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## – Local and Global Knowledge on Flood Management – How Can Local Knowledge Contribute to Resilience in the Mekong Delta, Vietnam?

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## 1. Introduction – Coping with Floods in the Mekong Delta

The waters of the Mekong River recurrently affect the four downstream riparian countries – Thailand, Laos, Cambodia and Vietnam. The monsoonal climate causes tropical storms and typhoons which originate in the Chinese Sea and generate floods by which eight million people are frequently affected in the region causing serious human causalities and economic and social damages (Weichelgartner n.y.: 1) along the Mekong waterways. Flooding – as the major hazard affecting people in the Mekong Delta – is to be considered a natural event in as much as it manifests a human-induced phenomenon. The latter, Villagrán De León (2006: 8f.) denotes as “socio-natural”, referring therewith to hazards which are being created by human action<sup>1</sup>. Climate change and the constant decrease of forest areas mainly due to agricultural extension, which is driven by socio-economic changes<sup>2</sup>, contribute to the aggravating risk of floods in the delta (Weichselberger 2006: 11). This notion of floods as severe hazard is to be contrasted with the perception of floods as development resource constituting livelihood strategies in the delta.

The strong interrelation between flood management and development planning becomes apparent. Due to this relation, the paper will focus on flood management and development planning interchangeably in order to analyze the role of local knowledge for resilience-building.

In order to gradually approach this main concern as to how local knowledge can contribute to resilience in the Mekong Delta, the following structure has been chosen for the term paper. After this very brief introduction to floods as ‘real world problem’ respectively ‘-phenomenon’ in the Mekong region, and a short account on the objectives and methodological framework of this paper, chapter two (problem identification) identifies a knowledge gap to be tackled. It is argued that the strong dominance of global knowledge systems applied to flood management in the Mekong Delta needs to be complemented by a respective account for local knowledge schemes in order to create a holistic, contextualized and consequently more efficient framework for resilient flood management and development. In a next step then, this hypothesis needs to be backed by a dense

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<sup>1</sup> To the author’s understanding a hazard is also socially constructed, because people have different perceptions of the same hazard and associate different risks with it, independent from its actual natural force but on the basis of personal vulnerabilities.

<sup>2</sup> Factors defining socio-economic change are (1) the population increase in the delta, which already is one of the most populated agrarian regions in Southeast Asia (~ 405 people / km sq.) and (2) the delta’s position as the country’s ‘rice bowl’ and the basis for national rice exports (Vietnam is the world’s second largest rice exporter). These factors put pressure on agricultural land which in consequence fosters deforestation (cf. Miller 2006: 10f.).

argumentation, depicting the PROS of local knowledge for development planning in reference to resilience (chapter 4, problem discussion). The conceptualization of local knowledge and resilience beforehand (chapter 3) serves as theoretical framework for the problem discussion. The concluding remark (chapter 5) draws special attention to the challenges of interdisciplinarity and transdisciplinarity when considering local knowledge not as residual factor but as an essential component of a holistic knowledge approach to flood management and development planning for the Mekong Delta.

## **1.1 Aims and Objectives**

The purpose of this paper is twofold. First, it aims to reflect more closely on especially one aspect that the author of this paper was taken by during the interdisciplinary course – namely, the complexity of phenomena one deals with in development studies. This complexity is aimed to be reviewed along the case of flood management. The same complexity is not only fascinating but may also be deterrent and lead to half-hearted commitment by development practitioners or researchers. Therein lies the second aim of this term paper. Again, along the example of local knowledge's contribution to resilience, the paper is supposed to critically reflect on the problems and challenges implementation-oriented research and development practice still face when trying to do justice to the complexity and politics of development.

