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‘Mobilizing resilience from below’
Linking institutions to actors and knowledge to decisions
A case of the Netherlands



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November, 2006
Interdisciplinary Term Paper
International Doctoral Studies Program

Source Picture 1: Deltaworks, Picture 2: BBC News, Picture 3:V&W
The pictures depict technological knowledge, actors and institutions, three elements contributing to socio-ecological resilience

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Abbreviations and acronyms

CBO	Community Based Organisation
DRM	Disaster Risk Management
GTZ	German Agency for Technical Cooperation
ISDR	International Strategy for Disaster Reduction
LNV	Dutch Ministry of Agriculture, tourism and fisheries
MEA	Dutch Ministry of Economic Affairs
NGOs	Non Governmental Organisation
RIKZ	Rijkwaterstaat – National Institute for Coastal and Water Management
SES	Socio – ecological system
UN	United Nations
UNU-EHS	United Nations University – Environmental and Human Security
V&W	Dutch Ministry of Public Works and Water
VROM	Dutch Ministry of Housing and Spatial planning
WMO	World Meteorological Organisation

1 INTRODUCTION – FROM VULNERABILITY TO RESILIENCE

Disasters occur when a natural hazard affects a population not prepared to recover without assistance. The impacts of hazards differ for people with different levels of preparedness, resilience and capacity for recovery (Brauch, 2005) Although Disaster risk management (DRM) is a comparatively new area of social concern and practice, it is a very relevant aspect for development studies given that disasters of natural origin have devastated an increasing number of regions, destroyed investments and set back progress in development. Following the UN initiative for an International Decade for Natural Disaster Reduction (1990-99), this theme has gained considerable attention as a policy issue both at national and international levels and currently stands as a cross – cutting theme in development cooperation programmes

Until a few years ago, disaster relief aid was a major intervention approach whenever sudden events disrupted the functioning of society and overstretched available self-help capabilities. This approach is mostly curative and founded upon centralized, top – down and technical strategies for dealing with disasters. However, uncertainties of the global environment as well as expanding socio – economic activities within fragile ecosystems has exposed the weaknesses of this approach in terms of its inability to prevent the escalation of natural hazards into disasters.

DRM approaches are therefore shifting efforts from this purely curative approach to one geared at building the "immune system" of communities against natural disasters [ISDR, 2005]. The rhetoric of achieving this process seems much clearer at policy level than the reality. The increase in the destructive impacts of hazards has spurred the concept of resilience building into the core of DRM Practice. Resilience however, does not happen in a vacuum; - it needs a clear medium through which local communities can be empowered with knowledge about their risks, effectively warned and equipped with the right skills to be able to adapt, cope, re-group and recover in the event of extreme occurrences. The role of institutions has therefore come back to the fore as a vehicle for moving the rhetoric of resilience into reality by providing the right incentives for building resilient communities. Such communities will then be able to cope, adapt to and effectively regenerate as well as recover from extreme events without collapsing.

1.1 Aims and Objectives

This paper seeks to contribute to the academic and policy efforts geared at building resilience against disasters and specifically floods. Using the case of the Netherlands Flood Management programme, this paper:

1. Provides further insights into the nuances and complexities of resilience as a concept and reviews different perspectives around the concept to develop our working understanding of socio-ecological resilience.
2. Attempts to theoretically examine the role of institutions as vehicles for resilience building; the challenges of "institutionalizing" resilience. In so doing, we identify key building blocks of a resilient system, which form the conceptual map of our paper.
3. Provides lessons learned and practical challenges for institutionalizing resilience against floods using the Netherlands Flood Management Programme.

It is important to note that this paper does not in anyway present the Netherlands as a model to be emulated by disaster prone countries, neither as a perfect case of flood-resilient society. It provides insights into the concept of resilience and by analysing the Netherlands Flood Management programme demonstrates the process by which institutions can contribute towards resilience building by extrapolating the key lessons learned as well as the challenges that are likely to be faced by countries trying to emulate this model, especially those from the developing world.

As a case study, the Netherlands is regarded as a forerunner in water management given its long history of reclaiming land from the rising sea levels. As will be demonstrated in the case study, resilience as a concept, just like adaptation, is a context-specific process that is shaped by local conditions and which mostly depends on socio – cultural and ecological dynamics; level of economic development, population capabilities and political cultures which are distinctively different from one country to the other. Analysis of the Netherlands case provides some insights into the role of institutions as well as challenges inherent in building resilient communities.

1.2 Methodology

This paper is a product of a thorough review of literature as well as a reflection of the authors' experiences in their respective fields of expertise. Different sources of relevant literature were therefore employed:

1. Through reviewing literature from ISDR, UNU-HES, WMO, development agencies like GTZ and so on, we familiarized ourselves with current international development policy issues on DRM as well as the progress made in tackling the proliferation of natural disasters and in so doing found a niche for our paper.
2. Having understood the progress made so far at policy level, it was vital to review the academic discussions around the DRM discourse and most specifically on the concept of resilience. The online journal on "Ecology and Society" was a key link to academic discussions from which we were able to conceptualise the nuances of resilience building. With reference to this literature we were able to write our theoretical chapter which analyses resilience from an institutional perspective
3. A review of various academic cases drawn from research on coping strategies, from African, Asian, American and Asian contexts, we were able to sift through and come up with general building blocks of issues identified in the literature as being key to building resilient systems. These building blocks form chapter 4 of our paper and provide the framework for analysis of the Netherlands case. A key body of literature was from the "Resilience Alliance" which has for the past decade engaged in developing case studies of how communities are coping with diverse forms of disasters.
4. Finally, we reviewed academic studies on the Netherlands Coastal and Flood Management programme. Netherlands policy documents were a useful entry point into relevant knowledge to familiarize ourselves with the case at hand as well as examine the evolution of the flood management program in the country over time.

