The DRMKC - the Disaster Knowledge Management Competence Centre - is the European Commission initiative, which implements a scientific based network on better knowledge transfer as usable information, to manage the competences for EU and their member states regarding Disaster Risk Management (DRM) policies.

The DRMKC contributes to the European Union Civil Protection Mechanism (EUCPM), a program to foster cooperation among national civil protection authorities across Europe and the UN Sendai Framework program, where EU Member states have to indicate the given global targets as well as action plans on prevention. In addition, DRMKC has set up an active infrastructure for sharing disaster loss data based on a harmonized data transformation approach to make the information comparable for all spatial scales in Europe, the Risk Data Hub (RDH).

Developed and launched in summer 2018 by JRC - DRMK, the Risk Data Hub is a data sharing infrastructure, which wants to combine essential needs on different scale level of stakeholders and users. The RDH wants to establish a catalogue of relevant data sets with a spatial range from regional and country level to cross border data, such as based on Copernicus Services. With such a centralized access point, the software system combines tools and methods on top of the data inventory for calculating indicators according to the mentioned initiatives. The most notable feature of the data sharing solution is the concept of the Country Corner, where a data provider, as representative of a Member State, has the empowerment and the control over the sovereignty of integrated data can steering the decision what will happen with the data and on which purpose data will be analyzed.

This Deliverable is reporting first results on testing the RDH Country Corner concept from the perspective of Austria in combination of initiatives to set up a national Loss & Damage Data Base.
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References

This study refers less to references than to practical implementation and presentation of the experiences made. Nevertheless, publicly available information about tools and data resources is assigned with footnotes, directly within the text.

Acknowledgement

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For the fruitful contribution and discussion, I'd like to thank Matthias Themessl as well as colleagues from ZAMG, Stefan Reisenhofer, Christoph Matulla for the VIOLA data access and Stefan Kreuzer for providing economic loss data from the Government of Lower Austria.
1. Purpose, Objectives and Scope

The DRMKC Support System is the resource, implemented by the European Commission intended to provide National Authorities with technical advices in the field of disaster risk management. It aims is to liaise expertise and good practice within the EU for the specific needs of a National Authority on a country level.

The European Commission Disaster Risk Management Knowledge Centre (DRMKC) has developed a web-based GIS and data analytics toolbox - Risk Data Hub (RDH) - for the purpose of sharing documentation, risk related data and information as well as to support risk management activities in Europe. As a knowledge broker, the Risk Data Hub is expected to be the point of reference for curated EU-wide risk data, either through hosting relevant datasets or through linking to national platforms.

With this feasibility demonstration of a the RDH Country Corner for Austria, a stronger linkage between EU Software solution and member state´s requirements will be pursued within the sophisticated application architecture. The RDH Country Corner offers functionalities in order to enable member states to use a common and technical framework for combining data and information on different spatial scales. The applicability of the RDH Software architecture for Austrian data sources and its integration chain is the major objective for this support request. In addition, this demonstration will evaluate the RHD user management, the GUI (graphical user interfaces) of the web client, the provided analysis approaches and functionalities as well as the compliance to data management principles.

Due to Member States’ reporting demands, such as for EC-UCPM\(^1\) or SendaI Framework\(^2\) a push towards the assessment of various risk-related indicators and targets, like numbers of mortality, affected people and disaster related economic loss, should be feasible in terms of national risk assessment. The DRMKC Support System provides further recommendations on needs and development issues to the RDH. In this manner, this support action aims at bringing together European strategies, policies, member states’ needs, implementation perspectives and ideally creates a data and information hub for multiple purposes. Besides the integration of Austrian disaster data into the RDH, the proposed activities will intensively deal with issues on harmonization, on heterogeneous

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\(^1\) https://ec.europa.eu/echo/what/civil-protection/mechanism_en

\(^2\) https://www.unisdr.org/files/43291_sendaiframeworkfordrren.pdf
data sources and differently structured content at national and regional scale level. As Use Case for this purpose, flooding events in Lower Austria in the time range between 2005 and 2015 will be analyzed, at least two different data sources will be harmonized and implemented within the RDH Country Corner system.