## **1.2 Methodology**

The following paper is based on literature review, internet research as well as inspired by the outcomes of a recent informal focus group discussion with PhD students of the WISDOM<sup>3</sup> project. Thanks to their in-depth knowledge, the Vietnamese PhD colleagues from natural science and engineering disciplines imparted an understanding of the Vietnamese flood governance regime, based on a highly complex, partly completed dyke system. Interesting but also challenging for a non-natural scientist was the elaborated presentation by one of the Vietnamese doctoral students from the team, working on a hydrological model for the delta. In the meeting the main discussion centered around technical issues, but one point was raised that naturally touched the disciplinary antenna of the author being a social scientist: conflicts between government and farmers arise due to their different perceptions of risk, the former following a protective approach to floods, the latter strongly depending on the waters of the Mekong and therefore lobbying for

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<sup>3</sup> Water-related Information System for the sustainable Development Of the Mekong Delta in Vietnam.

moderate, proactive coping strategies. This conflict highlighted the empirical relevance of the question to be addressed throughout this paper. How can community resilience be strengthened through local knowledge systems, accounting for the diverse actors' interests being at stake in a predominantly scientific knowledge based approach to flood management? This existing 'real world conflict', neatly combines the concept of local knowledge – for which ample references were found especially in ethnological and development sociological writings – and the boundary concept of 'risk and vulnerability'. Lectures in the interdisciplinary course imparted a good understanding of the boundary concept to be applied in this paper; especially the publications by UNU-EHS<sup>4</sup> on risk and vulnerability proved a valuable source for answering the main question of this paper.

## 2. Problem Identification – Towards a Holistic Knowledge Approach to Flood Management

Any issues and problems related to the water sector in Vietnam have been mainly technically dealt with. Vast engineering projects contributed to a highly sensible human-regulated water regime. Former government policy put most weight on structural devices, such as dams and dykes in order to control floods and to regulate the waterways in a way to maximize agricultural intensification and to protect its people. (cf. Weichselgartner 2005; Miller 2006).

These prevailing structural control strategies by the government strongly focus on the vulnerability aspect of flooding which legitimizes the protective efforts undertaken by the government. But this management strategy seems to be way too one-sided considering the actual situation of diverse livelihoods in the Mekong Delta. Since many people crucially depend on its nutritious and revitalizing streams for subsidiary agri- and aquaculture, the aim cannot be the prevention of flooding itself. Instead, more weight needs to be put on the reciprocal counterpart of vulnerability, namely resilience (see 3.2) which relates to the ability of people to efficiently mitigate and respond to flood hazards effectively (cf. Weichselgartner 2005: 4).

The strong dominance of scientific devices for top-down water regulation has neglected local knowledge and practices in proactively and flexibly coping with floods and also led to an underestimation of the importance of the local embeddedness of human-controlled water schemes for efficient flood management.

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<sup>4</sup> United Nations University – Institute for Environment and Human Security.

It therefore is important to impart throughout the discussion that flood management does not solely imply the transformation of the physical landscape but also has very strong implications for the flexibility and modification of the social landscape as well. Only through approaching the respective local knowledge systems, these complex social dynamics behind the technical control mechanisms can be made visible and contribute to a holistic perspective on the waters of the Mekong – being perceived as hazard and as resource – which then can translate into more coherent management strategies.

Since it is acknowledged that about two thirds of the world's population live in areas which got at least once affected by e.g. earthquake, floods and droughts between 1980 and 2000 (cf. UNDP 2004: 1) writing and projects on disaster preparedness dealing with global devices, such as early warning systems based on remote sensing data and aerospace images, experienced an enormous upswing. Despite this boost in concern with disaster risk management in academia and humanitarian relief and development agencies, the topic so far got rarely linked explicitly to local knowledge systems. While the concept of local knowledge nowadays is mainstreamed in international development discourse, especially considered relevant for projects in the agricultural, environmental or health sector (cf. Schröder 1995: 1 / 8), the links between local knowledge and disaster management and preparedness have hardly been analyzed in respective scientific communities nor applied for project design by development practitioners (cf. Dekens 2007: 20f.).

Contributing to closing this knowledge gap on local knowledge and disaster preparedness<sup>5</sup>, this term paper is supposed to impart a better understanding of the role of local knowledge for flood management and coherent development planning. Before however entering the actual problem discussion, the next chapter will provide a brief introduction to the different concepts the term paper is based on. Local knowledge needs to be conceptualized and its proposed linkage to 'resilience' in flood management more closely elaborated on.

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<sup>5</sup> The following discussion will not focus exclusively on preparedness but more generally on the disaster management cycle as a whole, referring to phases of mitigation and response.