The conceptualization of the paper evolved through rigorous interdisciplinary interactions and reflection on our practical work and academic experiences which, when pooled together created synergy as a result of the diversity of our disciplinary perception and cultural orientations.

2 SETTING THE STAGE: Conceptualizing Vulnerability, Risk and the Role of Institutions in Resilience building against disasters

2.1 Disaster Risk, Vulnerability and Resilience

Understanding the concepts and their implications for disaster risk management is essential for the appropriate design of policies and management strategies for resilience building. First of all, the difference between hazard and disaster will be drawn. 'A Hazard is a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Each hazard is characterized by its location, intensity, frequency and probability' (UN/ISDR, 2004; Thywissen, 2006). A disaster on the other hand is the after effect of a hazard on people, 'in such a way that their lives are directly threatened or their social and economic support structures are destroyed. A disaster fundamentally becomes a socio-economic phenomenon' (IFRC, 1993; Thywissen, 2006). Based on this definition, disaster risk is a function of a hazard multiplied by the levels of vulnerability, which can be represented as below.

Disaster risk = Hazard x Vulnerability

Therefore, it is clear that a risk exists only if there is vulnerability to the hazard posed by a natural or human-induced event (GTZ, 2002; UNU, 2006). Disaster vulnerability in this paper is based on three elements: physical fragility or exposure, socio-economic fragility; and lack of resilience (Cardona, 2004). In the definition of disaster vulnerability proposed by Cardona it becomes clear that 'resilience is the flip side of vulnerability – a resilient system or population is not sensitive to natural hazards, climate variability and change and has the capacity to adapt' (IPCC, 2001;Thywissen, 2006). More precisely resilience is 'the capacity of a system, community or society potentially exposed to hazards to adapt by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures (UN/ISDR, 2004; Thywissen, 2006).

2.1.1 Institutions and Resilience Building

Having understood the nexus between risk, vulnerability and resilience, this section of the paper seeks to make a theoretical link to these concepts. This shall be done by introducing institutions as rules of the game [North, 1993] that facilitate the process of building adaptation capabilities and dealing with the uncertainties that result from hazards. Institutions in this paper are perceived as values, norms, rules, legislation, policies, laws that govern human interaction as well as respective organizations that formulate and enforce norms and laws (Ostrom, 1998).

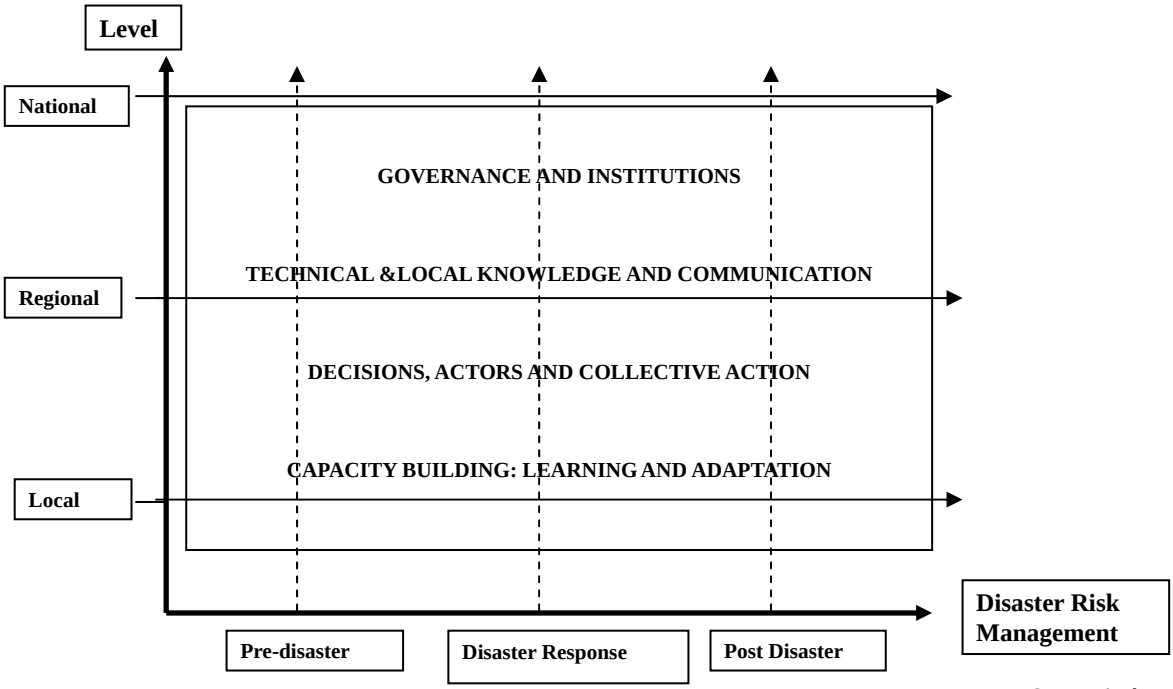
The multifaceted nature of resilience opens the space for institutional roles to serve as governors of human behaviour hence contributing to building the immunity of a system. Bohle (2002) introduces the whole discussion about an external (environmental) and internal (human) side of vulnerability, thus identifying ecological as well as social vulnerability as important factors when focusing on building resilience. Anderies, J.M, (2006) in his work of SES in Mangroves in Peru reflects on the fact that these external and internal sides of vulnerability are induced by agents who possess a set of allowable actions related to their physical interactions with the system which influence how the entire system reacts or responds during a hazard. In this context, these interactions contribute towards making the external as well as internal environment vulnerable unless they are well managed. This collective nature brings into fore the concept of Socio-ecological resilience which among others requires the management of diverse and competing interests between various users so that the common good of ensuring reduced risks and vulnerability in times of a hazard is achieved.

