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Engaging in Local Ecological Knowledge Integration – An Ethnographic Approach to Understanding Social- Ecological System Change

The Case of the Tam Giang Lagoon, Vietnam



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Abstract

Local ecological knowledge (LEK) represents a key link between resource users and their social-ecological system. Adaptive co-planning aims to integrate LEK to potentially complement scientific-based advice and ensure the sustainable use of environmental resources. This study investigates what important factors a planner need to consider when accessing LEK by applying an ethnographic participant observer approach in the case of a fishing village at the Tam Giang lagoon in central Vietnam. It shows that mutually reinforcing local perceptions and self-organized network adaptations are coevolving with system changes, adjusting to economic pressures and cannot be split into reductionist categories for knowledge integration purposes, but rather have to be seen as culturally embedded into their specific context.

Key Concepts: Local Ecological Knowledge, Adaptive Planning, Knowledge Sharing, Ethnography, Epistemology, Social-Ecological Systems

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List of Abbreviations

AO	Aquaculture Operator
EBA	Ecosystem Based Approach
IWRM	Integrated Water Resource Management
LEK	Local Ecological Knowledge
LRU	Local Resource User

1. Introduction

All ecological [...] arguments are simultaneously political-economic [...] argument and vice versa. Ecological arguments are never socially neutral any more than socio-political arguments are ecologically neutral. Looking more closely at the way ecology and politics interrelate then becomes imperative if we are to get a better handle on how to approach environmental/ecological questions. David Harvey (1993, 25)

Taking the words of David Harvey to heart a planner approaching contemporary environmental issues may realize that this is indeed a socio-political undertaking. Especially coastal ecosystems and their resources worldwide are degrading due to a range of underlying economic forces and interacting anthropogenic drivers of change, such as overexploitation, pollution and climate change (Hughes, 2005). Environmental planning of marine and terrestrial resources is now at crossroads facing the complex challenges of a crisis unprecedented in human history (Crutzen, 2002). Scientific and top-down planning methods, however, are in many cases lacking the flexibility to deal with these dynamic and complex challenges, which in turn gave rise to more adaptive and participatory planning approaches (Berkes, Colding and Folke, 2003). Within this shift to a new communicative planning paradigm, the inclusion of local stakeholders has become of increasing importance as their local ecological knowledge (LEK) has been linked to resilience and social learning enhancing capacities. Local resource users (LRU) are at the interface of the social and the ecological and, embedded in their complex and ever-changing social-ecological system can be considered both as drivers and recipients of these exposures (Bennet et al., 2015). Their unique and adaptive ways of surviving and striving within their specific context represent a valuable information source for sustainable planning (Hornidge and Antweiler, 2014). However, the differences in epistemologies and narrow conceptualizations of the concept of LEK by formal institutions poses a great barrier to science, as it is intangible for conventional reductionist methods of measurements and quantitative data collection. This has resulted in an overly focus on the primary producers and the ecological part of the system by scientific research, neglecting that LEK is highly case-dependent, horizontally consolidated throughout the community as a whole and cannot simply be separated from their local context (Gadgil et al., 2002; Fazey et al., 2012). Furthermore, critical scholars have pointed out that LEK itself is biased as it is coevolving with contemporary developments in the environment which are themselves shaped by the very economic imperative causing the ecological crisis in the first place (Nadasdy, 2007).

2. Research Question

Concerning the above, this thesis' purpose is to answer the following research question:

How may an ethnographic approach contribute to improve planning for social-ecological system changes through an understanding of local experience with environmental resources and village network adaptations?

In order to address this research question appropriately with suitable examples at hand, the case of the small fishing village Trung Làng at the northern banks of the Tam Giang Lagoon in central Vietnam was chosen. The location has been a site of co-planning trails with the hopes to avert a possible collapse of the invaluable hotspot of biodiversity and natural resources, following a decades-long uncontrolled economic exploitation (Abelshausen, Vanwing and Jacquet, 2015). The major part of the fieldwork focused on the local level with an ethnographic participant observer approach. The aim was to investigate the three sub-questions, necessary to answer the main research question, which are:

1. What are local experiences and perceptions about social-ecological system change?
2. What are local level network adaptations based on these experiences and perceptions?
3. What are potential points of departure for an ethnographic approach in accessing LEK?

3. Significance

3.1 Scientific Significance

Recognizing and studying LEK provides the opportunity to get access to localized information, understand local perceptions about their social-ecological system more holistically and therefore draw on new spatial and temporal viewpoints, which top-down scientific management lacks (Bundy and Davis, 2012; Mamun, 2010). This is of particular importance for Vietnam, where new methods such as co-management have entered the spectrum and have been tested for the past two decades (Abelshausen, Vanwing and Jacquet, 2015). However, there remain barriers and challenges to the LEK integration process, inter alia, induced by a knowledge gap in how the exchange of different knowledge systems can be conceptualized (Fazey et al., 2012; Mamun, 2010). Furthermore, opinions about the scientific validity of LEK and the potential of the new and more adaptive management approaches to change the current resource trajectory towards sustainability diverge. Therefore, there is a need for further investigations on the current state of LEK and channels through which it can enter management ideas (Nadasdy, 2007; McLain and

Lee, 1996). This analysis would further emphasize that the social is inextricably linked with the ecological and sustainable environmental planning is more likely to be achieved when these interrelations are taken into account (Berkes, 2011). Moreover, the results of this case study are not only important for environmental management disciplines but could contribute to compiling a synoptic picture of large-scale environmental change and social-ecological regime shifts at the coast of Vietnam and internationally, as they traverse and impact a manifold range of human activities (Bundy and Davis, 2012; Gadgil et al., 2002). These findings and further insights into processes of LEK can therefore contribute to a variety of fields, which intersect with sustainability, participation and policymaking and are practically non-existing (Abelshausen, Vanwing and Jacquet, 2015). As it is difficult to systematically conduct properly planned and replicated experiments in complex systems, local observations can be of significant value (Bennet et al., 2015). However, studies at the local level require time, continuous involvement and a range of interdisciplinary skills and are therefore rare and in high demand (Berkes, Colding and Folge 2000; Berkes 2011).

3.2 Social Significance

Pursuing research about the potentials of LEK is not only about enhancing environmental resource planning and ecosystem conservation, but also about the very process of environmental decision-making as a key component of political ecology itself. Essentially, in livelihood determining matters, being able to share one's own experience is also a concern of having a voice within hierarchical governance and management structures. Depending on who is addressed, being able to share local experience might be about livelihood, profit, protest against environmental overexploitation or even political resistance or cultural critique (Hornidge and Antweiler, 2014). Understanding these discrepancies is part of the determination process of what institutional changes, interventions and least harm adaptations are necessary to cope with social-ecological change (Nayak, Armitage and Andrachuk, 2015). A flexible management regime, which embraces the notion of different knowledge systems, mirrors the values of involved LRUs through adaptive and deliberative approaches and will more likely receive local support and have higher chances of successful implementation (Schoeman, Allan and Finlayson, 2014). By investigating the state of the current local knowledge as a concept for sustainable resource management, this study aims to increase the recognition of the value of understanding different knowledge systems and to highlight the contribution LRUs can make to it (Santasombat, 2011; Bundy and Davis, 2012). After all, the concept of LEK naturally draws the attention and allocates resources to those who are dependent on them the most (Agrawal, 1995).

4. The Case Study

As the name already implies, an exploration of LEK would require research at the interface of LRUs adaptations to changes and local environmental planning. A case study approach offers the necessary local context and the base for in-depth observations and new insights into complex causal processes and correlations (Hall, 2003). According to Lijphart (1975, p. 160), a case study is a “study of a certain problem, proposition, or theory”; it is a detailed examination of a single phenomenon. Whereas scholars often claim that case studies offer limited scientific value, due to low potential to generalize, Flyvbjerg (2006), argues, that case studies can act as a ‘Black Swan’ and thereby test, reject or produce a theory. Furthermore, by purposefully selecting a particular setting, indeed conclusions can be drawn that are likely to be relevant for other cases. Arguably, the Tam Giang lagoon in central Vietnam is a case of such relevant settings. Less privileged regions, such as Vietnam, which would nevertheless profit from the integration of LEK into planning, are predominantly governed by autocratic hierarchical models (Phuong, Biesbroek and Wals, 2018). With Vietnam recently being reclassified as a middle-income country from a low income country and forfeiting a big part of the concomitant external support, every effort in capacity building is appreciated (World Bank, 2013). The site selection process was seeking out a suitable and important social, economic and environmental asset of high complexity due to a multiplicity of interrelated actors, activities and exposures in a top-down governance environment with proven adaptive planning efforts.

Through intensive literature research, networking and prior preparation in the time from December 2018 to April 2009, the Tam Giang lagoon was identified as a valuable context in which to execute this exploration. The lagoon is the most northern part of a coastal complex consisting out of a system of three connected main water bodies with two openings to the South China Sea, stretching along the shore of the Thua-Thien-Hue province in central Vietnam as shown in the map below (Fig. 1). The complex is separated from the ocean by large barrier of sand dunes. It covers an area of 219.18 km² and represents the largest lagoon system in Southeast Asia. The lagoon is also a local hotspot of biodiversity and natural resources. This status, however, is vulnerable and currently under a variety of critical stress factors. When the effects of globalization, rapid global economic growth and the hunt for resources first reached this remote region of the world in the 1980s, people began to realize the economic potential of shrimp farming in the lagoon. What followed was a two-decade long phase of uncontrolled economic development of the area, with large export-oriented companies like CP and SCAVI tapping in (Cp.com.vn, n.d.; Scavi.com.vn, 2016). Today around 300.000 people depend on the lagoon’s ecosystem services. The enormously successful aquaculture and fishery activities have led to a significant push of

livelihood opportunities but also left the lagoon complex in a biologically catastrophic condition and social and economic disarray by the early 2000s. Due to environmentally irresponsible behavior, illegal pond construction, deforestation and unregulated overfishing, dilemmas around resource access, land allocation and other user conflicts quickly emerged. Alongside this development, co-planning efforts were made induced by various projects and measures commissioned and funded by international organizations (Armitage et al., 2011; Tuan et al., 2009).

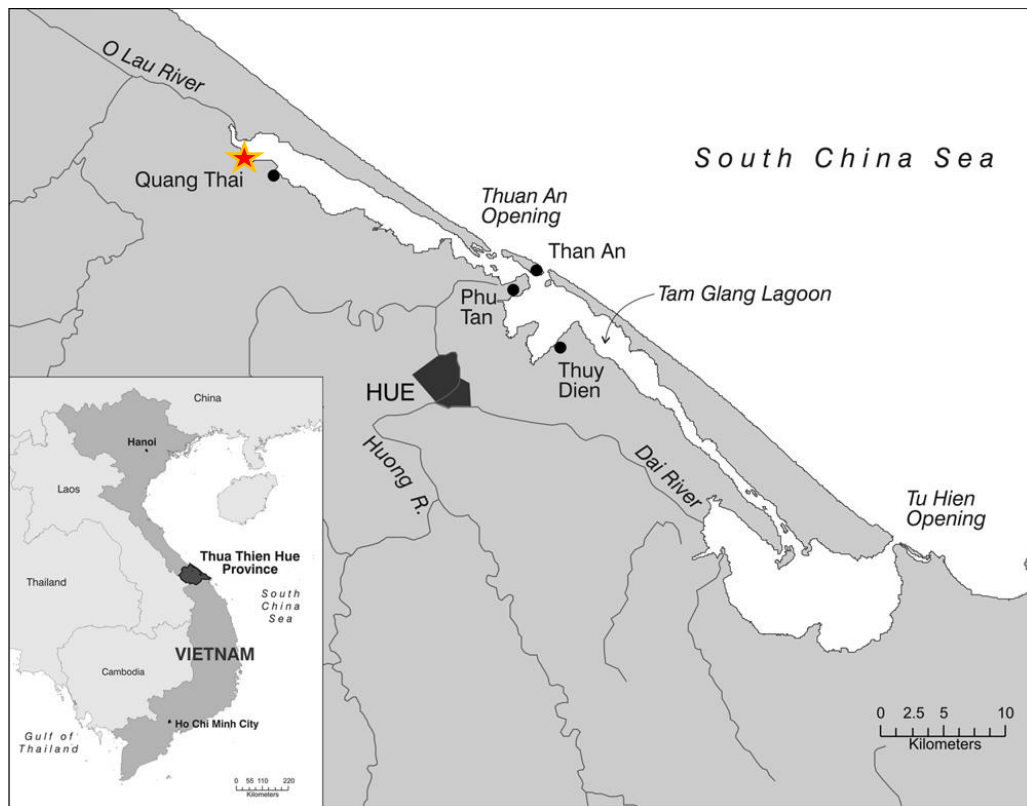


Figure 1. The Tam Giang lagoon complex in central Vietnam (Armitage et al., 2011, p.704).

The value of the Tam Giang lagoon and the problematic issues evolving around it have long been recognized (Thanh and Do, 2002). The co-planning approaches applied in many communes around the lagoon were enabled by the creation of policy windows following the 1986 *Đổi Mới* reforms, essentially a national economic reorientation allowing the emergence of adaptive and participatory planning. That created flexible conditions, informed by a variety of knowledge sources, to be better able to respond to change and learn through experiences (Van Tuyen,

Armitage and Marschke, 2010). The emergence of new institutional networks, such as civil society associations, allowed for progress in decentralized decision-making and territorial use rights (Nayak et al., 2015). This is especially important for local level organization processes, as higher-level authorities in Vietnam are known for only intervening in matters they consider urgent enough. Nevertheless, the question remains whether these efforts are effective in the long term without external funding.