### 3. Theoretical Framework: Conceptualizing Local Knowledge and Resilience in Flood Management

#### 3.1 Local Knowledge

Originating in ethnology, local knowledge came to the fore on the international development agenda when first pessimism spread on the hegemonic status of post-Second World War top-down developmentalism in the 1970s (cf. Schuurman 2000: 7; Nuscheler 2004: 78f.). What Nederveen Pieters (2001: 12) denotes the “democratisation of development politics“ relates to approaches of bottom-up development that finally entered mainstream discourse bringing ‘humans back in’ – focusing on local knowledge and participation of target groups – in order to fight poverty (cf. Schröder 1995: 5 / 7f.).

Nowadays, the reference to local knowledge in respective academia, its ‘mainstreamed’ acknowledgement by development agencies or it being at the heart of e.g. lobbying activities of non-governmental organizations (NGOs) produced a diverse range of definitions and special terminologies of local knowledge. A discussion on the whole spectrum of *termini* and the different meanings associated with it certainly goes beyond the aim and capacity of this term paper<sup>6</sup>. Nevertheless, it seems to be important to more closely reflect on the term ‘indigenous knowledge’ since first, it is internationally the most commonly used one; and second, its conceptual review will help to make transparent the author’s understanding of local knowledge and therewith the conceptual framework this paper bases its argumentation on.

In its original sense, ‘indigenous’ referred to knowledge systems that were considered as traditional or informal. This rather descriptive category however was changed and turned into a normatively loaded concept in the 1960s to the late 1970s. ‘Indigenous culture’, understood as the culture of the marginalized became the ‘political’ anathema of the ‘high culture’ of the sovereign state (cf. Scoones / Thompson in Antweiler 1995: 24). Despite its worldwide popularity and usage though, the term ‘indigenous knowledge’ does not account for the meaning of local knowledge as understood in this paper. The author distances herself from the above mentioned term for several reasons: *First*, its inherent normative hence political connotation implies a qualitative assessment that discriminates between indigenous knowledge of ethnic minorities as just and ‘good’ knowledge to be protected and global scientific knowledge – exported by Western societies and applied to

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<sup>6</sup> For a detailed elaboration on the different terminology and associated meanings of ‘local knowledge’, see Antweiler (1995: 24f.).

the ‘rest’ of the world – to be disintegrating and ‘bad’<sup>7</sup>. While the over-idealization of the concept obscures any weaknesses of indigenous or local knowledge<sup>8</sup>, this paper aims to show that none of the different knowledge systems is better or worse than the respective other. It rather supposes to discuss the integration of these different knowledge systems to equal parts as device for the creation of holistic flood management regimes and therewith as contribution to resilience-building in flood-prone areas. *Second*, the strongly proclaimed dichotomy between global and local knowledge (see below) is artificial in the first place. According to the sociology of science perspective (cf. Berger / Luckman 1980: 26f. / 45ff.) local knowledge is not exclusively characterizing non-Western societies and global knowledge not exclusively to be associated with Western societies. Instead both, forms of local knowledge and global knowledge constitute every society in general and are therefore not to be misunderstood as bipolar reference systems. *Third*, the term ‘indigenous’ suggests the association of static and closed communities. This association is reinforced by the essentialization of ‘the’ local versus ‘the’ global. In contrast, the concept applied in this paper defines local knowledge as an open, flexible, learning and dynamic system.

After this general confrontation with the meaning of indigenous knowledge, some further essential features of local knowledge have to be discussed contrasting it with what was already referred to above as ‘global knowledge’. Classical scientific knowledge concentrates on universal laws which seem to be globally applicable. Global or specialized knowledge is represented by so-called ‘experts’. Local knowledge however gets associated with pre-scientific, pre-modern knowledge – an association which in itself contains a normative connotation. In order to avoid any disparaging undertone it therefore seems to be useful to define local knowledge as knowledge and practices based on everyday experiences that endow actors with certain frames of reference of interpretation and meaning and enables actors to meaningfully cope and act in the social world they live in (cf. Lachenmann 2004: 127). This requires local knowledge to be holistic and sets it apart from specialized global knowledge, while of course still keeping in mind, that none of the different forms of knowledge represent absolute reference systems.