A resilient SES is therefore one capable of anticipating, adapting and coping with uncertainties and unexpected extreme events without loosing its stability, performance and regenerative ability (Ostrom, 1998; Lebel et al, 2006; Folke, et al. 2004). To build resilience therefore requires the development of institutions that can generate the right incentives to enhance the adaptive capacity of social systems to anticipate, cope and regroup when faced with uncertainties while maintaining a balance that does not restrain ecosystems from performing their function in a sustainable manner (Berkes and Carlson, 2005; Adger and Tompkins, 2004).

2.2 BUILDING BLOCKS OF A RESILIENT SOCIO-ECOLOGICAL SYSTEM

Following the Hyogo Framework for Action 2005-2015 and the International Strategy for Disaster Reduction, this paper seeks to make a contribution to how the 'Resilience of Nations and Communities to Disasters' can be built and fostered. The following section will provide a framework for building resilience in socio-ecological systems. The proposed building blocks make clear that a society's capacity to manage resilience resides in, among other aspects, disaster risk management and technical knowledge, governance and institutions, decisions, actors and collective action and capacity building.

Figure 1: Building Blocks for a resilient socio-ecological system



Source: Authors

2.2.1 Disaster Risk Management, technical & local knowledge and communication

Disaster risk management (DRM) in this paper is defined as a series of actions (policies, programs, plans, projects and/or measures) and instruments expressly aimed at reducing disaster risk in endangered regions, and mitigating the extent of disasters (GTZ, 2002). DRM can be divided into three main moments:

1. **Pre-disaster** activities consist in risk assessment, prevention, preparedness and early- warning
2. **Disaster response** activities consist in warning – evacuation, saving people, providing immediate assistance, mitigation and assessing damage.

3. **Post-disaster** activities comprise ongoing assistance, restoration of infrastructural services, reconstruction (resettlement/relocation), economic and social recovery and rehabilitation; ongoing development and planning activities, risk assessment, mitigation and prevention.

Effective DRM depends on, among other aspects, how well technical, scientific knowledge as well as communication is embedded into each of the disaster risk management cycles. Therefore DRM needs to be integrated into local, regional and national level information systems, planning departments and research institutes. Combinations of both local and scientific knowledge and information about natural hazards should be fed into each disaster risk management cycle as well as at each intervention level. This helps facilitate policy formulation and early-warning as well as rapid response. More precisely technical knowledge for flood control, for example, should combine remote sensing, decision support systems, geographic information systems knowledge, and other geological mapping methods. These methods then need to be processed to inform policy as well as to alert the population to prepare or respond. These kinds of knowledge systems can monitor vulnerabilities and risks as well as informing policy and population against floods.

The knowledge and information must combine scientific, social and ecological information on risks, hazards and vulnerabilities. Interdisciplinary research is crucial for effective disaster risk management and building resilience against disasters. Natural Resource Management practices need to be established to secure local ecological knowledge and skills, reduce vulnerability and strengthen user's capacity to respond and adapt. Therefore Disaster Risk Management should go hand in hand with integrated Natural Resource Management. Moreover, a reasonable scientific basis for predicting and communicating disasters is required, such that useful knowledge about risks for effective preparation and response can be received. If building resilience, however, can only be achieved once integrated into sustainable disaster risk management and governance (Lebel et al, 2006; Ostrom, 1998), it will be of particular interest to analyze the importance of governance and institutions in the next section.

2.2.2 Governance & Institutions

Governance in this paper is defined as the structures and processes by which societies shape individual and collective actions (Walker, B., et al, 1992; Lebel et al., 2006). It includes laws, regulations, discursive debates, negotiation and mediation, conflict resolution, elections, public consultations, protests and other decision-making processes. Governance emerges from the complex interactions of many actors at different levels, not only the Government but including the private sector and NGOs. For governance to contribute to the building of resilience, integrated DRM should be embedded in multi-level and polycentric governance (Olsson et al, 2004). Multi-level governance that upholds social justice improves the fit between knowledge, theory, action and socio-ecological systems allowing societies to respond adaptively.

Building resilience means putting in place institutions that can contribute towards building an adaptive capacity of social systems to be able to anticipate, cope and regroup when faced with uncertainties while maintaining a balance that does not restrain ecosystems from performing their function in a sustainable manner (Ostrom, 1998; Berkes and Carlsson, 2005; Adger and Tompkins 2004). Important for resilience building are integrated institutional interactions embedded in multi-layered cooperation between expert and local knowledge (UNU, 2006; ISDR, 2005). Multiple, independent centres of authority create opportunities for local institutions to evolve (Berkes and Folke, 1993) and empowering local communities through allowing space for non-state actor involvement in DRM (ISDR, 2005).

Power dynamics in terms of interests to certain resources and building robust resilient systems for certain sections of the ecosystem should be well-understood and factored in DRM strategies (Anderies, J.M, 2006). Resilience is built through understanding the dynamic processes, structures and laws by which societies share power and shape individual as well as collective action. Participatory resource and risk mapping, collaborative management as well as deliberative processes of governance and decision-making are incentives for collective action and resilience building. It will thus be of interest to analyze the importance of decisions, actors and collective action in building resilience.