The fieldwork, following an ethnographic participant observer approach with semi-structured interviews, was conducted between mid-April and mid-May by living with a host family in a fishing community. The location was the remote village of Trung Làng in Quảng Thái commune at the northern point of the lagoon in close vicinity to the Cửa Lác dam (marked by a red star in figure 1). The village was chosen based on the recommendations of local expert advice and its geographical preconditions, social composition and human interventions. Trung Làng is a remote village with close proximity to the lagoon. The area and its people, primarily active in the fishing, aquaculture and agriculture sector, are affected by climate change impacts, such as increased flood risk, storms and draught events. However, water pollution poses the biggest threat to local livelihoods and ecosystems. Not only was the region impacted by the 2016 Marine Life Disaster, inflicted by the Taiwanese company Formosa Plastics (BBC News, 2016; Zara, 2016), but there are also further known and unknown external pollution sources. Next to illegal factory activities and constructions of upstream reservoirs, the lagoon's waters have to endure intensive aquaculture exploitation, destructive fishing methods, illegal garbage disposal, increasing demands and population pressure due to failed top-down planning and government forced resettlements of sea peoples. This has led to the site becoming a scene of many water quality studies and co-planning trials, such as the government induced rearrangement of lagoon activities in 2012 to improve water flow and quality (Van Tuyen, 2006). Hence, the local population is accustomed to scientific research endeavors in their surrounding area and already had opportunities to form an opinion about participatory planning approaches. However, as Van Tuyen (2006) pointed out, back then few people understood the context and the interrelation of the factors causing the dire situation of the lagoon. Since then a lot has changed making it an interesting case for the investigation of the potentials of LEK in a dynamic social-ecological system. Worth mentioning here was the availability of a host family offering a place to stay and the opportunity to be closely integrated in the village life and all daily activities.

5. Literature Review and Theoretical Framework

5.1 Defining Local Ecological Knowledge

Epistemology, the study and process of defining different ways of perceiving, knowing and making claims about the world has been an essence in the work of philosophers from the past and present (Godfrey-Smith, 2003). In the recent decades, the question of ‘what constitutes knowledge’ has made its way from its philosophical core into new stages of development and application in various scientific fields such as environmental science, resource management and planning (VanDeVeer and Pierce, 2003). The way we define, perceive and know things inevitably lays the foundation for decisions and implementations (Lee 1999; Fazey et al., 2005). Furthermore, how we then proceed to share and acquire new knowledge through learning shapes the path for all planning and management activities used (Cash et al., 2003; Fazey et al., 2012). Opinions of what exactly constitutes knowledge are diverging, but in a simplified way, in most of the recent literature on environmental planning (e.g. Gadgil et al., 2002; Bohensky and Maru, 2011; Rathwell, Armitage and Berkes, 2015), it comes down to a range of binary concepts opposing each other: There is on the one hand the scientific, the universal or the empirical knowledge versus on the other hand the traditional, the situated or moral knowledge, or often also referred to as local ecological knowledge (LEK). While in science, knowledge is found through measurements, true or false verifications and expressed explicitly through facts, the often-called traditional or local knowledge is always contextual, cannot offer a universal truth or falsity and is therefore tacit in nature (Agrawal, 1995). Theoretically, holders of LEK have a holistic approach to understand how things interrelate and are adaptive by nature towards solving problems. Generation by generation their knowledge has been gathered by those whose daily lives depended on it. Repetitive observations, experiments of trial-and-error and other common resource use practices of historical continuity have incrementally honed their skills to survive and thrive under certain local environmental conditions, which mostly was orally transmitted to future generations (Berkes, Colding and Folke, 2000). In contrast, a holder of scientific knowledge typically observes the environment and solves a problem in an analytical way by dissecting it into its component parts, looking at, and solving them separately in isolation (Agrawal, 1995; Mamun, 2010).

The definition for LEK in this thesis stems from an ethnoecological perspective (Gragson and Blount, 1999), which is in line with the participant observer approach of the fieldwork and is best described by Santasombat as

a repertoire of situated experience developed in particular physical and cultural contexts, from intimate interactions between people and the environment. It is culturally embedded in its local context, and grounded in particular territories. (Santasombat, 2011: 134)

This repertoire represents a dynamic knowledge sphere in continuous process and in close contact with other spheres and internal and external influences (see figure 2). It is utilized by local people living, striving and adapting to their own dynamic contexts and according to Berkes, Colding and Folke (2000) and Bundy and Davis (2012) it includes four key attributes: (1) A set of local observational knowledge and experiences with the environment such as species or physical settings; (2) a set of common practices and ways of how local people go about their daily resource use activities; (3) a belief system about how resource users are embedded in or relate to their surrounding ecosystems; and (4) a shared system of expressions to transmit knowledge within and in-between generations. From these components, it is evident that LEK has strong and interrelated practical, social and often spiritual properties. It therefore cannot merely be reduced to its ecological component (Hornidge and Antweiler, 2014).

5.2 The Recognition of Local Ecological Knowledge

In conventional environmental resource management, a major domain of the natural sciences, scientific knowledge and procedures as described in the prior section still make up the majority of the mechanisms and approaches informing decision-making (see Figure 2) (Fazey et al., 2012). In times of the global environmental crisis, rapid change and increasing complexity bring great uncertainties. It is increasingly agreed upon that resource governance is an interdisciplinary topic, however, with social and environmental issues becoming more and more dynamic and interrelated, reductionist ideas and conventional equilibrium management solutions have reached their limits alleviating the contemporary environmental pressures (Berkes, Colding and Folke, 2003; Allmendinger, 2017). Various scholars (e.g. Agrawal, 1995; Byrne, 2003; Bohensky and Maru, 2011) have already articulated for some time that modern social and environmental problems cannot be solely resolved by singular, technocratic and science-centered solutions. That is the reason why in many fields of management and planning there has been a considerable shift towards more flexible and integrative approaches recognizing the concept of participation, deliberative forms of resource governance and the need to include local expertise (Berkes, Colding and Folke, 2003; Fazey et al., 2012). This shift is also associated with the coupling of the social and environmental entities into one system (Raymond et al., 2010) and the increase in academic literature on the integration of different types of knowledge for the sake of sustainable planning and management (Icamina, 1993). Drawing from more than one source of information can be crucial in social and environmental conflicts and specifically LEK bears the potential to incite important transformation processes in these issues (Reichel, Martens and Harms, 2012).

Within this new turn, adaptation and resilience (explained below) have emerged as some of the key concepts and the social-ecological systems framework as a principle to understand the interrelatedness of our surrounding environment and us (Hornidge and Antweiler, 2014). According to Özerol (2013: 73) a social-ecological system “includes the entities of common-pool resource, resource users, public infrastructure, infrastructure providers, institutional rules, external environment and the links between these entities”. These constituent parts, factors and links are caught up in a self-organized, ever-changing and coevolving interplay of asymmetrical power structures, economic interests, unpredictable dynamics and feedbacks between social and ecological processes with emergent properties (Delgado-Serrano et al., 2015). Within this seemingly chaotic system, one of the said links between entities is represented by specific local knowledge, which increasingly serves as a signifier and key information source for managing specific contexts (Reichel, Martens and Harms, 2012). Furthermore, resilience is the ability of a system like this to withstand disturbance without structural and functional changes and to remain flexible in the face of changing environmental and social contexts, complexity and uncertainty (Davoudi et al., 2012). This is closely linked to the process of change a system goes through to be better at coping with trends and stress, and thereby maintain its identity, which is referred to as adaptation (Smit and Wandel, 2006). LRUs around the world are observing environmental changes and adapt to them. Hence, the close ties with the changing natural environment and the new key concepts are already an intrinsic part of LEK (Hornidge and Antweiler, 2014). Planners and managers need to not only learn from them but also need to understand these adaptation processes to be able to act upon them, enable participation and build social and ecological resilience (Bohensky and Maru, 2011).

The following examples gathered from various case studies may further elucidate the beneficial link explained above. Local knowledge can offer precise insights and normative indicators about environmental change such climate change, biodiversity loss and pollution (Nakashima, 2012). It often also represents an opportunity to collect these indicators and other data to create a locally situated monitoring and interpretation platform in complex contexts at a lower cost than formal scientific measurements and is therefore a viable option for regions where financial resources and trained personnel are scarce (Sobral et al., 2017; Mamun, 2010). Furthermore, with increased participation and rising population pressure in regions of substantial resources, human values become more and more important to resource planning, especially regarding conservation of finite resources, tolerable degradation and the prioritization of uses (Schoeman, Allan and Finlayson, 2014). In this regard, the spiritual component of LEK can play a profound role in ecologically sound exploitation processes as it can function as an unwritten guideline to the

sustainable use of resource. Local practices may even lead to the conservation of a resource or ecosystem service without that being the primary objective (Berkes, Colding and Folke, 2000). Overall, dynamic LEK can theoretically be linked to its equally dynamic social-ecological context in a coevolving relationship and therefore has the potential to help respond to changes and trends in ecosystem services and resources (Berkes, Colding and Folke, 2003). Schoeman, Allan and Finlayson (2014) also frame it in a way that “the more we know, the better we act”. However, the recognition of LEK goes beyond its significance for science and management. It helps to bring justice to the holders of that knowledge, by providing them with a platform to address problems from the local perspective (Bohensky and Maru, 2011). Nevertheless, the attempts to integrate LEK in to resource management have also been accompanied by institutional challenges and barriers, as further explained in the following part.

5.3 Challenges and Barriers

The shift from technocratic, reductionist management solutions towards the participatory, communicative rationale with the integration of LEK works in theory, but changing a running system is an iterative and often tedious operation (Sorensen, 2015). The integration process of different knowledge systems can come with inherent internal challenges and has to overcome various external barriers, depending on the context and especially if conventional ways of approaching this issue prevail.

5.3.1 Internal Challenges

The gathering of LEK and transfer into ideas compatible with planning cannot be compared to the straightforward procedures of natural sciences such as sampling or measurement data acquisition. The practice of LEK, unlike factual scientific knowledge, depends on social mechanisms, which in turn are influenced by locally varying hierarchies, social institutions, ideologies and cultural traits (Agrawal, 1995). The access and subsequent interpretation of LEK therefore requires time and skills across a variety of different natural and social sciences, such as environmental studies and anthropology (Berkes, Colding and Folke, 2000; Mellado et al., 2014). Institutions, often referred to as ‘the rules of the game’, provide the framework under which societies form and apply their specific knowledge (Koppenjan and Groenewegen, 2005). Understanding these can be inherently difficult for an outsider in any context, but is crucial for the effective utilization and implementation in later governance stages. Furthermore, since emphasis is put on the exchange of knowledge between LEK holder and planner to reach an effective collaboration in a respectful manner, this understanding has to be mutual (Gadgil et al., 2002). Subjects in a knowledge exchange process often come from different backgrounds

regarding language, social pressures or needs, goals in mind or urban and rural origin. They can also act differently according to their own individual cultural values, beliefs and social norms. Even if appropriate considerations about differences are attributed in the exchange process, being able to find common ground and evade potential misinterpretations is highly situational (Fazey et al., 2012).

Technical experts and their professional language who are not sensitized regarding this matter can be intimidating to lay citizen to the point that holders of LEK refuse to cooperate, as they are often not used to articulate their know-how and the technical principles behind it in their own words (Benham, 2017). This inevitably leads to another difference between the two forms of knowledge and major challenge in their integration process – the portrayal and passing on of information. Scientific facts can be shared through formal and explicit forms as for instance written reports, diagrams or presentations. Individuals then interpret and make sense of these facts in relation to their experiences and existing personal expertise (Raymond et al., 2010). The ways to communicate tacit knowledge on the other hand are much more implicit, intangible and outlined less directly (Abelshausen, Vanwing and Jacquet, 2015). Collecting data on LEK and expressing it with words often represents just a tiny fraction of what is otherwise rooted in actions, ideals, emotions, values and practices influenced by subjective perceptions (Ruddle and Davis, 2013). Additionally, depending on how participants in a knowledge exchange perceive or define the concept of knowledge itself, the outcome of it can take different paths. Thus, if one perceives knowledge as an explicit item, which can stand on its own, the depth of detail of a knowledge exchange will be determined by how many of these items a person can hold. In this case, the transmission of LEK would fall short of the true potentials of LEK and it illustrates that formalizing tacit knowledge in these ways seems almost impossible (Fazey et al., 2014).

Another issue with the integration of LEK into scientific-based management is that in practice the boundaries between the two knowledge systems are not that distinctive as theory presumes (Raymond et al., 2010). Rural populations have long been integrating scientific insights into their traditional lore, as access to alternative sources such as the internet, NGOs and other governmental and scientific information channels is increasingly available. Within this new local hybrid knowledge, chances are that old names and methods vanish and new names and ways coming from the outside take their place (Gadgil et al., 2002; Ehlert, 2014).