These analyses are re-using partially results and experiences made from a former national feasibility study “DAMAGE.at” to foster an Austrian hazard & damage data base system. In addition it will consider European directives like the INSPIRE data models and existing INSPIRE Vocabulary on Natural Risk Zones. Austria runs an own INSPIRE Registry service (https://registry.inspire.gv.at) where persistent EU Vocabulary can be extended by covering national needs. Such an extension for code lists was proposed for the categorization of “Specific Hazard Type”. The Specific Hazard Type code list contains aggregated and assessed vocabulary concepts on existing categories in the Austrian VIOLA data model, a data base for events like extreme weather or gravitational mass movements events (e.g. continuous rain, landslides, etc.). A second classification used from the EM-DAT was used and adjusted, see Fig 1.

Figure 1: Different resources with applied concepts (here VIOLA & EM-DAT Categories) for event categories used to create a common vocabulary and published in the Austrian Registry vocabulary server

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4 https://registry.inspire.gv.at/codelist/SpecificHazardTypeValue

5 https://www.emdat.be/classification
2. Used Data and content

In adjustment with the ASDR (Austrian Strategy on Disaster Risk Reduction), the geographical area of the federal state of Lower Austria was selected. Lower Austria is the largest federal state in Austria, relatively heterogeneous structured in the sense of society, economy, and geomorphology. It encompasses the federal capital Vienna, which has different political responsibilities. Both federal states are exposed areas by the River Danube.

![Figure 2: Lower Austria as Area of Interest](image)

The chosen time frame ranges between 2005 and 2015, based on the reference period requested by SENDAI for the calculation of the respective indicators for global targets.

Flooding events and associated damages within this period were chosen to deal with exact numbers of economic loss values. This data are collected within the legal framework named Disaster Compensation (Katastrophenbeihilfe) and provided by law of the government of Lower Austria, the Department for Assessment of Private Losses on municipality level. This data is in the report named ‘Economic loss data base of Lower Austria’.

A comprehensive data base on flood events or damages for the geographical extend of whole Austria does not exist. There are detailed flood data bases hosted by Hydrological
Services and the Natural River Protection Agency, a Sub-department at the Ministry for Sustainability and Tourism (BMNT). The knowledge about the purpose like extent of time and the cohesive quality of the content was not accessible at the beginning of the study. Based on this aspect and knowing that the Extreme Event Data Base – VIOLA, a Service by the Austrian Meteorological Service (ZAMG), is retrievable, this data base was used. Both data sources will be explained in more detail as follows.

**Economic Loss Data Base - Lower Austria**

The description focusses only on the supplied Economic Loss Data Base for Lower Austria extraction and does not explain the entire content of the federal Disaster Compensation Data Base. The submission process chain as well as the quality assessment are excluded and not part of this consideration.

For the Disaster Compensation Data Base any private individuals affected by natural damage can submit a loss report to their local authority. This web based submission process is based on predefined loss and damage categories supplemented by the location, description and monetary loss estimation. On the municipality level all information are collected and submitted to the Government where the decision process starts - more detail (only available in German) under:


The provided information on losses comprises comprehensive, aggregated information, which contains almost 5000 entries in the time range between 2005 and June 2018. Different event types, like floods, storms, mass movements, snow pressure, etc. are included. In this data base floods are overrepresented with around 4000 entries. The event category Flood does not have any sub categories such as flash floods as well as any information about the trigger mechanisms by weather or the consideration of the hydrological network. There is also no explicit distinction between river based floods or a small scale flood caused by precipitation. The textual description about an event is very formal and conceals implicit information about the source.