2.2.3 Decisions, Actors and Collective Action

Disasters need to be understood as the product of cumulative decisions taken over long periods, because then the processes by which these choices are made become a focal point for potential change (Comfort, et al., 1999). Decisions taken in response to a specific disaster become defining elements for the (temporary) resolution of that crisis, but also likely steps toward the creation of the next crisis (Comfort, et al., 1999). Building resilience against floods relies on practical and effective decisions and actions for disaster mitigation, preparedness, response and recovery. Maps of the decision processes for disaster mitigation, response and recovery help to identify critical actors at each jurisdictional level, their risk assumptions, their different types of information needs; and the design of an information infrastructure that would support their decisions. Only through the help of such devices and environmental risk management tools will it be possible to transform the destructive spiral of disaster into a learning process for building resilience and responsible disaster risk management (Comfort, 1993).

Affected populations which face hazards should be enabled, through assistance, to manage their own environments more responsibly and equitably over the long term by joining a global structure that supports informed, responsible, systematic actions to improve local conditions in vulnerable regions (Comfort, et al., 1999). Resilience can be build through providing voice to the vulnerable and powerless victims (Thompson, 1995). As local communities are mobilizers of resources voluntary collective action through building trust and reciprocity is a stimulant for accountability and social justice. The ability to organize social systems depends on local networks and their strengthening to facilitate re - organization during and after shocks. Collective action allows for mobilization of diverse interests, building social networks as in safety coping nets (Anderies, J.M, 2004). The institutionalizing or organization of collective action can be made through the formation of CBOs or NGOs (ISDR, 2005). Collective action provides a platform for collective horizontal and vertical learning and building and exchange of knowledge from diverse context – specific experience (Lebel et al, 2006; Ostrom, 1998; Berkes, et al, 1999).

In order to build resilience in socio-ecological systems, the important elements are institutions, decisions and collective actions which enhance the capacity for local re-organization, decision-making and action before, during and after disasters. It is important that communities understand their risks and are able to organize themselves to take action.

It is therefore necessary to enhance social capital to build networks for collective action by empowering communities in participating and taking collective responsibility in tackling socio-ecological uncertainties.

2.2.4 Capacity Building and Awareness raising: Learning and Adaptation

Disasters can be substantially reduced if people are well informed and motivated towards a culture of disaster prevention and resilience, which in turn requires the collection, compilation and dissemination of relevant knowledge and information on hazards, vulnerabilities and capacities (UN, 2005). Multi-way information exchange systems can increase the capacity of communities to engage in coordinated actions by making available and sharing timely accurate information about risk. Such systems lead to 'self-organization' of disaster risk management (Comfort et al., 1999). Informed action at the local level- for instance local initiatives to reduce vulnerability and increase community participation- may be facilitated by training, capacity building and resource transfers (Comfort et al., 1999).

Resilience is embedded in building the capacity of a risk-aware community as a tactic for maintaining re – organization; strengthening networks that can be triggered into action during crisis (Lebel, et al, 2006; ISDR, 2005). Capacity building for learning and adaptation needs to start at the local level. It is at this level that disasters, vulnerabilities and risks are felt. This means that building resilience involves context specific measures and not a one-size fits all approach. Natural phenomena are locally based and depend on the characteristics of local ecosystems. Nevertheless, this means that there needs to exist a plan of action for the protection and security of the population that is integrated into a multi-level DRM and Governance strategy. Capacity – building should take into consideration traditional natural resource governance mechanisms and local knowledge regarding flooding seasons, cropping, forestation etc. and strengthen and integrate these capacities into a broader and comprehensive DRM framework. Easily understandable information on disaster risks and protection options are important for citizens in high-risk areas in order to encourage and enable them to perform actions that reduce risks and build resilience (Hyogo, 2005). This information should incorporate traditional and indigenous knowledge and cultural heritage and be tailored to different target audiences, taking into account cultural and social factors.

Finally, it is necessary to build up capacities through the inclusion of disaster risk reduction knowledge in relevant sections of school curricula at all levels and the use of other formal and informal channels to reach youth and children with information and thereby promote the integration of disaster risk reduction as an intrinsic element of the United Nations Decade of Education for Sustainable Development (2005–2015) (Hyogo, 2005: 15). Furthermore promoting the implementation of local risk assessment and disaster preparedness programmes in schools and institutions of higher education and targeted at specific sectors.