5.3.2 External Barriers

Despite receiving more attention in academic literature, a generally accepted model for an effective exchange mechanism between the scientific and local communities has yet to be developed (Mamun, 2010; Fazey et al., 2012). Additionally, one might say that environmental management and planning culture, especially in highly hierarchical countries like Vietnam, is path-dependent on technocratic solutions and scientific expert based advice (Phuong, Biesbroek and Wals, 2018). Often the respective institutional capacity does not allow for embracing a new type of knowledge, let alone an entire new model of implementation. In many cases, this would require a fundamental structural change (Benham, 2017). Various scholars in the field of planning and management (e.g. de Roo, 2003; González and Healey, 2005; Koppenjan and Groenewegen, 2005; Allmendinger, 2017) have put forward the need for a flexible institutional and organizational structure and a move towards combining bottom-up approaches with central, top-down guidance in order to be able to handle novel complex conditions, dynamic contexts and above all the integration of new concepts such as LEK. While this is certainly true regarding for instance various European contexts, studies have demonstrated that within rigid governance structures and routinized practices, as for example in the Vietnamese context, there are hardly any efforts to transform (Termeer, Dewulf, and Biesbroek, 2017). Some instances of social networks or institutional settings at higher governmental levels have proven to be open for bridging knowledge systems in theory (Abelshausen, Vanwing and Jacquet, 2015; Phuong, Biesbroek and Wals, 2018). However, the actual process of scaling up LEK from the local level and formally recognizing its relevance at higher levels without compromising its integrity and potentials mostly remains a distant future goal of NGOs and researchers (Rathwell, Armitage and Berkes, 2015).

Power imbalances, individual status, common and marginalized ideas, underlying agendas and general accord within the social and political arena can have severe impacts on the process of knowledge exchange. Powerful actors can influence the path of decision-making and whose voices will be heard or neglected, to a point that researchers, regardless of their field of profession, might not have a say in that regard (Fazey et al., 2012). Furthermore, Abelshausen, Vanwing and Jacquet (2015) report that while actors and stakeholders of lower levels often already, albeit only partly and unknowingly, put theory about changing towards a more communicative rational and knowledge exchange into practice, actors of higher positions fail to do so. Although these actors are often educated in the ways of the new paradigm, Abelshausen, Vanwing and Jacquet (2015) show that the higher the power level is, the more reluctant to change they seem to be. Benham (2017) indirectly links this sort of behavior to the fact that integrating LEK not only means to

receive precious information potentially filling gaps in science-based resource management, but it also includes delegating a significant portion of decision-making power to the primary resource users, which is incompatible with strictly hierarchical governance structures. Management based on scientific facts does not require opinions, whereas holders of LEK do have an opinion and the desire to share it. In fact, as described above, opinions and motivations are a constituent part of LEK as well. Hence, the inclusion of LEK consequently means involving more diverse and potentially conflicting opinions, disagreements and increasing complexity, which can be daunting or seen as an unnecessary barrier by decision-makers and therefore neglected (Benham, 2017).

Lastly, for the LRU, whose knowledge is in the center of attention here, the process of knowledge sharing does not necessarily represent an easy task either. Selecting and providing relevant information to outsiders can be irritating and time consuming. Especially rural communities often lack the capacities to engage in dialogue and interact with scientific or government staff (Benham, 2017). It is not uncommon for higher government stakeholders to take this lack as an excuse to even commencing an integration attempt (Rathwell, Armitage and Berkes, 2015).

5.4 New Forms of Adaptive Planning

Schoeman, Allan and Finlayson (2014) explain that water is often managed from within an economic framework and water management is seen as a process where human and environmental needs are traded off. While Schoeman, Allan and Finlayson (2014) focused on water as a resource, in times of anthropogenic change and overexploitation this is certainly the case for many resources or ecosystem services. As explained earlier, it becomes clear, that due to increasing social and cultural conflicts within resource governance and concurrently articulated political and ethical considerations, value-neutral, technocratic and purely economic advice led approaches are not sufficient in finding solutions for these problems (Cook and Spray, 2012). Conventional scientific resource management is a remnant of a time when repercussions of overexploitations were a distant future threat, nature was bent at human will and strategies to maintain the status of ecosystems were designed according to the assumption that everything can be controlled and predicted (Nadasdy, 2007). Newly researched concepts such as the linked social-ecological systems or LEK are inherently unpredictable and do not fit into conventional methods to maintain stability. Within the recent development, what multiple scholars term the 'new ecology' many assumptions and strategies of the conventional way of management are now considered outdated (Holling and Goldberg, 1981; Winterhalder, 1994). The developments of the new ecology, whether resulting from challenges or opportunities, call for new approaches that on the one hand are capable of handling unforeseen changes, and on the other hand honing already

available adaptive capacities such as local knowledge. Consequently, parallel to the debate about the integration of local and scientific knowledge and along the shift from the technical to the communicative rationale, new adaptive and integrative approaches emerged, redefining management and governance of water and other natural resources (Berkes, Colding and Folke, 2003).

Genuine adaptive and integrative approaches emphasize the strong interdependencies between the social and natural realms and do not conceptualize them as separate entities (Hornidge and Antweiler, 2014; Schmidt, 2013). In order to deal with unpredictability resulting from complex and adaptive system behavior, LEK of LRUs can contribute as an informing link between the social ecological system and decision-makers (Pahl-Wostl, 2006). To avoid the barriers and challenges of the integration of LEK into conventional planning approaches, the essence of adaptive forms does not lie within only one singular top-down approach or static model viewing LEK as merely complementing. Instead, it steps down from this hierarchical way of thinking and acknowledges the fact that planners and institutions must learn from the consequences of their actions and feedback mechanisms from the environment (Berkes and Folke, 1998). This process of 'learning-by-doing' is the major characteristic for the shaping and continued development of policy in a never-ending cycle (Berkes, Colding and Folke, 2003) and a method to enable participation and decision-making despite uncertainty multi-scalar issues (Pahl-Wostl et al., 2007; Allen et al., 2011). It is not a single or group of individuals who conduct the integration and further use of LEK but the surrounding circumstances. Adaptive management can provide a flexible framework for that, allowing for a more qualitative resource planning and reorganization, rather than rigid quantitative yield targets and irreversible trajectories (Berkes, Colding and Folke, 2000; Gadgil et al., 2002).

Holling (1978, p. 4) already explained decades ago "what a complex system is doing seldom gives any indication of what it would do under changed conditions". Since a continuously evolving complex adaptive system never stops being complex and adaptive, the process of learning-by-doing and the evolution of LEK consequently never cease either (de Roo, 2003). Due to the common traits of adaptive management and LEK, namely the coevolving developments within the social-ecological system and the integration of uncertainty and resilience practices, adaptive forms of planning have been labeled as the 'scientific analogue of LEK' (Berkes, Colding and Folke, 2000). Acknowledging that indicates the first step of the term LEK dropping its imposed characteristic of merely being complementing to scientific knowledge and instead is now merging with different forms of knowledge under the umbrella of adaptive planning.

5.4.1 Combining Adaptive Planning with other Approaches

The strong scientific foundation of adaptive planning in complex adaptive system theory and the new ecology is undeniable (Gunderson and Holling, 2001). It bases on the understanding that social-ecological systems do not always fall back to one original state of equilibrium after a disturbance and that causes and effects are nonlinear (Davoudi et al., 2012). This has profound implications for the practice of environmental planning, however, the recognition of this alone is not sufficient. Schoeman, Allan and Finlayson (2014) assign the role of adaptive planning more of a guiding model and outlines the need for it to be combined with more practical approaches such as Integrated Water Resource Management (IWRM), Ecosystem Based Approaches (EBA) or other forms of coproduction, depending on the case. EBAs focus more on the balance between conservation and sustainable human resource use by improved decision-making and influencing local perceptions through valuation of ecosystem services. A common EBA practice for instance is the restoration of riparian mangroves as an alternative to rigid flood protection infrastructure (Cook and Spray, 2012). IWRM serves as a governance platform for negotiations, knowledge exchange and cross-sectoral planning and hence promotes sustainable social and economic development (Schoeman, Allan and Finlayson, 2014). Rooted in multi-scalar governance it aims to improve fragmented institutions and legislations in land and water management while at the same time improving the environmental quality of assets like lagoon or river basins (Mukhtarov, 2008).

The explanations above show how far the demarcation between these different approaches manifest in theory; however, as explained earlier as well, the essence of true adaptive planning lies within the pluralism of approaches. The individual, contextual mix of approaches depends on the political system, the existing assets, the goals to be achieved and stakeholders involved. Experimenting is inevitable and there is no guarantee for success, however, from the beginning of the process, adaptive planning can foster LEK and thereby enhance the ability to learn and adapt to challenges from the individual to higher societal, institutional and organizational levels (Berkes, Colding and Folke, 2000).

5.4.2 The Co-Production of Planning Decisions through Enhanced Knowledge Exchange

Any combination of approaches under the umbrella of adaptive planning implementations particularly emphasizes the importance of collaboration in the design, analysis and evaluation of decision-making, to ensure acceptance of said implementations and stimulate knowledge exchange processes between all stakeholders (Fazey et al. 2012). This process has been defined by Folke et al. (2002: 20) as one “by which institutional arrangements and [LEK] are tested and revised in a dynamic, ongoing, self-organized process of learning-by-doing”. A process which in

recent literature has been further affiliated with trust building and social learning, essentially culminating in adaptive co-governance (Plummer and Armitage, 2007; Berkes, 2009). The coproduction or co-design of decisions and implementations informed by a variety of knowledge sources, in accordance with the dynamic epistemological pluralism of Miller et al. (2008), is an intrinsic part of adaptive planning. Fazey et al. (2012) also advocate refraining from using the word knowledge integration, as it indicates the accommodation of one category into another, whereas a genuine process of co-design rather bases on the exchange of knowledge in a mutually respectful manner. The sections above also infer that engaging in adaptive planning approaches can realize mutual benefits between LEK holders and planning institutions, along with stimulating a respectful coexistence. While adaptive planners seek local expertise, information and perspectives science cannot access and receive public support, enhanced resilience and adaptive capacities through social learning, they can provide a platform, coordination and guidance for LRUs to articulate their needs and competences and organize themselves on higher administrative levels. It is through this process of recognition and mutual exchange that LRUs can receive the attention and opportunities to contribute to the management of their own environment (Santasombat, 2011).

In order to realize these mutual benefits, successful co-governance depends on effective and flexible bridging mechanisms to challenge prejudices and misinterpretations. Rathwell, Armitage and Berkes (2015) have analyzed various knowledge exchange facilitating settings and framed them into four different typologies: (1) The epistemological arena, a philosophical approach embracing different knowledge systems, engaging with them and reflecting power structures and cultural traits affecting them. (2) Enhancing knowledge exchange through various methods and processes, such as joint monitoring activities, modeling of changing environments, storytelling or collaborative ecosystem assessments, to make exchange mechanisms more tangible, potentially leading up to joint scenario planning of resources. Presumed this close interaction between stakeholders, scientists and planners happens in a respectful, non-tokenistic manner, it can create alliances between formal and informal knowledge holders and vertical links and boundary objects between the local level and higher levels of governance (Gadgil et al., 2002). (3) These boundary objects and other connecting links can be used for the creation of network in order to enable trust building, communication of shared values and other information and eliminating stereotypes and bias resulting from different backgrounds of involved stakeholders. (4) The creation of an institutional and governance environment, which facilitates social learning, equally shared decision making and collaboration cycles to tackle complex issues. Collaborative forms of governance can provide a context for bridging knowledge systems, however there is a strong need

to engage in these four settings in order to realize the mutual benefits. All of the main principles and conditions within these settings are important for a successful knowledge exchange process; however, concerning the fieldwork, this thesis will concentrate on the first theoretical setting of the epistemological arena and reflect how it can be conceptualized in practice.

5.5 Adaptive Planning Criticism and the Role of LEK within it

The developments of the new ecology and the major cultural shift in planning and management can also partly be seen as a countermovement to outdated but still prevailing western political ideals and consequences of static, and often biased equilibrium-based resource governance. The adaptive turn prompted open-minded managers to approach traditional societies for new evidences and inspiration for their own practices, as they had adapted to their environments successfully for generations (Nadasdy, 2007). This was celebrated as the rediscovery of the traditional ways – management in conformity with nature (Berkes, Colding and Folke, 2000). It would be naïve to assume, however, that the rediscovery alone can address the challenges of the impending environmental crisis. In fact, it poses even more questions. For instance, how can we ensure that the knowledge exchange or integration process of the two opposing systems will eventually change the trajectory of conventional methods towards sustainability and enhanced resilience? Given the above addressed challenges, barriers, power imbalances, hierarchies and long-standing dominant position of top-down scientific management methods, there is reason to believe it is more likely that the development trajectory of LEK itself changes instead. Since adaptation is in its very nature, the argumentation that LEK is adapting to the dominant system of scientific and economic interests and taking over its traits is entirely justified (Nadasdy, 2005). Nadasdy for example supports this claim stating:

Given the legitimizing power of the term ‘science’ in contemporary Euro-American society, it is hardly surprising that anyone wishing to take indigenous knowledge and practices seriously would first need to label them as ‘science’. (Nadasdy, 2003: 138-39).

Would this render the debate about the integration of LEK unnecessary? Questioning the capability of science to objectively evaluate the potentials of LEK and label it as useful for decision-making, would first require an assessment of the underlying scientific concepts under which LEK is assessed, such as resilience enhancing capacities, participation and public support or social learning. The next sections will critically analyze the key concepts of adaptive co-management, against which to judge contemporary environmental action.