It is important to note, that ‘local’ does not inevitably stands for geographical or physical space. It rather more generally denotes context-bound social spaces in which

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<sup>7</sup> See e.g. Hobart as referred to in Antweiler (1995: 44).

<sup>8</sup> Local knowledge is not automatically equally distributed in society, just or democratic. In fact, access to local knowledge within the community might strongly be based on power relations (cf. Schröder 1995: 4f.).

“communities of practice” (cf. Gerke / Evers 2006: 5) share, negotiate and potentially modify their stock of knowledge in order to being able to cope with current situations or future challenges (cf. Schröder 1995: 4). While indigenous knowledge is bounded in shared language, tradition, and values of a particular community (cf. Gerke / Evers 2006: 5) indicating a conserving and isolating tendency, local knowledge is constantly and actively revised in reference to problem-orientation. Due to its context-bound and situated nature of problem-solving (cf. Linkenbach 2004: 234), ‘local’ then is best understood as the opposite to the meaning of ‘globally valid’.

Since up to this point the discussion on local and global knowledge has been very abstract, it seems to be important to actually illustrate forms of local and global knowledge on flood management (chapter 4). Beforehand however, attention will be drawn to the concept of resilience and to its linkage with local knowledge.

### 3.2 Local Knowledge and Resilience

In the literature of risk management and disaster preparedness, many different models and definitions on vulnerability are to be found<sup>9</sup>. The concept of vulnerability encompasses various dimensions – one talks e.g. of economic, political or social vulnerability of certain people or a certain community, that is at stake when facing a disaster. Due to this conceptual complexity, the paper will concentrate on a very specific aspect related to the boundary concept of ‘risk and vulnerability’ in order to answer the prevailing question as to how local knowledge can contribute to an efficient flood management regime in the Mekong Delta. As has already been mentioned (see 2.), flood events in the delta have an ambivalent character – they are perceived as hazard and as development resource at the same time. This requires a crucial balance between top-down protection measures and proactive coping and adaptation strategies. Due to the strong local knowledge component of the latter, the paper’s focus will be put on resilience.

Resilience is the reciprocal counterpart to vulnerability. This means that the more vulnerable a certain system, the less resilient it is and vice versa. According to Pelling, resilience is “the ability to cope with or adapt to the hazard stress through preparedness and spontaneous adaptations once the event has manifested itself” (Pelling 2003 quoted in Villagrán De León 2006: 50). Since there are as many different definitions of resilience as

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<sup>9</sup> For a good general conceptual and methodological overview of vulnerability as discussed in academia, among disaster management and development agencies, and in the climate change community, see Villagrán De León (2006).

to vulnerability, the author of this paper tries to concretize her own understanding by elaborating on Pelling's definition: coping mechanisms as inherent in the concept of resilience can take many different forms. Coping capacity e.g. can relate to diverse economic, infrastructural or ecological assets that enable people in flood-prone areas to efficiently deal with and consequently to be less vulnerable to the situation of hazard. These material or technical assets which communities possess of are to be understood as complemented by a rather intangible form of asset. This is where local knowledge in its various forms (see chapter 4) comes in and leads the following discussion to its starting point, namely to the question as to how local knowledge actually can contribute to resilience-building.

The author understands various coping strategies which people apply in order to handle or to adapt to flood situations as forms of local knowledge which can directly contribute to resilience. But the author argues further, that the full potential of local knowledge as one important factor in building community resilience crucially depends on the coherent integration of local knowledge systems into the formal disaster and development strategies of the Mekong Delta as a whole. In other words, local knowledge can unfold its effectiveness as factor of resilience only – and this leads back to the “how” as it is questioned in the title of this paper – if it is *acknowledged* and *communicated* as equal component in a holistic flood management approach. What exactly is meant by this hypothesis will hopefully have been made clear by the end of this paper. In order to achieve this, the following problem discussion will mainly centre around one major question, that will gradually lead to answering the overarching issue of this term paper, namely “How can local knowledge contribute to resilience in the Mekong Delta, Vietnam?”.