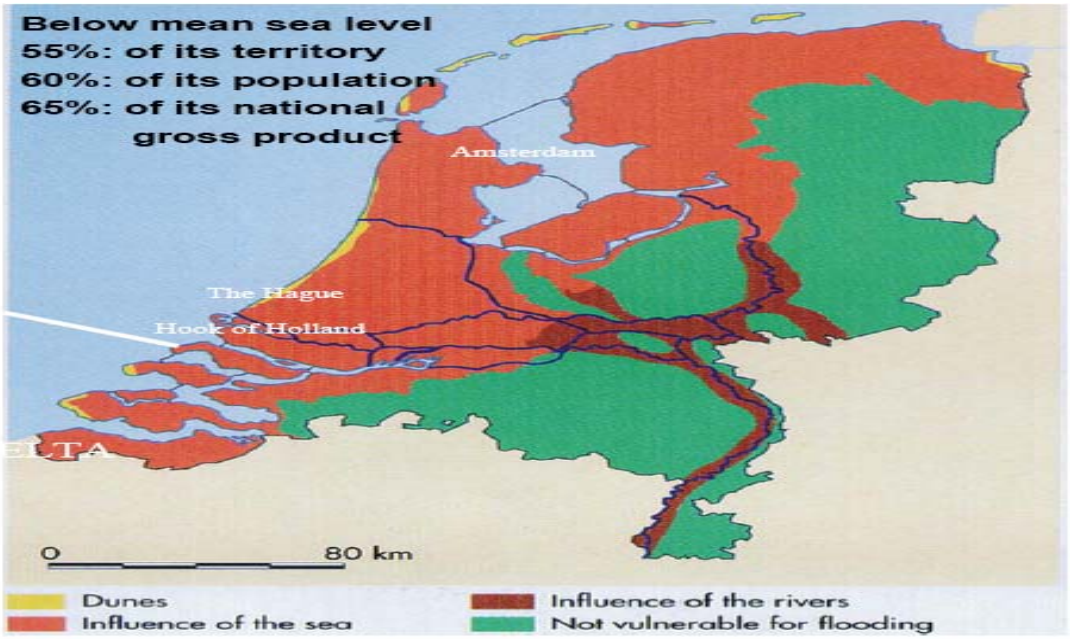
3 INSTITUTIONALIZING RESILIENCE IN DISASTER PRONE COMMUNITIES

3.1 The Case of the Netherlands Flood Management Programme

3.1.1 Floods: A History of Struggle against Water

The control and prevention of floods in the Netherlands is nested within the Integrated Coastal Management Program of the national government. This is because the coast is one of Netherlands's key assets as well as a threat to its survival. The vulnerability and risk levels of the Netherlands are a result of rising levels of its coasts and rivers in a country that is predominantly below sea – level. The Netherlands is host to the Delta, Holland Coast and Wadden Coasts respectively. The Netherlands is part of the North Sea that stretches from Cap Blanc Nez [France] to the North part of Jutland in Denmark [V&W, 2003; pp7]. Vulnerability of the Netherlands towards floods is defined in terms of the pressure from the sea resulting in rising sea level, climate change, storm intensity and low-lying position of the delta as well as the pressure from the land caused by population growth and intensification of land use for economic value and livelihoods support. These factors have subjected the Netherlands to a constant war with water. Figures as illustrated by the map below shows that 60% of the entire country is below sea level. This fragile ecosystem is host to 60% of the entire population, which contributes close to 70% of the entire GDP [V&W, 2003].

Map 1: The Netherlands' vulnerability to floods



Source: V&W, 2003

Coastal and water management in the Netherlands has primarily focused on flood defence as well as ensuring spatial quality. The role of "people", as in local communities has played a key role in the evolution of present day flood management programme of the Netherlands. The ever - changing dynamics of the coast alongside the interaction with other social economic factors has however necessitated the need to create more flexibility in policy and flood defence system calling for a more integrated and flexible approach. The country currently enjoys a safety level of 1:10,000 such that a citizen who lives up to 100 years has a 1% chance of experiencing floods. The institutional framework has played a key role in providing the people with the right incentives to collectively engage in defence against floods and take responsibility as we shall see in the following sections of this paper.

3.1.2 Institutional arrangements for flood management in the Netherlands

Building resilient socio – ecological systems around the Coast in the Netherlands has been a national priority since the 12th C. Complexities emerging due to increased pressure from the sea and the rivers as well human induced pressures has shaped the nature of water and coastal governance towards a strategy for building resilient systems – those that can evolve, adapt, cope as well as resist shocks during floods and storm surges. This policy shift has been an ongoing learning process since the floods of 1953 and has yielded a new definition of a sustainable / resilient system in the Netherlands. A sustainable coast is therefore defined as a function of the strength of dikes, dunes [safety] and the spatial quality within it [V&W, 2003]. This socio – ecological relationship has been modelled at local, regional and national level to identify the weak links / high-risk areas for policy planning, standards design; zoning; prioritization and allocation of budgets as well as for formation and enforcement of legislation. The role of institutions has therefore been shaped around this definition of what a resilient coastal zone is.

Resilience + Sustainability = High safety + High Spatial Quality

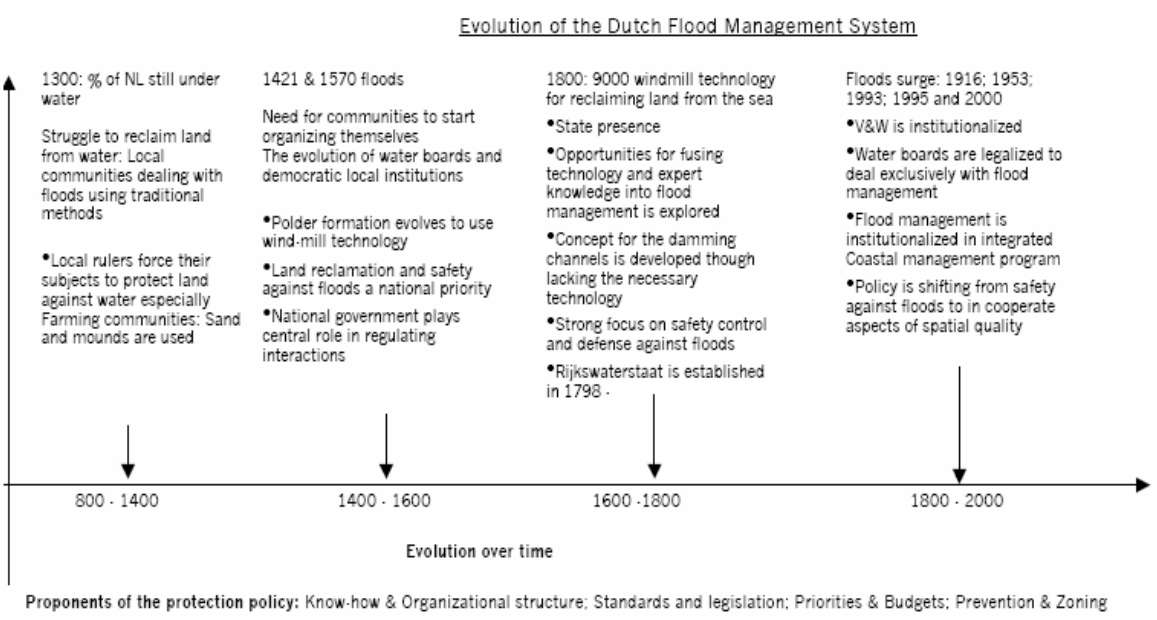
[V&W, 2003]