5.5.1 The Resilience Bias

Sustainability, arguably the concept with the highest amount of vague and varying definitions in social sciences, is predestined as overarching goal in the field of environmental resource planning (Walker et al. 2002), as it generally strives for “avoidance of the depletion of natural resources in order to maintain an ecological balance“ (Oxford Dictionaries, 2019). Sustainability definitions are vague in the sense that they indicate sustainability prioritizes one system over another and refers to the resilience of a desired equilibrium as opposed to the resilience of an undesirable one (Walker et al. 2002). While it is not particularly difficult to conceive a fitting definition of sustainability under which to frame the integration of different knowledge systems, the definition for resilience has become more and more explicit and less customizable. Davoudi et al. (2012) outline three different understandings of resilience: (1) the engineering resilience perspective of one single equilibrium; (2) the ecological resilience of multiple equilibria; and (3) the evolutionary or social-ecological resilience, which goes beyond the term equilibrium and rather sees continuously evolving equilibria nested within and influencing each other. Restemeyer, Woltjer and van den Brink (2015) add the notion of adaptability, transformability and robustness to the third understanding to make it complete.

In theory, the third understanding of resilience has received the most endorsement in academic literature, although in practice the other options have yet to be superseded. In fact, resilience becomes biased and inevitably undesirable if a system has already flipped and consequently puts anyone who is dependent on that system into predicament (Nadasdy, 2007). This leads to tendencies in how system changes are perceived in general. The losers in such a system collapse naturally advocate by all means, including LEK, for the preservation of the old system, whereas the potential winners do the opposite (Cretney, 2014). At first glance, adaptive planning processes lead to the reconsideration and omission of for the threatened system unsustainable economic activities and incite social and institutional changes. On second thought, however, within the new social and institutional setting, alternative opportunities will emerge and take the place of the former ones (Nadasdy, 2007). Investigating knowledge integration through the resilience lens therefore does not come without reservations as well (Bohensky and Maru, 2011). Rotarangi and Russel (2009 in Bohensky and Maru, 2011) remark “the idea that multiple knowledge systems are needed to achieve or enhance social-ecological system resilience reflects a perspective that is focused on satisfying the many facets of a system.” The questions, which social-ecological systems or stakeholders are these knowledge integration processes building the resilience for, and on which scales in time and space, becomes unavoidable when criticizing this approach. Especially, when LEK itself has already taken over the traits of the system it is supposed to serve or has

adapted to the equilibrium under which it functions best (Bohensky and Maru, 2011). Hence, the search and advocacy of a certain equilibrium is not only advised against by Davoudi et al. (2012) in theory, but also becomes a fundamentally political issue in practice (Nadasdy, 2007).

5.5.2 Participation and Power

Where there is a system imbalance and need for decision-making, the exploitation of power asymmetries is common as well, and adaptive management approaches have been criticized for being particularly power sensitive. When stakeholders come together for solving issues of high levels of expertise and technical terms, power is naturally unequally distributed (Engle et al. 2011). The participatory process and common strive for a predetermined goal of resilience of particular state provides powerful and well-organized stakeholders a platform to legitimately conduct the decision-making process according to their own interests. This can happen in an open, straightforward manner following existing system hierarchies or under the cover of applied tokenism. Hence, participatory processes are prone to becoming a catalyst of the tragedy of the commons, one of the very things it aims to contain (Schoeman, Allan and Finlayson, 2014). This is also because decision-making is often displayed as a formal, rational and expert-led process. However, competition, livelihood concerns and informal individual ambitions are more often the underlying determinants in decision-making processes. Depending on who is asked, holders of LEK might be potential beneficiaries or come off badly (Duijn et al., 2016). Moreover, it was stated earlier that enhanced sustainability due to LEK-based management often does not represent the purpose of a holder of LEK but rather a consequence of their embeddedness and interlinkage with their social ecological system from the start. Therefore, caution is required when blindly advertising LEK as the messenger of resilience without considering livelihood concerns and different adaptation stages of societies. An alternative information source is not much of use, if it is not that alternative after all, regardless of which approach is used (Nadasdy, 2005).

5.5.3 Social Learning

Social learning is a self-organized process of transformation of experiences, learning-by-doing and iterative reflection that occurs when knowledge is communicated and exchanged with others (Armitage, Marschke and Plummer, 2008). How successful a knowledge exchange process or a resilience and sustainability enhancing planning method works out in the end is determined by the results. Whether the results are perceived as a success depends on one's position in the current social-ecological system and how much one has invested in relations within it (Nadasdy, 2007) (see 5.5.1). Adaptive planning's answer to this problem is the increased institutional flexibility and openness of LEK for social learning (Schoeman, Allan and Finlayson, 2014). Proponents of this

notion may successfully solidify their argumentation in theory, however, as Nadasdy (2007: 217) points out, they often ignore “the broader political/economic context of capitalism/colonialism [which holders of LEK are embedded in and] that gave rise to the notion of and need for resource management institutions in the first place.” If social learning is a societal process of adaptation (Phuong, Biesbroek and Wals, 2017) it does not necessarily also entail a change in a trajectory, but merely the accommodation of new circumstances, which, in the case of resource use, are for instance modern economic interest and changing demands (Nadasdy, 2007). Stakeholders may even develop their own counter strategies and play, what Duijn et al. (2016) is referring to as, the ‘non-formal societal game’. This game includes the stirring of public opinions and local knowledge towards obstructing formal decision-making processes if certain interests were neglected. Whilst social learning does have the potential to incite changes at lower scales (Abelshausen, Vanwing and Jacquet, 2015), it is not sufficient though to tackle the dominant economic imperative within higher levels of contemporary exploitation industries, which is simultaneously the main driver of resource management (Colding, Elmqvist and Olsson, 2003). Next to the reluctance to engage in social learning at higher scales, most other significant impediments are deeply ingrained in local culture, such as entrenched institutional norms, land rights, lack of self-reflection and the support of market competition rather than collaboration (Schoeman, Allan and Finlayson, 2014).

5.5.4 The New Configuration of Social-Ecological Systems

Even in the hypothetical case of management institutions fully embracing the notion of evolutionary resilience and LEK being of ‘unspoiled and uncontested’ sustainable interest, there remain major institutional and economic obstacles for improving contemporary policy practice that influence the feasibility of adaptive management and let it appear as more of an ideal than reality (McLain and Lee, 1996). Instead, this reality is mainly shaped and directed by another entity, capitalism, which is rooted in monetary and resource flows. As the origins of these flows can mostly be tracked back to contemporary ecosystems and their services, one has to recognize their immense influence on our environment (Harvey, 1993). The capitalist induced will to strive for more instead of to ‘just survive’ “simply cannot be viewed as a set of social processes and relations that play themselves out on a neutral landscape. Rather, present-day social-ecological systems are themselves the products of capitalist processes and social relations”, and therefore indirectly influences local perceptions (Nadasdy, 2007: 217). As these flows shift and change, so do LEK and demands to adaptive planning. This means that to the interlinkage of LEK with social and environmental processes we have to add the aspect of capitalist relations and processes, as they have been shaping the structures of our social ecological systems now for decades (Nadasdy, 2007). As Harvey (1993: 27) puts it, “created ecosystems tend to both instantiate and reflect [...]

the social systems that give rise to them [so that] the very design of the transformed ecosystem is redolent of its social relations.” Keeping in mind the underlying processes shaping system behavior and therefore perceptions and knowledge, settles the debate about the integration of LEK on a necessary philosophical level, on which fundamental principles first have to be discussed. The literature defining the concept of LEK makes clear that the link between LEK and resilience, participation and social learning enhancing capacities can very well be established. From the literature with a more critical viewpoint on this it also emerges that opportunities to use this link for planning purposes is bound and indirectly influenced by the broader socio-political context, local economic interests and changing demands (Fazey et al. 2012), since these are part of the processes altering the system LEK is embedded within. The question is whether existing resource governing institutions can realize these underlying processes, come to terms with how to engage with LEK and whether it will succumb to power imbalances, local hierarchies and the resilience bias.

5.6 Self-organized Village Network Adaptations

So far, this thesis has elaborated on barriers and challenges in the integration process of LEK into the planning procedures of resources and that some adaptive and collaborative approaches are more suitable than other purely top-down and rigid hierarchical approaches in handling the resulting complexities and uncertainties. It also pointed out that regardless of the approach, it is important to consider underlying economic processes and human relations that shape social-ecological system behavior and eventually also planning implementations. However, so far this complex of themes has been elucidated from a planner’s perspective, a perspective of a neutral intermediary (Fox-Rogers and Murphy, 2015). Ultimately, a planner may have to deviate from this position in order to understand other perspectives. The various forms of adaptive co-planning and different settings for effective knowledge exchange certainly can lead to a rapprochement of planners and holders of LEK. However, could LEK and its corresponding adaptations not be regarded as a form of localized planning and management of resources itself? Indeed, next to hierarchical governance characterized by state intervention and co-governance consisting of collaboration among different actors, there is a third model referring to self-governance (Kooiman, 2003). Rhodes (1996) earlier described this part as the interplay of self-organized and autonomous networks, consisting of independent actors involved in the execution of a certain activity or delivery of a service. They tend to establish own rules and practices and are able to coexist with or resist to central guidance and regulation. The outcome of these is the combination and culmination of all prior shaping processes, changes in the environment, perceptions and

experiences manifesting themselves in specific forms and patterns (Boonstra and Boelens, 2011), here referred to as village network adaptations (see Figure 2).

Self-organization depicts that a complex society is not or not only centrally directed and planned by one governmental institution. Instead, an unknowing amount of different variables, such as characteristics of places, people and institutions, are continuously interacting with each other resulting in autonomous developments (Teisman, Buuren and Gerrits, 2009). The ability to self-organize is the capability to strive for a desirable social-ecological setting or survive in an undesirable one (Fuchs, 2006). In the context of the community in the case study this notion would then refer to situations in which local citizens and/or other stakeholders adjust or adapt out of own motivations, interests and experiences in specific actor-networks, possibly resulting in newly emerging socio-spatial groups, services, functions or livelihood sources (Portugali, 2000). Fuchs (2006 in Bonnstra and Boelens, 2011: 111) states that it is the duty of the scientist, or in this case, the planner, to embrace those network adaptations and “thus elaborate a critique of dominant structures in society and explore new potentialities for truly emancipatory movements.” Bonnstra and Boelens (2011) further elaborates that the planner can even play a crucial role in initiating these processes. It is therefore the responsible authority’s own negligence if these local level network adaptations are not anticipated and taken into consideration, as they will happen regardless.

Keeping in mind the prior sections and that LEK is not an item to be separated from its context, it is important to note that even if a dominant planning regime embraces local level network adaptations, this does not necessarily lead to the equitable inclusion of local experiences into planning. Planning solutions often appear to be derived from and centered around problems, resulting in only the thematic, but not wholesome community and process-centered inclusion of holders of LEK (Bennet et al., 2015). This means that even if an issue might be resolved, unattended local level network adaptations might lead to the emergence of new issues (Boonstra and Boelens, 2011).

5.7 Conceptual Framework

Considering the self-organized village level adaptations (marked in red in figure 2), planning of resources already indirectly takes place on the local level, as informal as it may be. However, this form of planning has limited capacities regarding trans-regional processes and activities and is criticized of not being able to keep pace with contemporary social-ecological changes (Fabricus, Scholes and Cundill, 2006). Hence, the formal side of planning (market in blue in figure 2) in the form of formal institutional central guidance is required as well to help direct these informal

processes in the commonly desired direction. Krugman (1996: 5-6) remarks here that ‘self-organization is something we observe and try to understand, not necessarily something we want’. It is the art of bringing together both pathways, which culminates in adaptive co-planning (Armitage, Berkes and Doubleday, 2007). Yet, planning authorities do not always choose to embrace this option, are path-dependent in not being able to embrace it or simply struggle with the differences in epistemologies between them and holders of LEK. Furthermore, the concept of LEK has mostly been adopted in democratic planning environments with an inherent mindset open for participatory and communicative approaches. Whereas in many developing countries, such as Vietnam, with predominantly hierarchical or mono-centric planning and government institutions, the abovementioned external barriers are often a too great hurdle to successfully integrate or apply LEK in practice (Phuong, Biesbroek and Wals, 2018). However, there is still the advantage of LEK being a cost-effective alternative information source to elaborate research endeavors for planning, management or conservation institutions in less privileged countries, which is increasingly recognized. Combined with the political opening of Vietnam since the *Đổi Mới*, this gradual process of recognition enabled the realization of opportunity windows to bypass the external barriers and feed in new ideas and policies such as co-planning or IWRM (Nguyen, Nguyen and Tran, 2008).

