instruments in reporting and control
- constructive goal-reaching and effectivity control
- guidance on human resources (quantity, future competence levels)
- operations concept
- reexamination, analysis
- avoidance of malpractice
- extend concepts of FAIR information principles [FAIR] to support transparency goals and accountability
- indications on weaknesses/vulnerabilities

Fig. 4: Basic Management Principles

Kremers (2021)
http://www.susgis.net/LNIS_9_Geoinformation_for_Sustainable_Development__Berlin_2020.pdf#page=93

Elements of Safety & Security Information Governance (1)

Missing information	Without IG	With IG
People	Nobody has the role, responsibility, and accountability to manage information including metadata or resource description and filing or recordkeeping.	The management of information is documented in job descriptions.
		Staff have the knowledge and skills to manage information and records.
	Nobody has defined and designed the metadata, filing or recordkeeping specifics which ensure that the information is appropriately captured and recorded.	Somebody has defined and designed metadata and workflows which ensure that information is captured with quality metadata, filed and recorded appropriately.
	Coordination with archives, recordkeeping or the library is not in place to apply and monitor existing rules.	Coordination and links or boundaries with archives, recordkeeping and library are in place and enables efficiencies.
Governance	The importance or business value of this information for DRR goals is not specified.	The information is aligned with DRR goals which clarifies the value and importance of the information. This includes emphasis on retrieval and access of the information.
	Business information categories with templates, classification and other criteria are missing or not applied.	Templates are in place and used including opportunities to enable metadata automation
	Metadata and filing or recordkeeping rules and mechanisms or criteria are missing or not applied.	Metadata comprises relevant descriptive, administrative, technical, operational details to discover, access, and reuse the information, including public or protected information, licenses or copyright, retention and review periods, source or producer and contact for questions.
	Compliance is not monitored nor managed.	Compliance is monitored and missing updates or lack of compliance are managed.
	Leadership does not know about information challenges or they are not considered important.	

14 GIDRM | © GIZ | October 2020

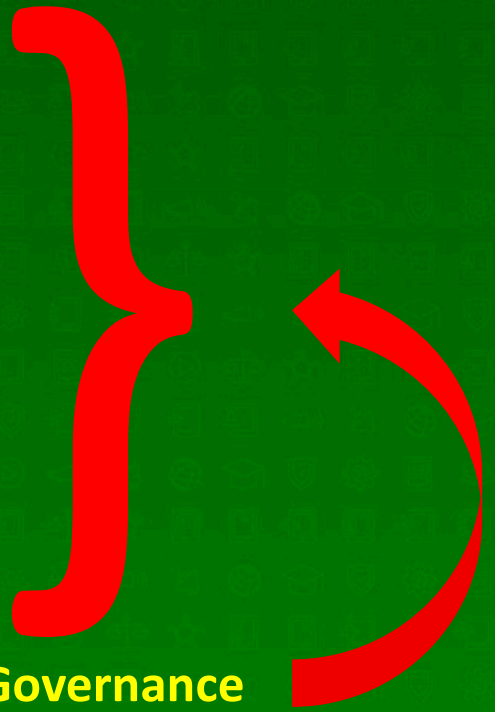
Information Governance for Disaster Risk Reduction, 2021
https://www.gidrm.net/user/pages/get-started/resources/files/GIDRM_InformationGovernance_4DRR.pdf

Elements of Safety & Security Information Governance (2)

- economic and business management issues,
- financing,
- economic instruments,
- sustainability in finance,
- recording and valuation of services,
- accounting
- dialogue with private sector / companies / business associations

Elements of Safety & Security Information Governance (3)

- methods,
- techniques,
- operations,
- control,
- accountability,
- ethics,
- risk management,
- compliance,
- administration,
- “all-of-society” participative Governance



Challenges in Process Models and Techniques (1)

„An increased availability of business process execution data, combined with advances in Artificial Intelligence (AI), has laid the ground for the emergence of information systems where the execution flows are not pre-determined, adaptations do not require explicit changes to software applications, and improvement opportunities are autonomously discovered, validated, and enabled on-the-fly”

“... event knowledge graphs which encode behavioral and causal inter-dependencies of objects and actors over time in the context of process flows and process knowledge allow to symbolically represent situations of all kinds for situation-aware reasoning.