The process of achieving sustainability and resilience is not as easy as the above equation depicts. To reinforce quality standards requires the combined effort of both the policy makers and the inhabitants of coastal zones, hence the need for local communities, private sectors as well as legislative and cabinet sectors of government and politicians to be

involved in the management and policy formulation process [Eurosion Project, 2003]. This calls for a deliberate process of establishing institutional frameworks that accommodate diverse views, interests and is also capable of inducing collective action and responsibility respectively in the process of keeping the country free of floods. In the Netherlands, the evolution of the flood management as illustrated in the diagram below provides an insight into the multi-layered and polycentric process of decision making so that the dynamics involved in coastal management and hence building resilient ecosystems is achieved.

3.1.1 Evolution of the Dutch Flood Management System at different levels

Figure 2: Evolution of the Dutch Flood Management System



Source: Authors

At the local level, collective action through local mobilization takes a leading role in reclaiming land and enforcing control against floods. These reclaimed lands were referred to as polders. To do this, they constructed dams to reduce the over-flow and control the amount of land lost given the rising sea levels. For coordination purposes, communities began to elect representatives to regional meetings where common water affairs were discussed [Olsthorn and Tol, 2001]. These meetings formed the basis for the emergence of water boards [V&W, 2003]. The very first phase of water boards as grassroots institutions was people-based and enjoyed autonomy to mobilize resources for flood management. In 1815, Water boards were constitutionally endorsed as legal public institutions with the sole responsibility of ensuring public safety against floods at the local level. With this new

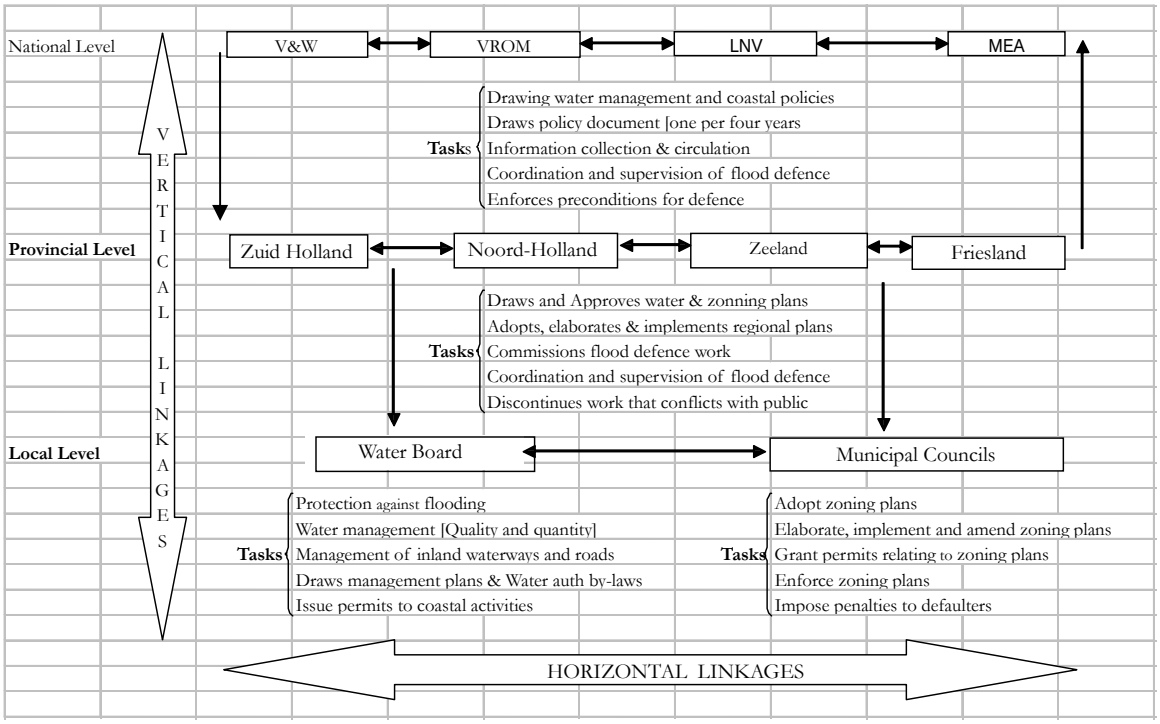
shape, its activities were coined within the Water Board Act (waterschapswet).

Four provinces are directly involved in coastal and water management in the Netherlands given their close proximity to the sea. The provinces formulate strategic and operational coastal management policies within frameworks set by national policy. They are directly responsible for groundwater quality and quantity management. The provincial administrative act allows provinces the power to establish and define water boards' tasks. To fulfil their administrative and supervisory roles, provinces rely on provincial council [elected body of 45-85]; the Provincial executive [nominated by the provincial council] and the Provincial governor [nominated by the government] as its key organs. Each province is divided into municipalities governed by the Municipality act. Like provinces, administrative roles of municipalities rest on the council and executive respectively. Their main task is to adopt, elaborate and implement zoning plans and policies developed by the water boards and endorsed by the national government. The water boards guarantee the legitimacy of the provinces whose public committee sits on the provincial council.