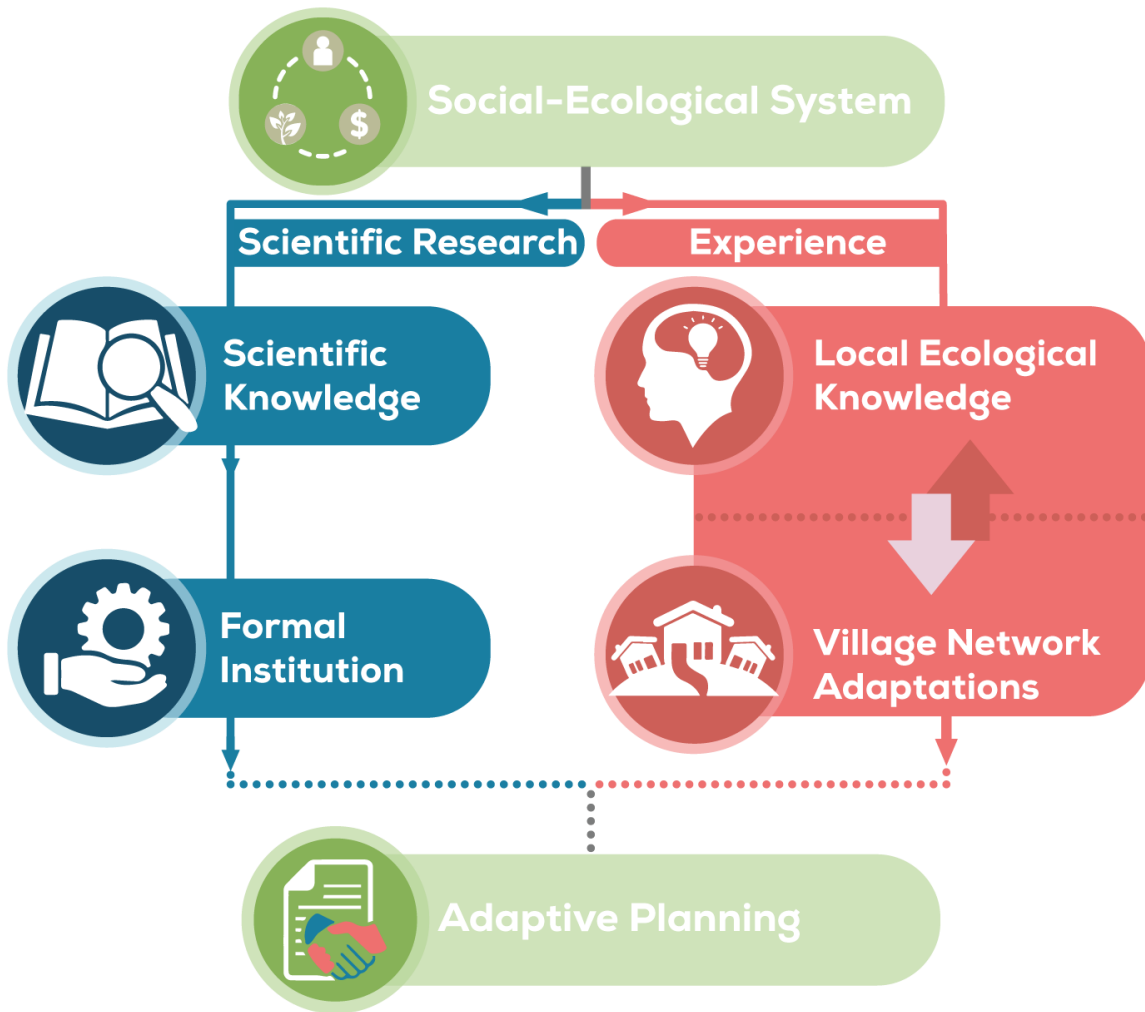


Figure 2. The conceptual framework: Adaptive planning as result of the integration process of two fundamentally different ways of understanding the social-ecological system.

Still, there has been a tendency to treat LEK as a static item providing ecological information regardless of the underlying social context, perceptions and motivations. Empirical studies, capturing the outcomes of adaptations, which are visible to outside researchers, do play an important role in planning for social-ecological change. However, failing to address the underlying motivations, interests and local experiences, which these adaptation are founded on, will consequently leave a lot of room for misinterpretations and possible long-term maladaptation. Once planning institutions have realized that the advantage of LEK comes along with the need to approach the concept holistically, one inevitably need to engage in the entire spectrum (see red part, figure 2) and the accompanying abovementioned internal challenges. This is an open-ended, iterative process starting with local experiences and perceptions shaping LEK

and continuing with self-organized network adaptations, which in correlation and repercussions with newly emerging features form the dynamic outcomes we see in the social-ecological environment. Concerning this process, this thesis has particularly discussed the importance of the creation of an epistemological arena as one of the settings to facilitate knowledge exchange. This setting provides the philosophical and ethical framework for actors to first critically reflect their own perceptions and further to identify the relationships and possible bridges between different knowledge systems (Rathwell, Armitage and Berkes, 2015). It is important that all involved parties, the holders of LEK and the formal research institutions, engage in this arena, which Miller et al. (2008) referred to as epistemological pluralism. Otherwise, the interactions between them will stay rather superficial and could even reinforce power imbalances and conflicts resulting from diversity (Weiss, Hamann and Marsh, 2013).

Since Miller et al. (2008) and Rathwell, Armitage and Berkes (2015) this theoretical approach to accessing LEK has only been slowly picking up pace in recent academic literature and empirical examples in this field are even rarer to come by. As the four key attributes of LEK demonstrate, however, the concept itself is strongly founded in practice and accessing it demands for the proactive commitment to differential negotiations and discussions, which is not always guaranteed. Therefore, this thesis offers an extension of the epistemological pluralism in the field in the form of an ethnographic participant observer approach (see 6.1). This approach promotes self-awareness, self-criticism and suggests to look at knowledge as pluralistic and overlapping. By increasing the awareness about the underlying perceptions of another culture, group of stakeholders or different community members this approach may open up ways to utilize environmental resource planning to bridge different knowledge systems, rather than widen the gulf between them.

While this approach operates at the local level of resource governance and therefore may not be able to tackle challenges originating from higher governance levels, it does offer a means to overcome lower level barriers to accessing LEK without entailing the delegation of power. This creation of flexible cross-scale institutional linkages without the fundamental need to change the system of hierarchies potentially makes this approach suitable for non-democratic political environments. This coincides with a recently emerging process in many Southeast Asian countries, described as 'the globalization from below' by Santasombat (2011), in which grass root actors and their locally situated knowledge are brought together with actors and top-down mechanisms of the new world order through slowly, bottom-up incited changes. Nguyen, Nguyen and Tran (2008) further describe the desire of lower level officials in Vietnam to overcome the conservative, stagnant and sectoral administrative system in coastal resource planning. At this

point in time it would be appropriate to advance testing and applying this approach in an empirical case, in order to make use of the momentum of the current transition, especially in the face of the consequential loss of foreign aid due to Vietnam's new World Bank status (World Bank, 2013).

6. Analysis

It should by now be understood that LEK cannot be seen as a stable variable only waiting to be integrated into a planning formula with the result being sustainability. Its context-dependent, shifting and adapting character means for planners, managers and scientists alike, that it is impossible to grasp in its entirety from a distant system level analysis (Raymond et al., 2010). After all, LEK is supposed to be filling in gaps in that system level analysis. Habermas (1981) indeed already advocated for a reorientation towards everyday life, the individual and the family level in his theory of communicative action. Going beyond the rationalistic planning regimes and strategic system analysis has the potential to change the current trajectory in common resource governance. However, it is also legitimate to inquire which direction this change in trajectory might lead to and criticize the contemporary course of events. It is the purpose of the fieldwork to extend the investigations to the epistemological setting of the local level and see how far a planner's endeavor to work with LEK can be realized in the face of the major obstacles and points of criticism. In that regard, this thesis derived three main points of concern from the recent debate about LEK: First, in order to shed light on the ambiguous concept of LEK this thesis aims to investigate LEK's underlying experiences, perceptions and motivations, to provide potential insights in their relations to the consequent self-organized local level network adaptations. This is owed to the criticism of adaptive, integrative and participatory forms of planning not considering that these are in turn shaped by economic, power and other human relations in the social-ecological system. Second, the inadequate theorization of the relation between LEK and its social-ecological system has led to an overly focused research on the ecological part while important outcomes of the network adaptations have been neglected. Consequently, there is a need to broaden the spectrum in capturing the network adaptations comprising the whole village community, which will be clarified in 6.3.1. This also strongly connects to the third point of inquiry. We have learned about the differences between conventional scientific thinking and LEK and the resulting challenges and barriers in the integration and conceptualization process. To build on the momentum of the newly emerging adaptive planning approaches tackling this issue and attempting to change resource use trajectories with the power of participation, the fieldwork pays particular attention to accessing LEK through participation and observation. By assessing

the course of its own methodology and being aware of the epistemological arena it takes place in, this thesis aspires to find potential points of departure for LEK to ascend from the village network into planning institutions.

6.1 Data Acquisition: Participant Observation

Important to remember is that there is no generally accepted model or theoretical framework regarding accessing LEK. This thesis approached the issue by bringing together relevant and traditional planning literature with renowned ethnographic research methods. Hammersely and Atkinson provide a fitting definition for the approach applied here:

Embeddedness and participation in people's daily lives for an extended period of time, watching what happens, listening to what is said, and asking questions through informal and formal interviews, collecting documents, artefacts [and photographs] – in fact, gathering whatever data are available to throw light on the issues that are the emerging focus of inquiry. (Hammersely and Atkinson, 2007: 3)

This way of doing research captures the very essence of LEK itself and is strongly rooted in natural experimentation and local empiricism (Agrawal, 1995; Ehlert, 2014). Furthermore, this approach follows a post-structuralist perspective, which defines spaces and places as open, relational and integral part of all social activity they provide a platform for and therefore sees the need for both planners and their subjects to be part of the process of spatial becoming (Murdoch, 2006). This means, embedding oneself in a case represents a viable research method in planning related issues. Additionally, within the context of the rigidly formalized research culture in Vietnam, research demands a high degree of flexibility regarding site selection and continuous engagement over longer periods (Ehlert, 2014), which this approach had no difficulties with.

Participant observation next to the conduction of interviews oftentimes proved as crucial. Many important interrelations only revealed themselves only after a certain time spent in the field and interview answers were often either too broad, influenced by political sensitivity or simply proved to be incorrect. Observations difficult to comprehend on the other hand could be elucidated by in-depth and follow-up interview questions. This pluralistic form of methodology offered the advantage to detect and neutralize possible and mutual shortcomings of the individual approaches (Kaiser, 2014). Furthermore, by beginning and proceeding the fieldwork in an exploratory manner, this approach gave enough room for inductive reasoning, which was important, as neither the interviews nor the observations happened in a uniform way (May, 2002). Adjustments and specifications in the interrogation and analytic categories as a result of moving back and forth due to new discoveries and theoretical insights happened on a daily basis. The fieldwork comprised of four weeks in total, 16 semi-structured interviews, excluding informal

conversations, and can be roughly divided into four phases: Phase one describes the initial organization, site selection and on-site information gathering, first conversations and trust-building. The second phase comprised of mainly interviewing and networking. Once having settled more comfortably, more participation in daily life activities in phase three were possible, before wrapping up and asking important follow-up questions in phase four. All collected data was saved either through recordings or through meticulous note keeping.

Although the coupling of two different methods already helped containing many sources of errors, a complete triangulation of data could not be achieved due to constraints of time and resources. The ethnographic participant observer approach is very time intensive and demanding with its focus on embeddedness and regarding prior preparations necessary to set things up. There are potential connecting points suitable for adding document analysis, which has already been touched upon in the chapter addressing the planning history of the case. However, to avoid the risk of false interpretations in such limited amount of time, the decision was made to fully engage in the abovementioned approach.

Another difficulty emerging during preparation and conduction of the fieldwork was that the themes, which would ideally serve as a structure to organize the findings, were overlapping immensely. While this on the one hand posed challenges in the process of creating research categories, it does on the other hand represent the matter of fact of LEK being too interconnected and context-dependent for a wholesome categorization, which this research approach is advocating to embrace. Additionally, this dilemma reappeared in the making of interview questions, making it almost impossible to follow a template as a guideline. Consequently, the majority of the interview questions turned out to be unique. Furthermore, despite having sufficient skills in the Vietnamese language for everyday life activities and conversations, a translator was necessary for the formal interviews to secure the reliable recording of data. The role of the translator, however, was more of a support to overcome difficulties with local accents as well as cultural barriers, rather than a crucial component of the research. Nevertheless, caution was applied during interviews to rule out misunderstandings and translation errors.

6.2 Data Acquisition: Semi-structured Interviews

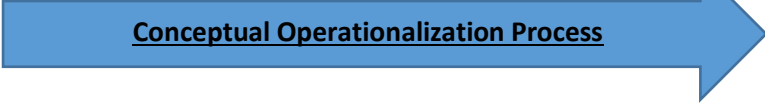
The qualitative semi-structured interviews aimed at creating a basis for the inductive analysis to understand the case. The goal was to identify underlying perceptions, values and motivations of various actors, potential influential factors, their opportunities to express these as well as how they adjust their lifestyles to changes and emerging conditions based on these values and perceptions. These are necessary steps to undertake in order to understand how the non-formal

dynamics of LEK unfold themselves in the local context of a case (Armitage, 2003; Duijn et al., 2016). One could conduct expert interviews with similar results regarding local adaptations of primary resource users, instead of engaging in the painstaking process of local research. Moreover, it is relatively easy retrieving information from scientifically sensitized stakeholders compared to conducting research on the local level, due to the abovementioned barriers and challenges. However, that is precisely the reason for the shortage of in-depth on-site studies of local knowledge (Fazey et al., 2012), which can provide valuable insights from a different perspective other than the one of the experts. Since focusing on both sides would exceed the frame of this study, the local side has been chosen as the site of interest.

Prior the fieldwork, the development of a semi-structured interview guide was broadly approached through a conceptual operationalization process of the research topic (Table 1) in accordance to qualitative research strategy by Kaiser (2014). The purpose of this is to translate the research interest into the local cultural context of the case in order for the interviewee to be able to understand and answer the questions. The guide remained flexible throughout the fieldwork, however, and topics and questions were added and discarded depending on emerging focus of inquiry.

Table 1. Conceptual Operationalization Process of the Research Topic

For reasons of clarity, the questions are not fully formulated here. An example of an interview guide with original questions has been added to appendix 1.