Available event items in the data base give information about the Political Unit (Nuts 3 Level), Name of municipality, a kind of successive ID, damaged objects, causes of damage, Starting and End Dates, estimated costs on losses, submitted cost demands, sum of verified
costs and the disbursed sum. A short textual description and the payment date complete the item information. Table 1 is representing the structure of content as example.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUTS 3 Level, Natural Name</td>
<td>HOLLABRUNN</td>
</tr>
<tr>
<td>Location</td>
<td>HARDEGG</td>
</tr>
<tr>
<td>Damaged object</td>
<td>Sewerage and water supply</td>
</tr>
<tr>
<td>Cause of damage</td>
<td>Flood</td>
</tr>
<tr>
<td>Start date</td>
<td>3/29/06</td>
</tr>
<tr>
<td>End date</td>
<td>4/3/06</td>
</tr>
<tr>
<td>Estimated cost</td>
<td>€ 19,000,00</td>
</tr>
<tr>
<td>Submitted costs</td>
<td>€ 19,000,00</td>
</tr>
<tr>
<td>Sum of verified costs</td>
<td>€ 13,388,00</td>
</tr>
<tr>
<td>Payment</td>
<td>€ 6,694,00</td>
</tr>
<tr>
<td>Data of payment</td>
<td>12/2/08</td>
</tr>
<tr>
<td>Description</td>
<td>Flooding of the sewage treatment facility and contamination of well and water network</td>
</tr>
</tbody>
</table>

Table 1: Example of Economic Loss Information of Lower Austria

VIOLA - the extreme event data base for Austria

Since 1948, damage causing extreme weather events have been recorded on the basis of media reports and were published via annual weather chronicles in the ZAMG Yearbooks. VIOLA (VViolent Observed Local Assessment) was set up in 2014 as web service and contains a digitized version of this archive and now provides information on extreme events in Austria on a monthly basis. It contains short-term events such as heavy rainfall, hail, lightning strikes and storm, as well as more persistent events such as continuous rainfall, drought and heat or cold periods, which cause socio-economic damage, see Fig. 3. In addition, events are presented which are attributed with indirect effects of extreme weather events, e.g. floods due to continuous rainfall, debris flows due to heavy rainfall or avalanches due to intensive snowfalls. The data model in VIOLA is a mature combination of...
concepts and their relations. Nevertheless, considering the existing EU data models and the vocabulary, a translation or transformation has to be improved.

Figure 3: VIOLA Web Visualization on Events in June 2013

For this study VIOLA was used to correlate entries and cognitions with the Economic loss data base in Lower Austria.

3 Data Harmonisation approach

Data harmonization in general is a transformation process which brings together different conventions in one data model like feature types, attributes etc. with the same semantic in one agreed and common data scheme.

The RDH is providing pre-defined target schemes for data integration according common rules. The event definition schema requires entities for hazard types, spatial information on NUTS 3 level, begin- and end data, event type as well as the event sources and their causes. These required target fields need an expert decision applying origin data sets on how to align the source information into the target ones. To understand the original data source following decision steps were necessary indicated as follows:

i) Understanding explicit information is a simple cognitive alignment from one concept into another, such as a described Flood in the origin source can be assigned to the pre-defined category ‘Flood Events’.
ii) Discover the **implicit information and structure**, for example „Damage caused by snowmelt destroyed basement of public bridge“ means that the event trigger was a change of temperature and with primary cause by precipitation and not by a peak of river flood.

iii) Apply a **common semantic and a terminology**, defined as controlled vocabulary on data sources. Working with the same meaning (semantic layer) means to achieve a common understanding of the terminology. The definition on a single term like flood has a strong dependence on the scientific domain or practitioners view. For example, INSPIRE⁶ defines FLOOD as “Processes of inundation of usually dry (emerged) land, or temporary covering by water of land not normally covered by water.”; Oxford Dictionaries⁷ defines Flood as an “overflow of a large amount of water beyond its normal limits, especially over what is normally dry land.” The given Definitions here are generic, on the scientific level, such differences are important. A more significant example with different definitions is the term “Heavy Rain”. The WMO give the definition⁸ -“Rain with a rate of accumulation exceeding a specific value, e.g. 7.6 mm per hour”. The Central Weather Bureau (Taiwan)⁹ defines “24-hour accumulated rainfall exceeds 80 millimeters, or 1-hour rainfall exceeds 40 millimeters”. Severe Weather Criteria Chart ¹⁰ defines “over an area of 1000 square kilometers or more than 50 mm or more in a 6-hour period or 100 mm or more in a 24-hour period”

