

Risk Root Cause Analysis is a systematic approach moving policy and research from symptoms to root causes of risk and disaster loss. Tackling the underlying factors that lead to risk is critical to reducing disaster loss and damage. This is increasingly recognised in international, EU and national flood risk management policies. The Sendai Framework for Disaster Risk Reduction 2015-2030, for example, acknowledges that a range of underlying causes and drivers give rise to disaster risk. Existing methodologies provide important overviews of current vulnerabilities, capacities and post-disaster conditions, but often fail to generate understanding and action on underlying causes – limiting the potential for risk and vulnerability reduction.

Risk Root Cause Analysis supports the design of structural and holistic solutions to flood risk that have lasting and far-reaching results, beyond short-term, partial interventions that most often focus on response to the detriment of longer-term risk reduction and preparedness efforts.

Root causes are the structures and processes that go beyond an individual crisis or event. They can be distinguished from *drivers*, which are the more proximate activities and processes that translate root causes into *unsafe conditions*, or the specific forms of vulnerability to risk that occur at particular moments and in particular places. For example, a first order explanation of disaster loss and damage might focus on the poor application or lack of knowledge of building standards and controls. However, risk root cause analysis interrogates the underlying economic models and governance structures that manifest in the lack of application of such codes.

The approach described here relates to the framework developed for the PEARL, (Preparing for Extreme And Rare events in coastal regions) project. The PEARL model for risk root cause analysis (RRCA) aims not only to trace the historical root causes of disaster but also reflect on the role of these factors in driving risks in the present and into the future. Beyond a linear model in which a hazard event results in risk, it provides a framework through which the multiple interactions, feedbacks and thresholds that characterise the relationship between risk and sustainable development can be analysed.

The RRCA framework (Fig. 1) is centered on dynamic physical, socio-economic, governance and risk perception processes. These four are interlinked in a **non-linear fashion** and in continuous exchange. Therefore the **risk** – as a function of **hazard, exposure and vulnerability** – is displayed at a single point but could be assessed at any given time step. Following the disaster, **Disaster Response, Recovery, Reconstruction and Transformation** processes both influence the physical, socio-economic, governance and perception factors within a spatial entity and are influenced by the historical physical, socio-economic, governance and perception context. These aspects contribute, either positively or negatively, to the accumulation and production of risk.

APPLYING RISK ROOT CAUSE ANALYSIS The PEARL team conducted cases studies in four different coastal areas: in *St Maarten (Dutch Caribbean)*, the *Elbe Estuary (Hamburg, Germany)*, *Rethymno (Crete, Greece)* and *Genoa (Italy)*. In each of the PEARL case studies methods were tailored depending on the context and knowledge availability.

Which methods?

A spectrum of methods can be used for RRCA, and the exact choice of methods will depend on the context for and aims of the analysis. In Genoa, phone-based interviews were used while in Hamburg we used predominantly a desk based approach.

Key principles

Be sensitive to local context, method will vary from place to place

Include multiple stakeholders from different disciplinary perspectives, recognising that different groups may have different values, beliefs and interests that influence how they view the causes of particular events

The PEARL findings show that combining qualitative and quantitative methods brings legitimacy, impact and analytical depth. Qualitative methods capture depth, context and meaning but can also be used in conjunction with quantitative methods, for example to understand the strength of different causal factors, or model actor relationships globally. Semi-structured interviews (e.g. expert interviews) and focus groups, or stakeholders workshops, can also be used. Group exercises such as actor or causal mapping may provide a useful starting point for the research. In places where lots of research has already been conducted, desk-based studies can usefully replace face to face interactions. Quantitative data collection and analysis (even of originally qualitative data) is easier for stakeholders to digest and can make an impact to be followed-up with more detailed recommendations or findings based on qualitative nuance.

Who should do it?

Ideally RRCA should be conducted by an organisation able to access many different stakeholders and seen as credible by those stakeholders. This may be an academic institution, or research organisation with experience in social science analysis. RRCA may be conducted by an international team, but knowledge of the context is also vital to identifying the right stakeholders to interview and refining the research questions. Building relationships with stakeholders is also important to promoting the uptake of RRCA in relevant policies and practices. The RRCA can also be a useful tool for generating new relationships at the start of longer-term research programmes and can be undertaken alongside power analysis or institutional mapping.

Box 1: Challenges to accessing stakeholders

In attempting to reach multiple stakeholders, PEARL case study research highlighted common challenges of language barriers, timing interviews to suit busy interviewees, managing the impacts of staff turnover and unexpected events, and stakeholder fatigue with being interviewed. These issues must all be borne in mind when deciding who will undertake the research, deciding on appropriate methods and scheduling interviews. In addition, vulnerable groups and their representatives are often the most hard to reach. Governance issues may also be particularly sensitive topics to draw out and discuss, especially with local stakeholders. If relying on focus group interviews alone, it should be remembered that the composition of the group will influence the responses, and that marginalised viewpoints may be excluded.