Such techniques may be used to facilitate the (automatic or by humans) tracking of execution consistency, for better understanding of process flows and process outcomes, and to drive ongoing process improvements (at either design- or retraction at run-time)”

Marlon Dumas, Fabiana Fournier, Lior Limonad, Andrea Marrella, Marco Montali, Jana-Rebecca Rehse, Rafael Accorsi, Diego Calvanese, Giuseppe De Giacomo, Dirk Fahland, Avigdor Gal, Marcello La Rosa, Hagen Völzer, and Ingo Weber. 2022.
Augmented Business Process Management Systems: A Research Manifesto. 1, 1 (February 2022), 19 pages

Challenges in Process Models and Techniques (2)

In addition to current basic efforts to achieve cross-instrument information coherence, future technical implementations will need to address decisions about the choice and possible change of innovation stages, as well as appropriate management methods and techniques in the areas of

- Cloud Computing, IoT, AI
- Situations Models, Facts, Actors, Documentation, Procedural Use
- Processes, Processes Groups, Chains, Networks,
- Standards
- Clearinghouses, Observatories, Testbeds
- Quality-of-Service Measures, Quality Management of Information (syntactic, semantic, pragmatic)
- Multiple Representations, Hierarchies, Generalisation, Abstractions
- Synergy Effects (cross-domains / cross-organisational / cross-border)

Complex cross-domain information models supporting just-in-time critical operations typically include a large number of variables and complex dependencies on functional, analytical, and operational constraints (affected people, resources, actors, time, space, facts, decisions, actions).

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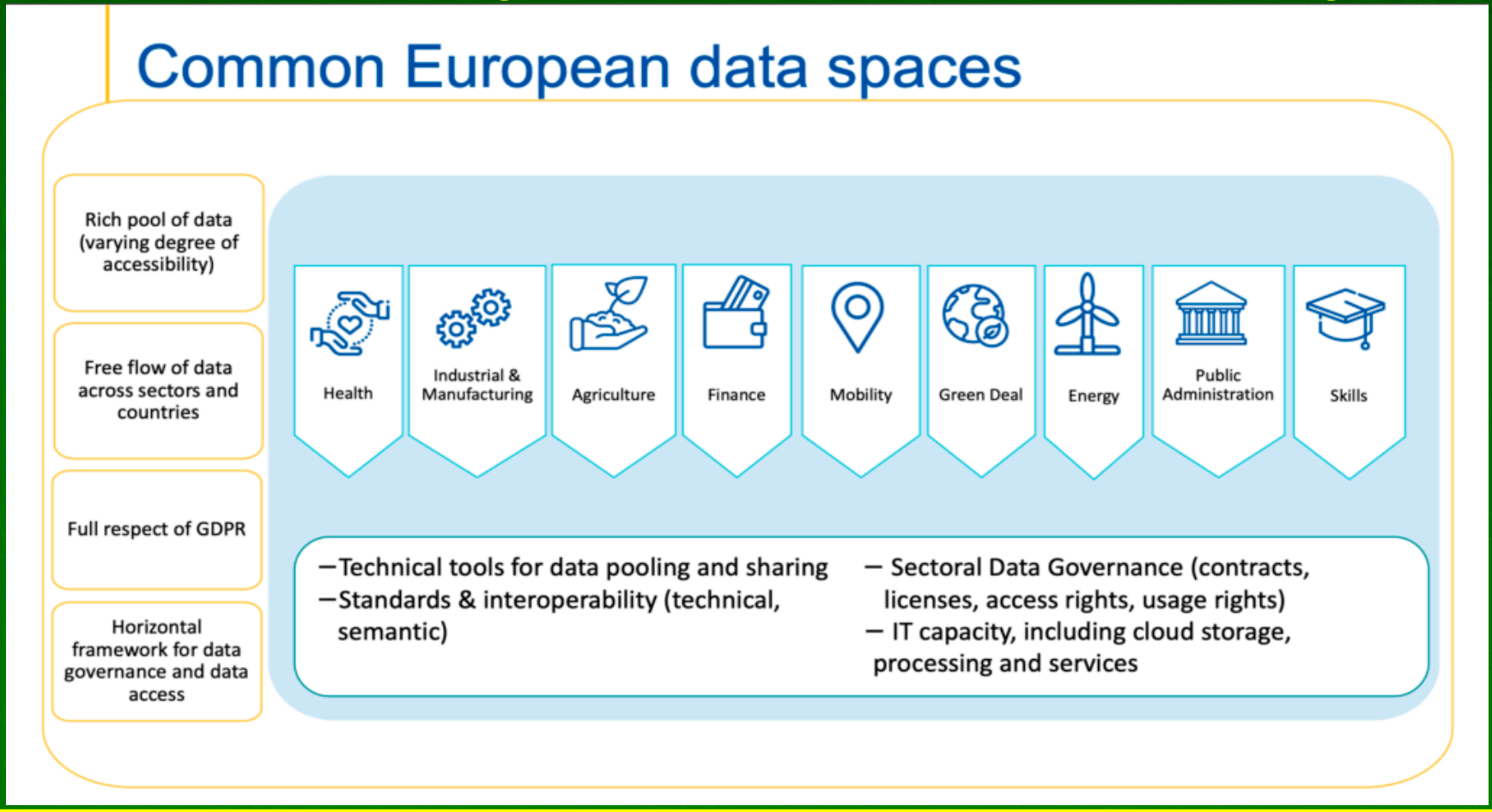
Join the elaboration of Strategy and Roadmap for creation of a Common European RISK Information Space