To overcome such heterogeneous definition of similar terms aiming to get a persistent reference and a long last usage a vocabulary services for public available controlled vocabulary (Registry) is very important. The INSPIRE Registry or GEMET Thesaurus are those.

iv) **Extract harmonised information**, this step is a simple filter and search function stored in formalized queries, like “Search all flood events with the term “river” caused on a specific area of interest”.

v) **Analyze and merge information**, e.g. join together events entities. All economic loss entries have to be correlated and combined with existing events from VIOLA. If an event was identified in VIOLA with the same or a similar cause in a similar time range they have to

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⁶ http://inspire.ec.europa.eu/codelist/NaturalHazardCategoryValue/flood
⁷ https://en.oxforddictionaries.com/definition/flood
¹⁰ https://www.cwb.gov.tw/V7e/observe/rainfall/define.htm
http://wmo.multitransms.com/MultiTransWeb/Web.mvc
¹¹ https://www.metservice.com/warnings/weather-warning-criteria/#chart
be merged and summarized into one event from VIOLA. If no correlation for an event is existing in VIOLA, a new event has to be created.

vi) **Load information** in a common structured data base by getting a common ID. All events merged with total calculated economic loss getting a structured unique Identifier.

With such a combined and clean data base, redundant information has been removed and reliable and robust data basement for the integration into RDH were created. The final and harmonised data base contains all information needed for the RDH target schemes, especially for defining events, and the desired event analyses.

### 4 RDH Country Corner Data Integration

The RDH provides simple and usable import functionalities. The target schemes are well and as simple as possible defined. The Import format is an Excel file. The order and sequence plays an important rule for the integration. The user has to start with the Event Definition Schema file. Event ID, Hazard Types, Spatial Extent, the date information as well as the Event Types and Causes are needed elements, see Figure 4.

![Figure 4: The Example of the Event definition Schema, example JRC](image)

The upload is done via a simple applicable Django web interface. A successful upload generates a notification via email. Each uploaded data scheme is editable and available via the Django interface, which is comfortable for minor corrections and the changing of records afterwards.

The Event Analysis Schema is straightforward structured and gives the freedom on what objective to run analyses. The common item is always the Event Identifier. The needed Dimension, in Figure 5 „people affected“ is just an example. For the Austrian Country Corner „economic loss“ was created. The Dimension 2 is the representation and the value interval for the analyzing tool.

![Figure 5: The Event Analysis Schema as Example](image)

For the combination of Event Definition Scheme and Event Analysis Scheme, the configuration of analyses regarding an event and its impact, a so called „descriptor file“ is
setting the internal relations, the terminology for the visualization and describing the diagram axis, etc.

The RDH Analysis Tool enables the calculation and visualization of imported data. There is a large bandwidth of different figures for accumulated losses, diagrams and visualizations with average numbers and thresholds regarding the Sendai Framework and its global target. Figure 7 shows the Sendai target indicator for category C, the direct disaster economic loss. Such utilization gives the user a valuable overview as an interactive playground to get the needed information with the respective for download- and export functionalities.
For the Austrian DRMKC Support Service around 360 data records out of more than 4000 submissions (VIOLA plus Economic Loss Data Base) for Lower Austria on flood events between 2005 and 2015 were identified as single Event Identifier and integrated into RDH. Around 190 of them are events with real economic loss which were reimbursed by federal states authority. Reasons for the different payout, criteria and threshold values for losses are described in detail in the feasibility study „DAMAGE.at“. The RDH via the Country Corner Austria is able to reflect these numbers and figures on RDH web platform.