			<u>Instrumental Operationalization</u>
General Research Topic	Research Sub-questions (Analytic Dimensions)	Interview Categories	Semi-structured Interview Question Topics
What do planners of environmental resource issues need to consider when accessing local	What are local experiences and perceptions about social-ecological system change?	Current state of LEK (context-dependent or generalizable) Do LRUs see a connection between environmental change and their own situation?	What has changed? Is it better or worse now than in the past? Threats (what and from where?)

ecological knowledge?		Sources of knowledge and responsibility (key attribute 1)	Where is the information coming from?
	What are local level network adaptations?	Main activities and adaptation (key attribute 2)	Main activities now and then Future impacts and resource availability Family's/Children's situation
		The belief system (key attribute 3)	Attachment to the natural resource Accountability
		Motivation, Interests, Incentives	personal, community or general welfare Main topics/emphasis of conversations within the community
	What are potential points of departure for an ethnographic approach in accessing LEK?	Horizontal Knowledge Consolidation (key attribute 4) underlying barriers to upscaling LEK	Conversations within the commune (when, where, with whom, about what)
		Vertical Knowledge Consolidation (opportunities to express their opinions) underlying barriers to upscaling (hierarchies/tokenism), boundary objects, points of departure Willingness to cooperate?	Complaints (when, where, to whom, about what) Who is responsible? individual/ community contribution Have there been any workshops?

The table and the example in appendix 1 show that in such local level qualitative studies the manifestation of the eventual questions is far away from the results they are hoped to attain. This is due to the abstract nature and intangibility of the topic itself, but was also done to avoid receiving vague answers or none at all. Therefore, the interviewees were also purposefully encouraged to first talk about any issues they are most concerned about. This was to see where they place particular emphasis and to give them a chance to find a comfortable position in the conversation. This resulted in a great amount of qualitative data, with interview times reaching up to 150 minutes. After each interview, they were meticulously summarized. Furthermore, in the meantime prepared secondary interview protocols helped to capture important or unspoken details, such as level of recognition, atmosphere during the interview or any other noteworthy information. The data was then inductively structured according to three units and four analytic dimensions (explained below). This helped to narrow down reoccurring themes and other content to the most important scope relevant for analysis. According to Robert Kaiser, this is an effective way to identify, compare and process the generated information. This represents a continuous process, referred to as 'inductive inference' and 'researcher explanations' by Miles and Huberman (1994).

6.2.1 Choosing Interviewees

Selecting interviewees was determined by the kind of knowledge the fieldwork was aiming for and the affiliation with either one of the units, which will be explained below. The interviews targeted the implicit knowledge, which Kaiser (2014) characterizes as intellectual property of the interviewee. Open-ended and flexible interviews with community members allowed for the gathering of the otherwise not yet codified or archived contextualized narratives, perceptions and interpretative knowledge (Bennet et al., 2015). This information cannot directly be deduced from outside experts or formal institutional conditions (Kaiser, 2014). In fact, in this case, the role of an expert is inherited by those members of the community who draw experiences from and adapt to those village life conditions and local network aspects, which were the concurrent area of interest during the continuously progressing fieldwork. Therefore, particular attention was paid to having a wide spectrum of interviewees in the end, covering all of the important aspects of the local village network. Since LEK is a formal and informal hybrid and produced and shared collectively, this procedure allowed for the subsequent comparison of emphasis of aspects and adaptation methods between different units. Worth mentioning as well, is that all interviews have been conducted respecting ethical and privacy aspects, only following explicit consent of participation by the interviewees, informed purpose of the study and ensured confidentiality (Kaiser, 2014).

6.2.2 Difficulties with Semi-structured Interviews

The collection of implicit knowledge poses certain challenges, as it often is not immediately detectable and can only be retrieved by linking questions to aspects, which with members of different units can identify themselves. The process of finding these aspects can be time consuming and requires shifting, rephrasing or postponing of questions, which often results in many broad and vague answers. Furthermore, Polanyi (1958) explained that certain informal information would only be shared by an interviewee, if there is a common level of understanding, which can be hampered by language, cultural or political barriers or simply by a situational shift in moods. These issues have been addressed by time-intensive informal trust building before conducting interviews, arranging follow-up interviews or conversations and the secondary interview protocol to note down any complications. However, the element of risk always remained.

6.3 Structuring of the Data

6.3.1 The Units

Many researchers of the recent decades have turned to LRUs in their search for alternative information sources and ways to keep track of ecological changes, especially in regions where other ways and means are scarce. Various examples are the studies on species abundance (Benham, 2017; Sobral et al., 2017; Raymond et al., 2010), local weather observation (Ehlert, 2014) or water quality changes (Gadgil et al., 2002; Armitage, 2003; Mamun, 2010). However, these studies mostly prioritize primary producers, in particular farmers and marine or woodland harvesters (Bundy and Davis, 2012). Since knowledge consolidates collectively through complex social interrelations, looking at only a certain section of it would not do justice to the whole potential of LEK and simply mean that important information for planning is missed out on. In some specific cases, for instance, the mapping of endangered species based on hunters' knowledge (Sobral et al., 2017), it may not seem justified to gather extra means to obtain a broader comprehensive view of the situation. However, as previously discussed, the root causes of degrading environmental resources, such as overexploitation stemming from economic inequalities or powerful political interests, should not be forgotten in the investigation of LEK for planning purposes (Nadasdy, 2005). Case studies, for example by Nayak, Armitage and Andrachuk (2015), have already revealed how social and institutional disparities influence the trajectory of social ecological change and the measures to navigate it. In order to achieve adaptive decision-making in environmental resource use dilemmas with complex user networks, analysis needs to span the entire social-ecological system (Nadasdy, 2007). More concretely this means

that instead of only focusing on primary producers who are in direct contact with the resource on a day-by-day basis, indirectly affected people and interrelations behind the curtain of local resource extraction and institutional administration need to be included as well.

For the reasoning above, special attention was paid towards the inclusion of the many different roles, responsibilities and functions of village inhabitants during the data acquisition process. The information collected was structured according to the following three units: primary producers, social and economic organization and formal institutional roles. The first grouping of primary producers, those stakeholders who are mostly in the limelight, are working most closely with the lagoon or in its surrounding environment, such as in fisheries, aquaculture, farming or in many cases all three combined. The second unit comprises of a variety of members all involved in the social or economic organization of the commune, such as the teacher, shop owners, members of the woman union association or traders. Lastly, the third unit includes people in certain positions of knowledge sharing processes or in charge of internal and external organization of social life in the commune, such as the village head, the political leader, or university staff. Every actor knows different aspects or shares different perspectives about the use of resources, which combined, can draw the complex network of social ecological interrelations (Mamun, 2010). Furthermore, the process of understanding the many ways knowledge is differentiated within the village included talks and interviews with members of all three different groups encompassing men, women and across older and younger generations. Nevertheless, the strong interrelatedness and the fact that many members of one unit could very well also fit into another suggests that the distinction of three units is not clear-cut. This however has been recognized during the conversations and interviews and speaks for the use of a flexible interview guideline. The separation of three units proceeded along the main activity and role of each member of the community, serves mainly for data organization and has been reflected upon in the analysis.

6.3.2 The Categories

The various members of the three different units have been interviewed regarding pressing contemporary issues. The resulting data has been structured according to four partly anticipated and partly inductively determined categories: (1) local experiences with social-ecological system changes, (2) underlying interests and motivations, (3) village-level adaptations, and (4) the perception of who is to take responsibility for coping measures and other interventions.

This first category, derived from the first key attribute of LEK mentioned in the above literature review, served multiple purposes during interviews as well as in the written section of the findings. With the goal to collect implicit knowledge, this category marks the beginning of each section

regarding the content. By allowing the interviewees to choose a current issue of social-ecological change to talk about in the beginning, one could not only see on what particular topic they put emphasis on, but it also pointed in the direction the interview would develop to and provided the opportunity to prepare more in-depth questions. Hence, the later sections of the findings will build upon this category. In fact, this describes the same procedure and purpose as in other studies on LEK with the purpose to document recent ecological changes (Benham, 2017), with the only difference being that not only primary producers and ecological changes are targeted but the whole range of community members.

The second category comprises what Kasier (2014) characterized as intellectual property important for the reconstruction of orientations and motivations for activities, adaptations and decisions of actors. This was of particular interest in this study against the background of the previously elaborated criticism of how LEK is utilized in environmental planning and management by Nadasdy (2007). A similar procedure was applied in the study about the role of traditional agroecological knowledge in adaptive management by Armitage (2003) which has been adjusted and adopted for this category. Based on the narratives and answers in other categories provided by the interviewees, the subject matters have been allotted an associated interest or motivation for why they were talking about it and acted upon it. These are the following:

- interests associated with ecosystem/species vulnerability (e.g. habitat protection or considering vulnerable time periods like spawning season or recovery processes)
- interests associated with own survival (e.g. livelihood concerns, harvest yields, safety)
- interests associated with own economic situation (e.g. strive for more leisure, comfort, higher standards)
- interests concerning resource management, regulations and governance (e.g. restrictions, land-use, quotas, zoning, future planning)
- interests regarding community welfare (e.g. education, health, sanitation, waste treatment)
- interests of social learning and innovation (e.g. continuation and renewal of LEK, incorporating new insights from external information sources or personal experimenting)
- interests to maintain ceremonial/cultural believes (e.g. spiritual worship or environmental consciousness)

The third category, derived from the second key attribute of LEK, bases on field observations and interviewee narratives about how LRUs and other villagers went about coping with current issues and conditions in their social-ecological environment. From this category the fourth one was

inductively derived, which includes inaction and delegation of responsibilities for coping measures to other parties, particularly higher government levels. Information recorded under this category often marked the end of an adaptation narrative and often also the beginning of a new one. These four categories helped to deduce interconnections between perceptions and opinions of LRUs about local social-ecological processes, their motivations to act or to stay inactive, as well as possible self-organized adaptations. The analysis process of the results may then provide insights into answering the research question.

7. Results

7.1 Case Description

Trung Làng sits at the north of the lagoon where the Cửa Lác dam separates brackish water from the lagoon with fresh water coming from the tributary Ô Lau. The construction of the dam in 2002 brought many changes. Not only does it function as a salinity control measure and reduces flood risk, it is also an accessible short cut between the commune and the coastal area. However, one aquaculture operator (AO) explained that with the obstruction of seasonal currents many migratory fish species disappeared as well. Furthermore, there were no more gradual changes in salinity or water levels. When change happened, it usually happened abruptly. The village of roughly seven hundred inhabitants features, next to residential houses, one paved main road, one community center (Nhà Văn Hóa), several shops, mooring spaces at the lagoon shore and a café with a beach volleyball court in the village center. Furthermore, speakers are spread around the village broadcasting news, distribution of tasks and any other information that is necessary to share, twice a day. The square in front of the Nhà Văn Hóa, as well as the road and private front yards are repurposed as drying spaces for rice during harvest seasons, approximately two to three times a year (see appendix 4, illustration 1). There is also a small shrine located near the lagoon shore, which sometimes featured little offerings, however, it was reported that it is not used often anymore, as former customs of spiritually guided harvesting methods and periods have mostly vanished. Instead, farmers and AOs have to adhere to the timetable of harvesting machines that usually are leased by groups or the whole commune for a limited period of time.

Traditionally there are two main groups in the community: farmers, mainly growing rice, peanuts and a few other tuber vegetables, and fishermen, catching wild fish, operating aquaculture ponds or both. The most common fishing methods for commercial use are Sáo, huge bamboo constructions build alongside the flow of the water current to trap larger fish at the end, and Lù, a kind of bow net to catch smaller fish, crab and shrimp (see appendix 4, illustration 3). While

recreational fishing became increasingly popular among younger generations, older traditional ways, such as Chuôm, a bamboo fish trap lowered to the lagoon bed, have been vanishing quickly. Additionally, destructive fishing methods, such as electricity fishing and dragnets, which destroy surrounding natural habitats, were very popular in the early 2000s, but have been banned after natural fish stocks almost collapsed. However, many villagers complained about people still using these methods despite the risk of punishment.

The operation of aquaculture is by far one of the most time consuming jobs in the commune. It comprises a variety of tasks to be completed on a weekly basis, such as the harvest of sea grass as fish food for the ponds (see appendix 4, illustration 4) or the cutting and trimming of bamboo poles as a preparation for construction of new ponds in the coming season. Since fish theft happens occasionally, AOs sleep on the lagoon on small self-constructed platforms to protect their fishponds. The most common fish species raised in the ponds is the grass carp, whereas pangasius and mullet are mostly caught in the wild. The fresh fish is sold directly at the lagoon shore each morning at sunrise at the same place (see appendix 4, illustration 6). There is no access by road, traders therefore have to come and leave by motorcycle over dirt paths. However, most traders are related to the fishermen, often live in the village as well, and bring the fish to the next local market. Bigger amounts of fish, for instance following a clearance of a fishpond, are oftentimes sold to outside middlemen and brought to the nearest city for further processing.

The café, among few other shady places along the village pier, serves as the main place of intercommunal communication (see appendix 4, illustration 2). It is the first place where male workers are coming together to share any important information. This process follows a certain hierarchy. The time between five and seven in the morning is the busiest one, when mostly middle-aged workers gather to discuss their plans over a coffee. Afterwards, it is mostly young kids playing on their mobile phones and watching television up until around four in the afternoon, when everyone returns from their chores to play games, read, talk or gamble. Older men and women in general are rarely seen here. They prefer the shady places at the pier. Regardless of the groups, the most discussed topics are prices of the fish in the morning, catch amounts, recent fish dying events or sea grass occurrences. However, noteworthy is that information for their livelihoods, such as occurrence of sea grass, is mostly shared on a relative-only basis, while more crucial information, such as word on pollution events, spreads much more quickly and farther. Additionally, there are internal farmer meetings two or three times a year during end of harvest season to discuss plans for upcoming seasons.