#### 4. Problem Discussion – The Challenge of Complexity

Along concrete examples of local and global knowledge on flood management in the delta, the following section will elaborate on the importance to account for local knowledge in water control strategies. This then would lead to the concluding remark (chapter 5) on the actual integration of local knowledge into the formal flood management system, considering the different stakeholders and interests to be addressed for such a complex venture.

#### **4.1 Why should local knowledge be used for flood management and development planning?**

In order to answer this question it is to begin with some examples that show the diverse forms local knowledge (and global knowledge) on flood management can actually take. The examples will already imply the role of local knowledge for resilient flood management, which will be concluded on at the end of this paragraph 4.1.

In her text, Miller (2006: 21f.) outlines local risk strategies that were usually applied by farmers in the Mekong Delta before the major governmental interventions aiming to construct a human-controlled water system. These former local risk strategies present the gathered experiences and knowledge on natural flood cycles. Local farmers adopted their cropping systems to the natural seasonal water availability. Such adaptive strategies represent a much specialised, problem-oriented form of local knowledge which had a direct effect on resilience – the application of this practical knowledge enabled the farmers to actively manage the flood cycles. This specialised knowledge contributing to resilience however rendered obsolete with the implementation of the national development strategy strongly focussing on agricultural intensification. The government introduced high yield rice varieties with very specific water requirements to be satisfied by technical irrigation schemes.

Such infrastructural devices can be fairly reliably managed through the use of surveying and visualising techniques to control the geomorphologic situation. The Mekong River Commission's (MRC) Technical Support Division e.g. invested in flood hazard maps based on hydro-dynamic modelling and remote sensing techniques (cf. Weichselgartner 2005: 6). These technical and technological devices to calculate e.g. on water balance and velocity are manifestations of global knowledge, processing science-based logical data that can be universally applied and guarantee the technical functionality of dams and embankments for sensible water control all over the world. But in fact there is more to these man-made control systems than mere scientific laws and logics. It has consequences which can only be approached through a local knowledge perspective that helps to explain why flood management in the Mekong Delta is not yet sound but encounters efficiency problems which have not been foreseen by scientific ‘calculations’.

The latter assertion needs to be exemplified in order to demonstrate the importance of the local embeddedness of technical and institutional top-down approaches to flood management. Miller (2006: 21ff.) explains that due to agricultural intensification

techniques, the spatial scale of water control has changed from on-farm level to commune-level. Consequently, decision-making on water management has shifted from the formerly independent farmer to local authorities, prescribing cropping calendars and respective water use which requires greater cooperation between farmers. In order to tackle this problem, the government established formal institutional mechanisms for the management of water resources (e.g. commune people's committees on local level). Nevertheless, these formal institutions are not very successfully operating, due to several reasons: farmers would be reluctant to cooperate in agricultural activities and water matters because of the forced collectivisation they experienced in the late 1970s and early 1980s and the long tradition of independent farming practices.

This specific socio-cultural context, on which the farmer's hesitation to get involved is based on, has to be taken into account in order to explain why the top-down imposed institutions might not be working. Their past experiences and history of farming practices constitute part of their local knowledge system which serves the farmers as framework for current action and coping rationalities. Because this reference scheme contradicts the new demand on cooperation, the farmers refuse to get involved in the respective institutions. If these rationalities are not being made visible and openly negotiated than any further initiatives of formal institution building and strengthening resilience will fail (see below).

The latter case presented, already hints at forms of local knowledge that differ from the kind of knowledge as embedded in the cropping strategies that were discussed above. In order to elaborate a little bit more on the diverse modes that constitute local knowledge systems and their linkages to resilience, another example needs to be given.