Figure 8: Submitted events combined with the Number of public economic losses. The detailed diagram Number of submitted losses (ca.520) in June 2009 on the Danube flood is also showing gaps on events without payout.
Affected areas are visualised as a GIS layer in GeoNode. GeoNode is a web-based application for spatial information and enables together with OGC\textsuperscript{11} conformal schemes components for a spatial data infrastructure. As a map server GeoServer\textsuperscript{12} is used. The here-

Figure 9: Graphical visualisation of the integrated data content, the affected areas embedded in a web GIS, the values are visible in interactive diagrams.

\begin{center}
\includegraphics[width=\textwidth]{figure9.png}
\end{center}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure9.png}
\caption{Graphical visualisation of the integrated data content, the affected areas embedded in a web GIS, the values are visible in interactive diagrams.}
\end{figure}

in shown geographical areas, representing the political districts on NUTS 3 level, the portrayal rules or the color intensity, are linked to the values, the total of economic losses. Details on integrated data are shown as a diagram and a table in an extra window of this application, Figure 9.

Beyond the described processes from a technical perspective on harmonization and data integration, it is especially essential to understand the content of data before data can be joined and analyzed with the RDH system. Spatial and temporal information of different data sources cause a lot of multilateral iteration processes. In Austria no unique event register is governed. From the conceptual thoughts, such a cross border Event Register, combined with a submission process where all proposed events from different submitters are visible and the decision process on submitted events, their trigger mechanism, declaration as sub events and finally providing a persistent identifier would be a valuable solution.

\textsuperscript{11} http://www.opengeospatial.org/
\textsuperscript{12} http://geoserver.org/
5 Evaluation RDH usability

Within the DRMKC Support System and on the basis of gained experience on the RDH platform the following assessment topics are assessed: a) GUI Graphical User Interface, b) Country Corner and Ingest Tool and c) the Data Management regarding Data Life Cycle and Data Provenance issues. At this development stage of RDH, it was tried to identify reinforcements as well as improvements.

Dealing with concepts like risk, prevention and preparation, the communication of information will always be challenging which even enforces this study’s motivation to support JRCs activities on a clean conceptual, mature and proofed Software System Architecture for sharing loss and damage information for a better understanding of risk analysis.

The RDH software ecosystem with the individual controlled Country Corner as a starting point of a federated structure is a step forward towards a common data infrastructure which enables analyses, like the calculation of indicators (e.g. for SFM) combining EU data sets with regional ones and making them comparable. Naturally, software which has to deal with such a complex data and information discipline on Disaster, Damage and Loss Data has a big potential for improvements. It faces not only on data sharing or management principles. Implementation concepts should also issue the consequences of data governance, sovereignty and control of data content by member states. As a general remark, the interface lacks a concise structure with regard to the risk concept as well as a required exposure vulnerability and hazard probability. Data request functionalities, especially satellite data - the provision of open source data for national usage would be a great benefit and would certainly boost the usage of the RDH.

Graphical User Interface

The graphical user interface of RDH convinces by his clear solution on catalogue services, on data layers, search functionalities, event categories and data analyses. The given overview on available data and the details on specific data sets are combined with informative and well-structured descriptions. The RDH landing page shows all important information, functionalities and provided services at a glance. In brief sentences pros and cons are describing positive as well negative assessed issues.

Pros:
• A clear landing page, web page is not overloaded
• Descriptions give simple and short messages

Cons:
• “Getting Started” is on the bottom of the page
• To distinguish marine and country side services is not really intuitive, only solved by mouse over function


Pros:
• “Introjs” as initial documentation tool is nice to get quick overview
• The landing page is clearly structured, Map Layer as data and the catalogue box on the left
• Well-structured catalogue box, number, names of existing and available data is shown
• Scenarios of analyses with interactive charts are visible
• when a scenario has been chosen, automatically additional information like the load of raster data for Rural areas is implemented
• To store a permanent data view page via the permalink tool, is a pragmatically solution