Regarding village internal issues, such as theft, spatial conflicts or any kind of turmoil, the village head (Trưởng thôn) is the main contact person. He is also responsible for advising people about flood preparation measures and monitoring the progress. Most of his information he receives from the political leader of the commune (Bí thư) or the authorities. As he often takes over the role of a coordinator between various people of various functions in the village, he has a good overview of current internal developments and needs. Nonetheless, there is no strong connection or increased formal information flow between authorities and the Trưởng thôn. Regarding external matters and connection with higher administrative levels, the Bí thư is in charge and the first person to address. Furthermore, various socio-professional organizations, such as the woman union or village level fishing and farming associations hold formal roles of rights allocation and information sharing. During fieldwork especially members of the woman union and trader groups have been observed of taking the role of informal information organization, such as advice on dealing with waste in a more environment friendly manner, filing of complaints, feedbacks and passing on information from city traders.

7.2 Experiences and Perceptions about Socio-ecological Changes

7.2.1 Environmental Dilemmas

This chapter shall establish the base for addressing the first sub question, which potentially discloses underlying interests and motivations for the following discussion. The rapid decline in water quality over the past five years has been a major reappearing theme throughout all interviews and the whole time of fieldwork. Regarding impacts and consequences for community life, however, perceptions, experiences and emphasis differed between the units of investigation. Fishermen and AOs of the first unit were mostly concerned about the decline of natural sea grass beds in the lagoon, which need a habitat of healthy levels of water quality to survive. The sea grass not only serves as an important nursery environment for young wild fish that seek shelter but is also harvested as natural food for fish raised in the aquaculture enclosures. If the sea grass disappears, AOs have to resort to costly industrial fish food, which, according to both fishermen and traders, has the side effect of making the fish grow bigger faster and changing its taste and texture. AOs now have to search for remaining sea grass beds and travel much farther distances, hence spend more money, gasoline and time compared to earlier when sea grass beds were still plenty around. There are times, interviewee 3 (21.04.2019) said, when they have no other choice than to use the expensive industrial fish food, although they know about the consequences. Furthermore, rapid decreases of water quality have already led to sudden fish dying events in the past, which left several AOs losing their harvest of entire enclosures overnight. Interviewee 1

(20.04.2019) had observed that dying events especially happened throughout the months of August and September when also wild fish species die and come floating downstream the river Ô Lau. All interviewees from the first unit suspected that the reason for the water quality decline originates from illegal activities by a factory upstream but none of them could confirm that with certainty. One fisherman (interviewee 4, 23.04.2019) specifically mentioned Formosa as the reason for the general water quality decline. Another reason often cited for contributing to the deteriorating water conditions is the use of destructive fishing methods, which churn up the lagoon bed or intrude and spoil other natural habitats.

The terrestrial pendant to the situation on the lagoon is the dilemma of rice farmers. To raise the levels of agricultural production, nearby forests have been cut down, slash and burn harvesting methods are deployed and pesticides and fertilizer are used extensively. This has caused problems with soil erosion and infertility. One farmer (interviewee 12, 27.04.2019) remembered that there used to be a brown-colored, fertile, however thin surface layer on the ground which now gave way to a white and infertile sand layer. Moreover, nowadays, farmers mentioned detrimental impacts on their crops at times when they use lagoon water for irrigation and the longer dry periods make them rely on the water more frequently. In turn, it was also mentioned by members of the second unit that the intensive use of pesticides and fertilizer in farming further contributed to the water quality decline. One woman (interviewee 6, 24.04.2019) pointed out, that farmers burn the left over grass in harvest periods as they believed it would get rid of the diseases in the ground. However, this may only be a secondary reason, according to the Trưởng Thôn, as the village does not hold kettle, which the grass could be used for otherwise. Carting it off would be too time-intensive and not worth the efforts. Most farmers spoken to were well aware and unhappy about their dependency on the fertilizer, pesticides and environmental unfriendly harvesting methods. The interviewed farmers mentioned however: “*We either use pesticides and fertilizers or we cannot harvest*” and “*burning the grass is the most practical way to deal with it, we have no other option*” (interviewee 10, 03.05.2019). In another village, Phu Xuan, further south along the lagoon, they use leftover grass for the construction of mushroom planters. This is not possible in Trung Làng Village, as it is lower situated and the frequent flooding events do not allow for such constructions.

Members of unit 2 are mostly indirectly impacted by the decrease in water quality. Interviewee 6, a shop owner and member of the Woman Union stated, “*If the lagoon is not healthy, the fish are not healthy. That means the fishermen cannot sell their products, which in turn means they do not have enough money to come to my shop, and we do not have anything to eat.*” (interviewee 6, 24.04.2019)

One of the most mentioned impacts by decreased water quality within unit 2 is the ‘poisoning’ effect it has on the fish and other food derived from the lagoon for local consumption. They also put emphasis on another source of pollution – waste. Lagoon waters, village pathways, backyards, rice fields and especially the coastal areas around the lagoon are all subject to arbitrary disposal of garbage. In order to at least get a hold of organic waste, every household keeps at least one or two pigs, which are fed all organic leftovers. While members of unit 2 picked this topic of conversation mostly by themselves, members of unit 1 only talked about it after it was specifically brought up during the interviews. One AO (interviewee 1, 20.04.2019) was then explaining that smaller plastic particles could negatively affect fish species, while bigger pieces of trash would get stuck in propellers of motor boats in shallow water (see appendix 4, illustration 5) or obstruct plowing activities on the field. The Bí Thư and Trưởng Thôn explained that the increased trash in the natural environment is due to higher consumption rates, increased availability and variety of products in countryside stores, population growth, convenience and different packaging methods compared to the past. In the past, food items, for instance, were stored in banana tree leaves and carried from and to markets in plaited baskets. Nowadays, convenient plastic is used for seemingly everything in all shapes and functionalities.

The abovementioned conditions combined led to the fishing and aquaculture business being an unstable and risky field of work. From observations, it became apparent that AOs have higher expenditures of time and money, due to the dilemma with the industrial fish food, while having a less stable income. Traders from unit 2 further remarked that the combined factors of overexploitation (regarding catch amount, size, age and rarity of species), seasonal changes, increased competition of traders and varying pollution effects lead to immense price variations on a daily basis. One housewife (interviewee 13, 05.05.2019) further disclosed that rumors about, for instance, pollution events or affected species could trigger a community-wide refusal to buy certain foods or products, which in turn can push prices downward. Furthermore, the interviewees from unit 3 mentioned the establishment of new bigger export- and service-oriented companies, such as SCAVI or CP, which focus on mass production (e.g. shrimp) and are privileged by the government when it comes to land-use rights. Lastly, climate change impacts, such as more frequent, longer and unpredictable flood and heat periods, were mentioned both by unit 1 and 3 as not only contributing reasons for the unstable job situation in the fishing village, but also impair safety and increase pressure on farmers during harvest season, when the rice needs to be picked and dried.

7.2.2 Government Inertia

A common reappearing theme during fieldwork was the wish for more and better government intervention regarding multidimensional issues such as water pollution. Overall, there was strong consensus within the commune that this is too much to handle for the average LRU, especially in the face of powerful cooperate stakeholders like SCAVI or CP. Particularly members of unit 1 demanded for a higher-level organization and regulation. They had a clear idea about the distribution of roles: *“Everyone has their own job to do, you know”* (interviewee 2, 21.04.2019). The decision-making power lies outside the commune and big companies having their share in responsibility for the water quality changes are out of their reach. *“So, there is nothing left for us to do than to alleviate the effects”* (interviewee 11, 03.05.2019). This is in line with statements made by the university staff involved in the site selection of the research. Regarding local expertise, one staff member was concerned, that *“if researchers or responsible officers need something from here, they just go, get it, and leave again”* (informal conversation, 19.04.2019). Furthermore, when asked about the long-term vision of the lagoon’s management the answer was, *“At the moment, there is none. The commune is left alone with its challenges, but actually does not have the capacities to handle them.”* Furthermore, *“authorities only step in when they consider the case as urgent enough. The impact of pollution is not sudden enough, and statistics will not have any effect.”* (interviewee 15, 04.05.2019)

Especially concerning the provision of information and other public services, interviewees complaint about being left in the dark by the authorities about the real reasons of the water quality decrease and what actions are taken to solve the issue. One trader portrayed how she came to know about the pollution event in the first place only by observing government staff doing ‘weird’ measurements down at the lagoon and guessing that there must be something wrong. The following rumors and fish dying events had confirmed her suspicion. Consequently, the Bí Thu explained that his position got more and more responsibility and pressure, being the only formal connection between authorities and village. However, he explained as well that the flow of information on environmental situations is practically non-existent as he is restricted in his report to information on social economy and security. Some people mentioned that there have been workshops over the past years, even including feedback sessions providing locals the opportunity to speak out. However, those workshops only took place outside the commune and quickly turned out to serve only two reasons. First, one wanted to find out how well government induced rearrangement measures have been adopted and second, who is eligible to receive financial compensation. Furthermore, it has been reported that the highest ever-involved government level was the district level.

7.3 Village Network Adaptations and Perceived Government Responsibility

7.3.1 Water Quality Decrease and Other Pollution

Alongside the progressive loss of natural resources, old fishing methods are also vanishing. Only older generations remember the use of Chuôm as the main fishing method, which is much less efficient compared to contemporary methods. In order to make up to the increasing lack of resources, the first reaction has been the intensification of all other extractive methods, such as aquaculture, which was mostly established during the early, mid-nineties. The initial wave of use of nowadays-illegal destructive fishing methods has been repressed by government initiatives, but depending on who was asked during the interviews, they are still occasionally or even frequently in use. Members of unit 1 complained that only a few households in the village using these methods could have a better life at the cost of all other inhabitants. One older fisherman (interviewee 7, 24.04.2019) stated that the problem with those methods is that those who use them can actually earn more money in the short-term due to increased catch amounts. However, they would do that in the exchange of fear of punishment by the authorities. Generally, one can say that destructive fishing methods are socially frowned upon. People carrying the electric fishing equipment usually avoided eye contact and other people observing, pointing at their catches, described them as ‘not good quality’ or ‘very cheap’. A bigger problem, and one that could not be addressed appropriately by authorities, according to members of unit 3, is the increased density of gills of fishing nets, which are also capable of catching smaller and younger fish. Those would have normally been able to slip through the fishing nets and guaranteed future catches for fishermen. However, lagoon resources have reached a point of depletion where fishermen feel forced to resort to the new nets. According to one AO, some have actually increased the size of and distance in-between net enclosures to improve water flow and quality. However, at the same time there are AOs doing it the opposite way, in order to increase their output to make up for previous losses, and therefore contribute to the deteriorating water quality even further. Additionally, many AOs experiment with various fish species, observing which fish can survive best under the new, worsening conditions.

7.3.2 Food Anxiety

Members of unit 2 are especially aware of the effects water quality can have on the fish they usually consume. Nevertheless, they also expressed high levels of mistrust in the industrial fish food and concerns about the overuse of chemicals in agriculture. The women in the village spoken to mentioned that they often walk very selectively through market aisles, deliberately only buying slow-growing, ‘low-value’ vegetables, such as pumpkins, gourds and zucchinis. Due to the low

profitability of these vegetables, they know that farmers do not plant those extensively and thus avoid the chemicals. Regarding fish for local consumption, many members from unit 2 explained that due to the impacts of industrial fish food on fish raised in aquaculture, locals now prefer fish caught in the wild, such as pangasius or mullet, despite the higher prices. Fish raised in aquaculture is cheaper and mostly sold to outsiders and city traders who do not know or care about the quality differences. After the Formosa marine life disaster, fish was entirely off the list for an extended amount of time. People then relied mostly on their own poultry. The situation exacerbated after a wave of swine flu also made pork a taboo. Summing up the daily repeating food dilemma, one homemaker noted defenselessly: *“You have to choose your food carefully when going to the market, but most of the time you do not have a choice anyway. If you do not eat you will die, but if you eat you will also die.”* (interviewee 8, 25.04.2019)

7.3.3 Garbage Disposal

The issue of the trash in the environment has, on the one hand, already been addressed indirectly by government authorities by integrating educational measures on recycling and environmental friendly behavior into school teaching programs (e.g. clean-up field trips or the Green Sunday Program). On the other hand, there has not been any government induced garbage collection, until three years ago, when the villagers collectively decided to enter a contract with a garbage collection company themselves. This, however, only concerns self-collected household garbage. Arbitrarily thrown out waste still occurs and remains an issue. In order to address it to some extent, the commune’s woman union informally organized an internal garbage collection, recycling and reselling program to support poor people as well. This, however, only concerns garbage consisting of recyclable material that still bears a monetary value.