http://dataspaces.info/common-european-data-spaces/#page-content

RIMMA Community

http://rimma.org/

join us today !

Community and Interdisciplinary International Conference Series on RISK Information Management, Risk Models and Applications

The RIMMA Community on Risk Information Management, Risk Models, and Applications will enable sharing of best practices as well as giving space for discussing methodological problems in risk (NaTech) and security (CBRNE) modeling from the information systems point of view for all phases of the disaster management cycle.

Join the EMISA members' meeting today

for discussion on the potential role of EMISA in

national/european **Disaster / RISK Information Management**

Strategies, Roadmaps, Research, Development, and Implementation

Thank You for Your Attention !

For further information, communication and cooperation please contact:

Download this presentation and selected References from
https://Horst-Kremers.de/20220602.pdf

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Business Processes in Disaster Risk Information Management

Horst Kremers [1]

Abstract: The processing and use of data holds enormous potential for new ways of enabling foresight, situation management and ex-post evaluation. For a successful decision and action support, we have to make the best possible use of this potential. Big Data volume, variety, velocity and veracity methods and techniques along with adequate application of management principles contribute essentially to avoid subjectivity, deception and implausibility. These data type oriented typologies need to be complemented by information use procedures quality measures like incompleteness, uncertainty, precision, ambiguity, reliability, usability, compliance.

While currently the focus is mainly in generating "availability" and "access" of information, the next years will much more intensely show a shift of focus into domains of information use (decision making support, analysis and all other management categories of action and control).

On the operational level, syntactic, semantic and pragmatic coherence (full semiotics coherence i.e. on syntax, semantics and pragmatics level) needs to be achieved on local, regional, national and international levels. Special attention is given to ontologies that cover pragmatics (multi-stakeholder operational decision and action management concepts for workflows and processes in dynamic situations) including modeling goal reaching control.

Decision&Command Support Systems based on cross-level and cross-organizational integration are widely missing. Joint projects across borders, domains, organizational boundaries, including Private Sector, can not only improve shared information processing but also raise awareness in the benefit of building on sound management principles, including prerequisite competences education and development especially for the huge variety of administrational / organizational units involved.

Advanced Process Modeling Models, Notations and Languages are urgently needed to formalize and guarantee fast and reliable procedures for Risk Information generation, documentation, analysis, flow and use in all the different phases of disaster management. special attention is paid to the following details: Service Level Agreements, decision and action contexts, dependencies, scenarios and alternatives, boundary conditions, exceptions, thresholds, deviations from compatibility requirements (including highly dynamic time-varying facts, data flow boundary conditions, and actors).

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Disaster indicate on the massive disaster losses and humanitarian consequences of the lack of timely preparation (anticipatory action) and inadequate incoherent information processing. Post-disaster detailed analysis of goal-reaching, performance and effectiveness control is in the key interest of all those that suffered (including post-event long-term health, social and economic consequences).

The EMISA Community of Experts can effectively contribute to reduce essentially the immense suffering of the deplorable victims.

Future research and development in those areas will provide significant contributions to all the complete cycle of Disaster Management only, if the inherent complexity of inter-disciplinary/cross-organizational data, data analytics, data transmission and use processes, and sophisticated ontology models for situation prediction along with consequences scenarios for all types of stakeholders is based on formal methods standards and Information Infrastructure principles.

Keywords: Standard Operating Procedures, Service Level Agreements, Rapid Needs Assessment, Anticipatory Action, Preparedness, Resources Management, Operational Anticipation and Preparedness, Relevance and Consequences of Decisions and Actions, Process Management Models and Implementations in Humanitarian Domains

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