According to the author of this paper, local knowledge also relates to informal norms and practices. Again, Miller (*ibid.*: 3ff.) gives an interesting example on how such informal norms and practices might produce structural exclusion of certain groups in society in regard to water control and therewith flood management<sup>10</sup>. Her study on gendered water relations in the delta hints at the importance of taking into account local knowledge in the form of informal practices. Access to water strongly depends on access to land in the Mekong Delta. By law, land use certificates from the government are to be issued in the

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<sup>10</sup> As has already been discussed above, local knowledge systems are not necessarily democratic. Instead, norms, conventions and 'unwritten' rules may be unjust and exclusionary in nature. To the author's understanding, such informal practices would nevertheless to be defined as part of the local knowledge system, because it structures the coping rationalities and coping capacities in a "community of 'good' or 'bad' practice".

name of husband and wife. In informal practice however, it is only issued in the man's name. This in consequence, excludes women from any formal consultation or decision-making processes concerning matters of land and water control, although women play a significant role in agricultural production for subsistence or cash crops. This exclusion of women from formal decision-making on agricultural and water matters goes along with a loss of unrecognized innovative coping strategies. Hence, while the formally mandated institutions are failing (see above), the most successful informal cooperation of local credit and loan schemes headed by women are not taken advantage of as 'cases of good practice' for the official strategy of resilience-building because they are not up-ward communicated.

This example raises two important aspects to the question as to why local knowledge is important for development planning: (1) because concrete local knowledge schemes such as the credit and loan initiatives of women dealing successfully with risk situations offer innovative, functioning and adjusted coping mechanisms of resilience; and (2) because the socio-cultural and ecological holistic perspective of local knowledge is important because it can help to make visible rather hidden power relations (e.g. gender-wise) in a society and its respective consequences. Without taking into account these tacit forms of local knowledge, which in fact have a strong relevance for everyday practice in society, the aim of coherent and just development planning considering the diverse interests of actors having a stake in the water control system might be at risk. Instead, continuing structural exclusion of women for example would lead to their further marginalization. Hence, the exclusion from farmers' meetings with commune and irrigation authorities hinders access to important water-related information (cropping calendars, agricultural innovation etc.), which is crucial "as competition over water has increased with intensification, making water-related information critical to successful production activities" (*ibid.*: 26). In this regard, water control management needs to be holistic, backed by negotiations of the different stakeholders involved; otherwise flood management runs the risk of only redistributing rather than resolving risk (cf. Lebel et al. 2007).

The presented discussion already implied what the actual contributions of local knowledge for development planning are. The discussion also served to impart an understanding of the many different forms of local knowledge. The following résumé can be derived from the examples given:

It has been shown that complex social dynamics are hidden behind the technical and engineering 'façade' of the human-regulated water regime in the delta. There is no doubt

that scientific knowledge of e.g. hydrology, soil morphology as embedded in particular engineering technology (complex dam systems etc.) save many people from severe flood risks. But what is important is that such global devices have to be adopted to the complexities of specific local contexts, meaning global knowledge has to be “localized” (Gerke / Evers 2006: 4).

People have developed a whole range of effective pre- and post flood management strategies. People for example organise labour teams to help each other to recover the land after flooding and to bring in the harvest on time preventing a severe impact on the yield by flood level rise, or e.g. people contribute rice to a commune fund which can be distributed to the ones who have been most severely affected by the floods (cf. Beckman / An / Boa 2002: 20). These coping strategies are forms of local knowledge. Their application directly contributes to the resilience of the members involved in such informal social institutions and networks that have been created overtime in order to live with the floods. Besides these many positive knowledge embedded social mechanisms of flood management, the social dynamics ‘behind the dykes’ also enclose discontinuities as in the example of the conflicts between the formal flood governance regime and the farmers hesitating to get involved in local water control institutions that have been top-down mandated by the government (see above). Such local discontinuities have a negative impact on efficient flood management and therefore resilience, because institutions are just not working due to missing local acceptance of top-down approaches. Another example is the structural disregard of women’s knowledge going back to the informal norms and practices concerning land use entitlements. The informal practices of land use and therefore water management are also to be regarded as a certain form of local knowledge.

Obviously, there is a difference between the types of local knowledge as discussed in the last two examples (farmer; gender) contrasted with the examples of the knowledge embedded coping strategies of labour teams or commune rice banks as have been presented above. In the latter case local knowledge appears very much action-oriented and explicit, centring on a specific problem-orientation (harvesting before flood level rises, e.g.) which has a direct effect on resilience. In contrast, knowledge in the form of informal practices and norms is less explicitly to be articulated, but nevertheless forms a strong but unconsciously operating reference system for coping rationalities and everyday action.

These forms of knowledge can only positively contribute to resilience if they are made transparent and negotiated.