Cons:
• Event categories are listed redundantly, horizontal and vertical on the left side
• No preview of available data in the left catalogue box is visible
• Area of interest is only defined on member states level, the navigation is limited to clicking on a given polygon
• Scenarios with interactive charts navigation are often too small
• Single events can be visualized, but user driven aggregation is not enabled
• the status of data load would be helpful, especially for large data sets
• No Metadata View and Data Citation on Raster Data and NUTS Polygons available
• Legends and portrayal rules should have a common structure
Country Corner and Ingest Tool

At this stage of implementation, it is a suitable solution and very useful concept. The upload functionality of maps as GIS layer is really pragmatical and is being well worked out. The processes how to ingest a new data set for standardized analysis is described in chapter 4. With Django / GeoNode an established solution was chosen. Apart from the Django content, to provide a simple library with good examples would be valuable to understand the consequences of a configured combination for different data sets. A kind of preview system or playground to deal with data, related data sets and analyses could increase the whole usage of available functions.

Improvements on visualization tools could be done on data set view but also on the data analytics view, for example providing zoom steps, interactive portrayalal rules, legend units, etc.

To configure the linkage between imported data layer and still existing is possible but it needs a lot of experience on how to deal with it. Some kind of supporting tool where meaningful datasets could be added would be helpful and would offer much potential to support risk and damage evaluations.

Also some kind of data request functionalities, especially for getting available satellite data, classified data, like land cover maps, soil or geology or other open data on an area of interest for national as well as a cross border usage would be a great benefit and would certainly boost the usage of the RDH.

Data Management

To set up a spatial data infrastructure, data management is an essential consideration. Data management as a transparent process based on guidelines how to deal with data to ensure its quality, reliability, accessibility and robustness, to avoid data loss, enables collaborative re-use of data as well as makes the content comparable.

An operator of a data infrastructure is constantly confronted with topics like sustainable data retention, the life span, storing the data physically or link the data, data formats, data specification, keep information on applied analyses algorithm, data citation and data versioning etc. These are aspects of Data Life Cycle and Data Provenance. To deal
with these subjects at this point would lead too far but the consideration of its components is important.

In general the RDH Data Management should consider data sharing principles, standards on data itself as kind of a data specification and its services. The RDH should create some clear messages about data quality, information on data processing methods, who creates data and which products are made of it. The minimum requirement is to cite the data by authorship, with confidence and give proper credit when data is reused, Persistent Identify, like hdl\textsuperscript{13}, doi (Digital Object Identifier) will become essential for each data sharing platform. A practical compendium gives the “Declaration of the European Open Science Cloud (EOSC)”\textsuperscript{14} about Data culture and FAIR data.

For loss and damage data infrastructures as an information hub which supports monitoring by data analyses it is unavoidable to deal with agreed classification and taxonomies for hazard types. In fact there are a lot of available classifications e.g. IRDR Perils\textsuperscript{15}, Cambridge taxonomy for risk management\textsuperscript{16}, EM-DAT\textsuperscript{17}, etc. A persistent online available vocabulary server, like a registry\textsuperscript{18} is not really established. An advantage is that registered items like a term are stringent aligned with a definition, a persistent identifier, the history about versioning and a transparent submission or change request procedures as well as a clear instance as vocabulary management or control body.

\textsuperscript{13} https://www.handle.net/
\textsuperscript{14} https://ec.europa.eu/research/openscience/pdf/eosc_declaration.pdf
\textsuperscript{17} https://www.emdat.be/
\textsuperscript{18} ISO 19135  Procedures for item registration
6 Recommendations and proposal for RDH

The following list is a short overview, ordered according to priorities on potential improvements on RDH developments to co-create benefits between EU Member states and EC. This list represents the Austrian perspective as a first outcome of the DRMKC Support Service.

- Clear Indication of used Terminologies for the Risk, Loss & Hazard within the RDH. In order to share the knowledge, explicitly concerning agreed wording of terms and terminology, the reference of a source or used glossary is needed.