Interviews for PEARL's root causes analysis work focussed where possible on eliciting personal and organisational opinions about the causal factors behind specific disaster events. This interview technique was designed to draw out specific causal attribution and the relationship between causes and impacts, moving beyond the broad-brush opinions of respondents and pre-existing conceptions by researchers and stakeholders about possible causes. The thinking behind it was that disaster events act as a 'window' through which hidden causes of risk are often revealed. It is worth underlining that when conducting interviews framework elements and timescales may be difficult for interviewees to separate out.

PRACTICAL APPLICATIONS

As illustrated below, RRCA can benefit policy-making and planning processes. The process of conducting RRCA involves multiple stakeholders and engaging them in how to integrate the findings into these processes ensures that this can be done in an appropriate, and legitimate, way.

Communicating the causes of disasters. Our desk study of root causes in the *Elbe Estuary and Hamburg, Germany*, highlighted the major shift in governance that occurred after flooding in 1962 – when all flood and storm protection systems were made state property – and has persisted until the present day. As well as identifying historic root cause pathways, the desk study pointed to new and emergent risk drivers, such as climate change, pressure on land for retention areas and public perceptions of security, and presented different viewpoints about the capacity of the current system to manage these risks.

Supporting arguments for holistic risk governance. In *Rethymno, Crete*, findings highlighted how flooding related to storm waves and flash flooding, was also linked to the challenges of maintaining existing risk mitigation infrastructure and, including greater public awareness-raising. These challenges reflected a long-standing history of weak governance capacity at the local level and a political organisation that precluded wide stakeholder engagement and institutional fragmentation of disaster risk management at higher levels of

governance. Austerity measures are also rupturing pre-existing political relations, opening up new possibilities in the future for public engagement in disaster risk management in the town. The analysis also emphasised the need to take advantage of a new moment of political opening in Greece's, and particularly Crete's, history to involve civil society actors in the development of more holistic flood management policies.

Generating innovative, local solutions. In *Genoa, Italy*, the progressive increase of extreme events and the presence of a flexible institutional structure allowed this root cause to be addressed through a change in the criteria for funding allocation and by creating new institutional units to reduce hydrogeological risk. The interplay between legal and financial issues generated a deadlock that prevented local authorities from effectively reducing risk. RRCA revealed the vital role of early warning systems and structural mitigation works in protecting against rapid-onset flooding due to the complex morphology and climate of the city. The research has led to practical recommendations about how data about funding flows for flood protection from different sources can be improved in order to maximise the use of funds and better monitor and track spending.

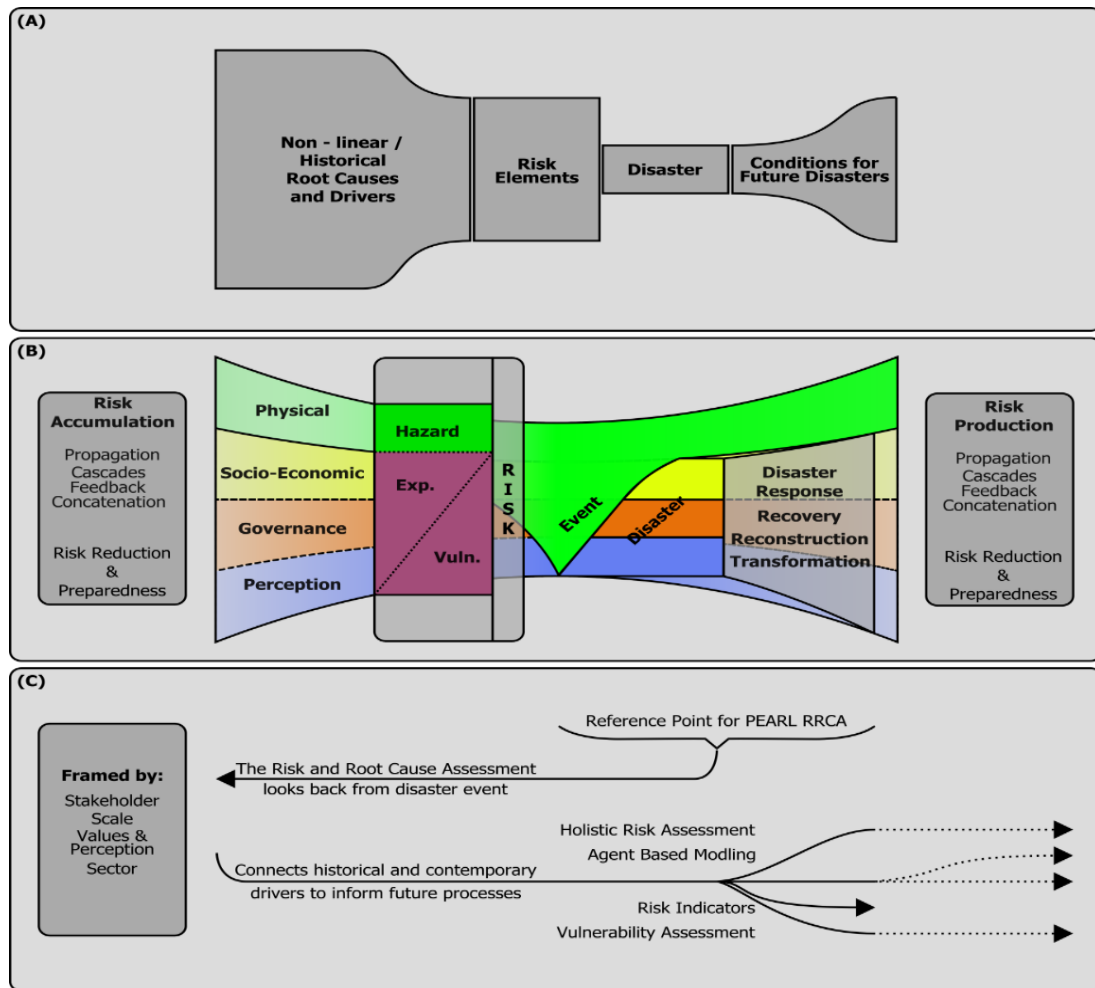
City-city and cross-country learning and innovation for flood protection in the context of resource constraints. Focussed in particular on flood events in 2014 and 2005, but also the influence of a series of destructive hurricanes in the 1990s on flood risk governance, the analysis conducted in *St Maarten, Dutch Carribeans* showed how improved hurricane communication, preparedness and emergency response measures were not met by improved government land use policies and infrastructure development, despite better construction by citizens and the private sector since the 1990s. The PEARL project has enabled stakeholders to share experiences through an online learning platform, such as a presentation by the Head of Disaster Management for *St Maarten* about the organisational structure for disaster response on the island.