At **national level**, VROM, LNV collaborate with V&W in policy formulation and delegation. The National government is responsible for setting broad policy agendas and proclaiming flood management visions, which are then adapted by the provinces. V&W is responsible for formulating coastal policy and coordinating activities of the provincial and local government. Aspects of water quality fall within the docket of VROM. Coastal and water policies are drawn every four years. Within its tasks, the national government backed by the Flood Defence Act [1996] and the Public Works Act, has the responsibility of drafting the precept document upon which zoning plans are extracted, adopted and implemented. V&W consists of the policy, inspection and Public Works and Water Management directorates respectively. The policy directorate is responsible for the total cycle of policy formulation, planning, implementation and evaluation. Within this directorate is RIKZ, which is a specialized arm of V&W responsible for undertaking risk and vulnerability assessments and which has mini – units within the water boards to periodically update local vulnerabilities within the national agenda. RIKZ in essence is the technical arm of the ministry with the role of acting as an information / knowledge collection, processor, and clearing house. RIKZ is internally divided into the research and development and Policy and information management departments respectively.

Informal level / Non – State actor level: Coastal governance also occurs within informal institutions in the Netherlands. This informal structure consists of all kinds of interactions between stakeholders that are not ruled and enforced by law. Of great importance are public authorities, who also function under the auspices of the government. They include the Association of Provinces [*InterProvinciaal Overleg*], the Union of Water Boards [*Unie van Waterschappen*], and the Association of Dutch Municipalities *[Vereniging van Nederlandse Gemeente*]. They act as unions within which members of their group are able to express their voice. Within the formal system, they link the informal to the formal. In addition, there exist public juries, public courts, coastal community centres, consumer organizations, environmental organizations and public water platforms.

Figure 3: Institutional Framework for Flood Governance in the Netherlands



Source: Authors

3.2 LESSONS LEARNED FROM THE NETHERLANDS CASE

3.2.1 Linking national, regional and local institutions

Through its multi-level coastal and water management policy framework, the Dutch institutional framework has created spaces for multi – layered involvement of institutions in DRM. As illustrated in the institutional arrangement, the disaster risk management program is highly decentralized allowing for establishing linkages between the local, regional and national levels. All the levels have distinct roles contributing to the overall goal of flood prevention and management. At policy level, 4 key ministries are involved in policy deliberation and formulation: This includes V&W, VROM, LNV and MEA. These ministries work in collaboration and facilitate the aspect of learning at the vertical levels representing national level. Linking the regions is achieved through the provincial administration where 4 provinces are involved in coastal and flood management. A team of national coastal management units seating at provincial level reduces the gap between the provinces and the national policy unit. The local institutions - water boards - are democratic institutions which mobilize local resources in terms of resident, non – state actors for collective action and response. The water boards do local mobilization and tapping into local contexts. They shape and bridge the gap between the people and the policy and national response process through their membership as well as democratic processes of participation.

This interactive process of coastal and flood management embedded in institutionalized responsibilities has provided a framework for effectively dealing with floods at all levels through well demarcated spaces for engagement, roles and responsibilities, accountability and efficiency. All the institutions are governed by binding acts and develop standards and regulatory legislation through deliberative processes provided within the water board's framework. A good example is the zoning approach as a regulatory standard, which has penalties as well.

An important question therefore arises of *'How to regulate people's behaviour to, in addition control free – riding as well as reduce voluntary risk*? This question poses a challenge in the provision of a public good. Flood management institutions need to provide incentives, both positive and negative so that people can not only participate

voluntarily, but also assume collective responsibility against *"voluntary risk"*.

Legal procedures and instruments play a key role in regulating behaviour and providing guidelines for interaction and contract enforcement between stakeholders. Once favourable environments have been put in place, it's meaningful to have a law that then enforces a given habit. Within this law, clearly stated statutes have to be documented and penalties enforced for offenders, given the fluid nature of stakeholder interaction. In 1992, it was made law that inhabitants of coastal regions had to participate in water boards' policy of unity say, pay interest principle in the Netherlands which is basically the taxation system for flood prone communities. In this case a sense of ownership and collective responsibility was enhanced. In addition, a national communication and public participation law at all levels of decision - making (local, national and regional) was established as people's voices were deemed as vital especially after the 1995 floods (Olsthorn and Tol, 2001; V&W, 2001). The flood protection act reinforces the importance of long-term safety and extensive protection against floods through both natural and artificial means (V&W, 2003).

The challenges however are that decentralization and multi-level governance is expensive and can lead to high bureaucratic red tape, which has a chance of stifling efficiency and rapid action when a decision has to be made. In the Netherlands, this has been overcome by allowing the water boards to be solely responsible for flood control given that they are in direct contact with the people. The other arms of government therefore depend on the water boards whenever decisions have to be made. The water boards have also developed a tax collection system agreed upon by residents of flood prone areas. This has been useful as it has made the water boards independent institutions and has given the residents the opportunity to demand efficiency, representation as well as enhanced ownership to decisions made. This cost has also enhanced collective responsibility, as people now understand the penalties of voluntary risk.

Multi-level governance is extremely expensive and requires very high annual budget allocations – it is not a one-time event and also requires maintenance. High financial costs are incurred in training, hiring and rewarding both staff and the public on various accounts during the process. Information collection, processing and dissemination, interactive partnerships, public and in-house training programs are also financially demanding. The need for a healthy staff, sufficient in numbers to undertake the responsibility, well trained

and equipped with relevant skills, participatory methods and interactive knowledge is high. Despite the 10% budget cut, V&W massively invests advancing technological flood management infrastructure if not maintaining them. The storm surge barrier in Zeeland ("eighth wonder of the world") cost the government 5.4 billion Euros (V&W, 2004). With 3,500km of the Netherlands resting on primary flood defence infrastructure, Olsthorn and Tol, (2001) note that about 40% of coastal budgets are directed at maintaining the structures.