- If machine-accessible thesauri, vocabulary servers (especially for IRDR peril classification, UCPM - No 1313/2013/EU, Cambridge taxonomy, etc.) already in place, reference Application should be promoted. The content should ensure the state of the art implementation, using linked data approach (describe uncertainties and/or similarities in a formal manner).

- Refer to the source of used terms in textual descriptions by links or footnotes to an accepted controlled vocabulary (e.g. INSPIRE and national Extension like https://registry.inspire.gv.at/codelist/ SpecificHazardTypeValue)

- Elaborate feasibility or existence of a common EU Event Identifier Register as federated register. Development of a common and agreed submission process on events and sub-events (ongoing, historical, warning) and management as well as a decision process structure, their trigger mechanism would be a valuable solution. For example what is the issue of acceptance and usage of GLIDE numbers, WMO UUID for Events, etc.

- User driven data request interaction on Copernicus Services as well as other data services like GEOSS data provider. Beyond the provided Analyzing Tools, the RDH would boost its acceptance for EU Member States if near real time data e.g. Copernicus Data Services, Data Cubes, etc. would be made available as additional data for correlation, intersection at least for visual interpretation, and comparison. RDH could be acting as central data request Hub (also implement results of relevant H2020 projects)

- Provide a clear and detailed Data Specification form (Data Format, needed Attributes, Data model, needed Data, e.g. on which resolution or aggregation level for RDH Analysis) for UCPM monitoring and Disaster loss data implementation of the Sendai
Framework. Support data providers to embed culture of standardization and interoperability in respective of LOSS/INSPIRE/SEVESO/E-PRTR Data Models.

- Improved data analyses and monitoring tool boxes, create and plot diagrams, figures or maps (drag and drop editor)
- Align data sets with a PID (persistent identifier), either reuse existing ID like doi or setup up and allocation mechanisms within RDH.
- Combine a knowledge based system, ontology driven as a base for a machine learning tool hub
- DRMKC is curating the project data base, if there is any demonstration and interaction between RDH and EC founded F&E Projects on data level that would be available, a real benefit of practical implementation and research is visible.

**Summary**

Data sharing and data processes in the risk and disaster ecosystem are complex ones. This is not only a challenge by the wide-ranging subject dealing with risk information it has also to deal with the reluctance how to make basic data for risk assessment available. For example Austria has a large number of databases and inventories regarding hazard and risk assessment with different technical approaches, different purposes and varying requirements from various projects and scientific as well as decision making perspectives. In order to fulfill the requirement’s especially for European UCPM monitoring processes and the UN SENDAI Framework and its Global Targets a common data infrastructure for standardized monitoring principles and terminologies is needed to foster incentives which enables cross border analyses and sharing information.

With the Risk Data Hub, the JRC DRMKC developed a software ecosystem for a data sharing infrastructure and a centralized access point for data, risk analyses and information is given. Especially the feature of the RDH Country Corner and their federated structure is a very valuable step forward towards a common data analysis and a calculation of indicators. The objective to combine available European, cross border data sets with regional ones makes a Loss and Hazard data comparison possible.
Within the DRMKC Support Service, Austria got the opportunity for testing intensively the RDH Country Corner with real data on economic losses and recorded event data from 2005 up to 2018. The functionalities in the RDH Country Corner itself do not setup any barriers for a data import in general. The Austrian activities on the RDH platform clearly showed that the challenges of harmonization and data transformation processes are on the side of the data providers.

The Collaboration within the DRMKC Support System elaborated on the basis of experiences made and a short evaluation on the range of functionalities provides a list of potential improvements to create synergies and benefits on EU Member state´s level. Such improvements are in the field of a data request actions, meaning that the RDH is an active data sharing part in the EU data infrastructure to retrieve additional data layers as background information. The second topic would be a better practice in data management components for the re-usability and to create reliable information, like data citation, explaining methods for calculation and data analyses and ensuring the usage of the same terminology. Especially within the harmonization process, the need of an Event Identification Register has become obvious.

The System RDH can support these activities in focusing on clear beneficial aspects on a common and agreed platform as a base for common calculation methods of global indicators, a data request hub and information support.