Engaging stakeholders across all levels, including national level and supra-national level bodies such as the EU, and improve capacity at the local-level to access funding and knowledge often available at other levels of government. This can be challenging: in *Rethymno, Crete*, attempts to include national-level stakeholders in a participatory action-learning alliance fostered by the PEARL project were abandoned as due to political changes and financial crisis in Greece personnel in national-level ministries of importance were either absent or unwilling to participate.

IMPLICATIONS FOR RISK GOVERNANCE AND CHALLENGES FOR INTEGRATING RRCA INTO POLICY

- **Causes of risk arise across multiple sectors and multiple levels of governance**, often well beyond the conventional remit of disaster risk management officials.
- **Root causes are also dynamic**, and while historic factors shape the causes of risk into the present, there are discontinuities and shifts in governance and socio-economic pathways which mean that pathways are not determined into the future. This points to the need for Risk Root Cause Analysis to be continuously reviewed.
- **There is a need to improve trust in government communications** in particular by groups who are often politically unrecognised and economically and socially marginalised
- **Large-scale economic and institutional shifts occurring at global, national and regional levels influence the nature of risks as experienced in local contexts.** Austerity measures and decentralisation, for example, have had positive and negative impacts in all PEARL case study contexts – exacerbating resource constraints for disaster management, but in some cases also leading to the development of more appropriate risk knowledge or creating new opportunities for social involvement in risk reduction.
- **Local contexts condition structural processes.** While austerity impacts were noted these unfolded in the context of local historical conditions. Cases showed that lack of trust between civil society and local government had made partnerships that could overcome some impacts of austerity difficult. Elsewhere budgeting protocols had made government funding reserved for flood risk management vulnerable to redeployment.

Fig. 1 PEARL Risk Root Cause Analysis Framework based on the FORIN approach



More information

PEARL project detailed case study accounts and methodological papers: <http://www.pearl-fp7.eu/>

UNU study on root cause analysis on behalf of DKKV (German Committee for Disaster Reduction), see: http://www.preventionweb.net/files/globalplatform/entry_bg_paper~studyingdisasterrootcausesweb.pdf

IRDR's Forensic Investigation of Disasters (FORIN) Project, including the first and second project reports with guides to objectives and methodology: <http://www.irdrinternational.org/projects/forin/>. The latest framework and guide to research can be found at: <http://www.irdrinternational.org/wp-content/uploads/2016/01/FORIN-2-29022016.pdf>

Arabella Fraser, Shona Paterson, and Mark Pelling (2016) Developing Frameworks to Understand Disaster Causation: From Forensic Disaster Investigation to Risk Root Cause Analysis, *Journal of Extreme Events*, 3 (2) <https://doi.org/10.1142/S2345737616500081>

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