The importance to facilitate knowledge interface processes<sup>11</sup> can be exemplified when coming back to the case of farmers vs. local water authorities: To dissolve the existing discontinuities it would be crucially important to facilitate processes of negotiation between farmers and government officials to find coherent solutions as to how local institutions of water control and its respective mechanisms of responsibility and decision-making should look like. Only if the local population sees itself and its diverse interests represented by such institutions, these institutions – because they got locally accepted and adopted – will make a positive contribution to bottom-up resilience. Tacit knowledge systems thus have to be made transparent, negotiated and then can only in a second step be translated into resilience.

Another illustration which shows that ‘knowing’ alone does not always and automatically contribute to resilience could be as follows: a ministry of public works constructs levees, which get destroyed by new floods. Since the authorities do not consult the local population who is aware of the failures of previous attempts, government agencies keep rebuilding vulnerable levees (cf. Villagrán De León 2006: 52). In other words and focussing on the aspect of resilience, this again shows that some forms of local knowledge cannot translate into resilience until they are communicated and negotiated. Only if the experiences of the local population had been acknowledged in formal development planning this would have led to more efficient or just dam constructions and would have finally paid off as a sustainable strategy of resilience.

Besides the insights into the various forms local knowledge is embedded in, the following conclusion can be drawn. Local knowledge is important for coherent and sustainable flood management and development planning, because it is holistic and therefore reflects on the diverse interests at stake in project planning and serves to make visible inherent discontinuities and conflicts. Since flood management entails a strong factor of uncertainty, local knowledge and its holistic perspective on the local context can moderate mere risk redistribution and socially embed global technical devices. Local knowledge inserts innovative social capital into project planning and creates ownership and

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<sup>11</sup> According to Norman Long, different value systems and rationalities of action encounter at the ‘interface’. The interface is where structural discontinuities – meaning communication problems and conflicts due to different rationalities and value systems [local knowledge systems] – might appear (cf. Long 1990).

empowerment. This reasoning is based on efficiency and normative argumentation, both overlapping in the common goal of sustainability. In his statement, Weichselgartner perfectly touches the core: “[...], cooperation across society is hindered when disaster reduction programs treat people as passive victims or ‘clients’ in disaster management processes, ignoring the experience of those most at risk, and where ‘paternalistic’ science and technology do things *to* them and *for* them, rather than *together with* them” (Weichselgartner 2005: 4).

## 5. Conclusion

In the discussion it has been proved that floods cannot be efficiently managed by exclusively applying engineering or classical natural science knowledge. Rather these are part and parcel of an interdisciplinary venture also calling in social sciences' perspectives and ecological reasoning. Even flood management seemingly easy to grasp, contains in itself frictions, discontinuities, causalities and in miniature mirrors the complexities of development as a whole. However, it has also been shown that it is crucial not only to rely on scientific accounts when dealing with flood management.

Taking into account the many non-scientific problem-solving capacities related to floods leads the attention to the local stakeholders concerned and dealing with floods on the basis of their everyday and practical knowledge. Transdisciplinarity comes to the fore when the facilitation of different knowledge interfaces is concerned (see above). The institutionalization of knowledge interfaces is crucial for the translation of some forms of local knowledge into community resilience, as has been discussed. But exactly this constitutes a core challenge to the development community: The difficulty is to go beyond mere populist concepts of participation, in which local stakeholders are consulted, but their knowledge schemes nevertheless handled as isolated module to be ‘attached’ to conventional development planning (cf. Antweiler 1995: 31). This certainly also constitutes a major challenge for the implementation of a holistic water-related information system as envisaged in the WISDOM project. Describing local knowledge is essential for basic research. But if the aim is to establish an efficient flood management regime, local knowledge needs to be equally integrated which requires first and for most strong political commitment.

The Vietnamese government introduced its mitigation strategy “Living with Floods” as a result of the severe flood in 2000. This new framework is oriented towards adaptation and

promotes the involvement of local communities – therewith their experiences and knowledge – in disaster planning (cf. Weichselgartner 2005: 10). Nevertheless, the transformation from reactive top-down protection strategies to bottom-up mitigation and development planning certainly will take some time and commitment.

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