The repercussion towards people's participation is two fold. First, the growth of machines is limiting the jobs that people can do. It can as well be argued that the construction of sluices in western Holland, the surge barrier in Zeeland and floating screw in Hook van Holland among others acts as a justification for the growing job insecurity in the water management industry in the Netherlands. Secondly, technological growth empowers one group of technical experts unlike the need for social factors and the computerized system is perceived as being superior. This is exemplified by the following quote by the minister during the official opening of the eighth wonder of the world: "the decision as to whether or not to close the storm surge barrier is made by the computer program known as (BOS).

3.2.2 Linking risk awareness, training and communication

Another question that arises when talking about building resilience is to know if the Netherlands Flood Management Institutional framework provides a framework for building an aware and equipped local community. Training and capacity building plays a key role in re-orienting and transforming bureaucracies as well as equipping the communities to be able to effectively understand warning as well as respond to hazards. In the Netherlands, elementary training and capacity building on coastal and water management with a component for flood management is a key area of study and is developed as part of the education curriculum within the Ministry of Education. This seems to create an aware population, as education institutions are a key asset for information dissemination and awareness raising. The water boards also organize local training programs twice in a year to educate residents on DRM and preparedness strategies (V&W, 2000; Harmon, 1994; IUCN, 1994).

The Netherlands has vast information on coastal resources. These can be attributed to the long tradition of research work in the Netherlands on water, coastal management and flood

prevention. The key challenges however is how to ensure that this information is well processed and disseminated to the local communities such that it can be useful and guide their pattern of response. However the key question becomes who accesses this information and how? According to the Earth Trends report of 2003 [FOI] the Netherlands is one of the few countries that has developed a national communication plan enforced in 2002. This plan "legally" guarantees the public to access government information which includes risk and vulnerability assessments, budget allocations as well as future plans at no costs. In this case the residents who are interested are able to reject future plans or contribute towards them, thus overcoming the myth of bounded rationality.

The Netherlands through water boards and provinces has developed nation – wide information flow and public awareness campaigns via mass – media notably 'The Netherlands Lives with Water' on television mostly on Thursdays to educate people on impact of climate change and to familiarize them on government policies towards coastal management. V&W, IPO, UvW and VNG support this program. This program provides the population with the key information appertaining to risks and how their actions have the potential to affect the vulnerability of their fragile ecological systems their responsibility. Apart from posters, billboards and brochures in coastal resorts, the highly used means of disseminating public information is through multi-media (V&W, 2003). This goal is to be fully achieved nation-wide by 2007.

3.2.3 Linking knowledge to policy and decision-making

Linking scientific and local knowledge to policy is important because it builds trust and confidence between policy makers and local communities and also bridges the knowledge gap between scientists, policy makers and communities, which in most cases affects the response mechanisms in terms of timing as well as understanding. Integrated scientific understanding of extreme events can help both to characterize vulnerability and to determine strategies that build resilience. Therefore, any research on and preparedness for extreme events will require partnerships among diverse sectors of society, including research institutions; local, regional, and national public-sector decision-making bodies, and public and private-sector organizations that help prepare for and respond to floods (Sarewitz and Pielke, forthcoming). Interdisciplinary research is particularly relevant for disaster risk management and needs to be embedded in decision-making structures, in order to be directly used and implemented.

In the Netherlands, RIKZ as the technical arm of coastal policy management and flood monitoring works collaborates with Hydraulics department at Delft – IHE and EUCC, the Royal Netherlands institutes for Sea Research (NISR) and of Ecology respectively (Information's Office-RIKZ). NISR for example has four key departments; physical oceanography; chemistry and biology; marine biogeochemistry and toxicology; biological oceanography, marine ecology and evolution. These departments therefore contribute a series of scientific knowledge, which is adopted in policy formulation process. This information is collated, processed and stored by RIKZ who also rely on the water boards for local information. In 2002, a local information system was established and residents have community bulletins where information is collected. A blend of both local and scientific knowledge is therefore utilized not just for policy formulation, but also for formation of the EWS for rapid response.

It is very important that local knowledge is fused into RIKZ's department of information for example which is more scientific and technical. The local information systems for coastal management which has a component for flood control combines remote sensing, decision support systems (BOS), geographic information systems knowledge, and other geological mapping methods together with local residents' and other sectoral information which is then processed by RIKZ's model to inform policy and response mechanisms. This knowledge system is also used for monitoring vulnerability and risks besides informing policy against floods (V&W, 2000). Building resilience occurs through decision-making processes that translate knowledge into action before, during, and after events (Sarewitz and Pielke, forthcoming).

4 CONCLUSIONS

Institutional dynamics can play a role in building resilient socio- ecological systems to cope and anticipate natural hazards and prevent their escalation into disasters; however they need to be integrated into multi-level and polycentric governance and form part of an integrated disaster risk management system. Linking local, regional and national level institutions is necessary to achieve multi-level governance that contributes in building resilience. The challenges for multi-level governance are that it represents an extremely expensive process, which requires high annual budget allocations and maintenance.

Main lessons could be drawn from the fact that training, capacity building and communication is essential for re-orienting and transforming bureaucracies as well as equipping the communities to be able to effectively understand warning as well as respond to hazards. Hence the system in the Netherlands has proven its ability to change and adapt (i.e. build up resilience) to future social an ecological flood risk. Challenges for further research are to identify complementary elements that contribute to building resilience in socio-ecological systems.

Last, but not least linking scientific and local knowledge to policy is important because it builds trust and confidence between policy makers and local communities and also bridges the knowledge gap between scientists, policy makers as well as communities which in most cases affects the response mechanisms in terms of timing as well as understanding. Building resilience occurs through decision-making processes that translate knowledge into action before, during, and after events (Sarewitz and Pielke, forthcoming).

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