7.3.4 Livelihood Diversification and its Consequences

One of the most apparent responses to the seemingly insoluble working conditions of the fishing and aquaculture business within the commune is the diversification of livelihood sources. There are notably three different forms of livelihood diversification in Trung Làng. The first one is the addition of new elements to the daily activities and distribution of those among family members. Many women, for instance, instead of helping out with fishing activities on the lagoon, have now taken up fish trading, to on the one hand assist their families in selling the fish catches or aquaculture products and on the other hand have an additional source of income. Others have added a hair salon compartment to their houses or work as drivers. The problem with this mixed diversification is that aquaculture and fisheries is a very time and energy intensive field of work comprising a variety of necessary activities to be completed throughout the year. Adding extra,

unrelated tasks clashes with this lifestyle and often does not allow for a continuation. Therefore, many interviewees of unit 1 were in midst of a transition of completely abandoning aquaculture and switching to a new service, which is the second form of intercommunal livelihood diversification. This has led to a higher variety of services available in the area than before. According to the Trưởng Thôn, the most popular new jobs are tailor and construction worker. Some fishermen and AOs decided to focus entirely on agriculture, which has slowly led to a constellation shift within the commune, from water related activities being the majority to now terrestrial activities.

The third form of livelihood diversification manifests itself through generational adaptation. Since village life cannot be sustained entirely by living off the lagoon anymore, older generations do not see a future in the fishery business for their children. Most young people therefore leave for the bigger cities, such as Da Nang, Ho Chi Minh or Hanoi, to study or earn a living and support their families with money transfers from the distance. An older woman noted, “*only long-time fishermen continue to go on, young people mostly do not even start at all*” (interviewee 8, 25.04.2019). According to her, it is too hard for young people to get a hold in the industry with the new conditions. Some are especially unlucky, as they had already bought all the necessary equipment but now desire to quit. Most of them now either wait for more government compensation to arrive or work in one of the new aquaculture companies around the area. The Trưởng Thôn and the Bí Thư have in fact assessed this as a positive development, as it provides young people with the opportunity to receive a stable income, keeps the poverty level low and relieves pressure from the lagoon. In general, the fact that the new generation discontinues with the traditional fisherman lifestyle does not affect the older generations. On the contrary, they are rather happy and not worried about the future, since life quality has improved overall and most of their children managed to make the transition.

7.3.5 Climate Change Impacts and New Developments

In the face of changing weather conditions and increased frequency of flood events, villagers are encouraged by the authorities to build two story houses with solid roofs, due to safety reasons. Walking through the village one can notice the many new developments taking place, providing opportunities for former AOs to find work in the construction business. However, there is a second reason to the manifold new developments – comfort. Some members of unit 2 explained that solid roofs provide a cooler interior and are less noisy during rain than the earlier corrugated tin roofs. This was important to better understand the newly purchased television. New houses often also included the acquisition of fans, fridges, water filtration systems and bathrooms, which were all still uncommon ten years ago, according to the Trưởng Thôn. These new developments allowed

for leisure activities, longer possible indoor working times, better storage of food and increased independency from natural water reservoirs, which let water pollution appear less grave. However, they also came with changing demands, such as functioning water sewage systems, which are still poorly managed. Most sewage flows into backyards to percolate into the ground. Furthermore, these new developments demand a high amount of space in the commune. Spatial conflicts between neighbors therefore occur more frequently. One woman lamented that in her case, as in many other cases as well, they had to sacrifice their private vegetable garden for the sake of the new houses. As a consequence, they have to go outside to buy vegetables now. However, she added here that young people are not interested in vegetable farming anymore anyways and buying them outside is more convenient and time efficient. Also noteworthy is that there are two huge contributing factors to making all the new developments within the village possible. Firstly, the money available sent in by their sons and daughters working away; and secondly the villagers nowadays have the option of paying higher sums of money by installments.

7.4 Interests and Motivations

There was a general feeling of powerlessness and lethargy among LRUs. Upon being asked whether people would like to help out by sharing their knowledge, one AO answered: *“Of course I am sharing my knowledge with anyone who asks, but nobody is asking”* (interviewee 1, 20.04.2019). However, the most used phrase by LRUs was *“let it be”*. Despite having many troubles and changes occurring, people were positive about life generally being better than it used to be. One woman remarked, *“All in all life has gotten much better, but the environment is worse off. Therefore we cannot be fishermen anymore”* (interviewee 8, 24.04.2019). This ‘let-it-be’ mindset was particularly prominent among younger generations. However, older generations did not find this irritating. The same woman further added, *“Young people may not care anymore, but life is changing. They change their jobs and that’s just how it is. The only thing I am sad about is when they have to leave to the city”* (interviewee 8, 24.04.2019). The same can be said of the local belief system. Only a few older inhabitants in the village remain knowing about the former spiritual component of resource harvesting and they were not particularly open about it. Younger people mostly referred to older generations when asked about this issue and remarked that they only would pray to ancestors that the future would be a good one.

While interests associated with traditional believes, social learning and ecosystem vulnerability kept rather low and neglected, interests associated with own survival, economic situation and community welfare and well-being were predominant. People often assigned a monetary value to subject matters in the interviews and conversations without being asked about it, usually also

annotated with the comment of being cheap and that everything of higher value (e.g. larger fish species) has disappeared. Moreover, members of unit 1 were mostly preoccupied with livelihood concerns and harvest yields, while members of unit 2 paid much more attention to raising one's own living standards. Members of unit 3 were the only ones mentioning any interest associated with resource governance.

8. Discussion

The state of embeddedness of a researcher in local community life offers plenty opportunities to document the various processes and encounters in great detail. From the results above, one can see that the developments within the community are deeply impacted by the environmental degradation. However, the discovered issues go far beyond resource extraction, yet still can mostly be interlinked. Reflecting on these interrelations can provide crucial insights in planning issues at hand, while disregarding them may not only mean to miss these insights, but also incite the emergence of new developments.

8.1 Disregarding Adaptations

Many of the findings show a trend of tokenistic co-planning of resources in the lagoon community. There is no overarching long-term vision and the commune is more or less left alone with the task to deal with local social and environmental challenges, despite very limited capacities. Authorities only intervene in the most urgent matters and otherwise sporadically pick information about the economic situation within the community and check whether prior top-down rearrangement measures are still in place. This is as far as the co-planning reaches as of the time of research. A research endeavor, which involves staying for an extended amount of time in one place, came to a surprise to many inhabitants of the village as well as to the university staff. The best example for this is the local city hall, which is visited by outsiders in only such rare occasions that it has been transformed into a rice-drying place and sports ground. This leaves locals with no opportunities to attend any meetings of importance, which mostly would take place outside the village at times when most locals need to work. Therefore, the intra-communal solution communication and finding process happens only on the village level, closed off from any outside interested party. Due to the leaping gap between local and district level, planners miss out on this local discussion as well as any consequential local network adaptations. This does not remain unnoticed by the local population. Not only do they feel left in the dark regarding information on important happenings within the lagoon, but also left alone when it comes to handling them. The overwhelmingly interconnected issue of water quality decrease and loss of their livelihood sources combined with

this feeling of powerlessness and having no voice evoked in many a mindset of forlornness, or in the words of most locals: “*let it be*”. Having abandoned many of the old ways of livelihoods, there is no motivation left to fix the cause of the problem but only to evade its consequences by becoming independent from the degraded resource, its uncertain future and inert authorities.

This feeling of insecurity about social welfare, (economic) security and how to handle the situation combined with growing distrust in experts and authorities are the underlying drivers for the resulting self-organized actions (Hornidge and Antweiler, 2014). However, these self-organized actions do not manifest in increased political activities or collective social movements. Based on their experiences with reaching out or filing complaints they have learned that nothing would change or that their voices would not be heard anyway. Additionally, their time-consuming livelihood activities would not allow them to spend extra time and energy to engage in the first place. Therefore, most locals do not join any political board; and the few who do, cannot reach higher than the local level or have to adhere to restrictions in the provision of information. Hence, those said self-organized actions come in the form of network adaptations.

The most common way out, for those who can afford it, is livelihood diversification. This process provides a form of local social and economic resilience in times of environmental instability and change (Nakashima, 2012). The three types of livelihood diversification seen in the village are good examples for this process of detachment from lagoon resources. Nevertheless, one can find more kinds of self-organized village adaptations to the many issues discussed above, such as the informal organization of waste collection and recycling, the experimenting with different fish species or the use of fishing nets with increased density of gills. Some of these self-organized adaptations come with yet again further increase in pressure on lagoon resources, as demands and consumption rates are multiplying. The ecosystem services are often only on a barely functioning level, just to maintain an income and gain more time to change to a new livelihood source, before the former is ultimately lost. Older generations who have seen the better days of the lagoon describe this process as a form of trade-off, saying, “*life is better now, while the environment gets worse and worse. There is nothing else one can do except for letting our children take up another profession*” (interviewee 8, 25.04.2019). As a planner of the lagoon’s resources taking the local mindset and the resulting local-level adaptations into account is crucial, as they can mutually reinforce each other leading to even greater losses.

What becomes clearly visible in the findings, is that in order to get a good understanding of local issues, their backgrounds and context, one has to include not only the directly involved stakeholders, due to the interrelatedness of the village network. This thesis identified and used

three different units of analysis; however, depending on the local context these could be extended. Furthermore, even within units, there are stakeholders of a clear overview of relations and others without. Therefore, it is good to have the information provided by one unit complemented by the narrative of another. The most prominent example here is the issue of local food. While members of unit 1, the primary producers and mostly men, could often provide in-depth information on where the fish is coming from and how it is caught, they many times did not mention any change or problems in their daily diets. Members of unit 2, mostly women and working in the trading business, on the other hand described grave changes in the average food intake of their families. They are further down the chain of consequences than members of unit 1 are and therefore have a better overview of interrelations of issues (example for chain of consequences in figure 3). That is also one of the reasons why members of unit 2 often appeared to be much more specific when talking about what exactly should be changed in order to improve their situation. On average, they also delegate less responsibility to the government and think of solutions themselves. This is also because many of them are part of the woman union, which functions as a place of information sharing and discussion and can afford to focus on clear and proactive ideas, while other organizations and individuals are preoccupied with dealing with consequences instead. However, the woman union is often still forced into a passive role regarding reaching outside the local level, since their concerns are mostly not considered urgent enough.

The Trưởng Thôn and most of all the Bí Thư, from unit 3 are the ones in the village with the closest contact to the external authorities. They mostly had a better means to articulate themselves regarding village concerns than the other units, as they are working with these issues on a regular basis. However, they also often tended to focus on the things that are working out fine, rather than on those issues with a negative connotation during interviews. They are in a position of responsibility and often under pressure, as they are the only ones, villagers can turn to for complaints and put their hopes in.

8.2 Disregarding Underlying Interests and Motivations

Although insufficient, measures to avoid self-organized adaptations, such as the co-designed re-arrangement of lagoon activities, compensation and workshops, have been undertaken. Nevertheless, the integration of locals or rather the consideration of their context-specific adaptations for planning processes is important but alone insufficient itself. One has to pay attention to underlying interests, perceptions and experiences of locals, in order to get an understanding of how local issues are developing.

The event of environmental crisis and increased economic pressures on the lagoon provide an entry window for market pervasion in the form of for instance industrial fish food or fertilizer and pesticides, which in turn, despite short-term benefits, have a worsening effect in the long-term. Taking the offer of the market is the easiest form of adaptation and quickest remedy to accommodate the major interests. However, later on, locals often face a dilemma. Their quick remedy indeed solved one problem, but mostly not the cause of it and instead created a few new problems. Traditionally, the spiritual component, or in other words environmental consciousness and constraints, served as a form of guidance in times of despair or ensured that situations like in the case of the Tam Giang lagoon could be avoided in the first place (Berkes, Colding and Folke, 2000; Reichel, Martens and Harms, 2012). Similar to the study of Ehlert (2014) about traditional weather lore in the Mekong delta, the former moral framework in the Tam Giang lagoon could not hold out against the pervading economic pressures and 'progressive' forms extraction. Former customs and guidelines are vanishing and have given way to economic necessity and top-down government planning. What Harvey (1993) and Nadasdy (2007) highlighted as the underlying processes that shape and reflect social-ecological system behavior can arguably be recognized in the case of Trung Làng Village. Livelihood concerns, directly or indirectly led by external market forces, represent the strongest drive for adaptations, resulting in a local transition process away from the traditional ways of managing natural resources, as also seen in different places in Southeast Asia (Santasombat, 2011; Hornidge and Antweiler, 2014). For many villagers accepting this means to survive in the newly emerging characteristics of their own social-ecological system. This explains the use of small-gilled fishing nets, disinterest in continuation of lagoon activities, or the distribution of aquaculture products to outsiders instead of local consumption. The co-planned rearrangement of activities to save the lagoon from overexploitation and to make it more productive again in fact stimulated this transition even further. Young people whose parents have been compensated to quit the aquaculture business have a hard time to get a hold in the business without parental support and now, due to lack of other options, rather leave to the bigger cities or wait for more financial support by the government to arrive.

Along with these newly emerging system characteristics, new experiences with higher living standards and convenience increasingly affect local people's motivations to adjust their lifestyles. The quickly newly emerging way of life for many villagers may have retroactive effects on lagoon resources, but also opens up new possibilities to adapt to trans-regional challenges such as climate change or flood risk in the form of for instance new and safer housing developments. However, yet again one has to keep in mind that everything regarding LEK is tied in and interlinked (Figure 3). New developments bring flood safety on the one side, but on the other, they for instance entail

the sacrifice of vegetable gardens. They bring televisions, bathrooms and more opportunities for leisure activities, but also evoke spatial conflicts and new demands such as expensive sewage systems. These developments force a disruption into the state of LEK, which science and adaptive planning had originally conceptualized as intrinsically resilience enhancing. Older generations are compelled to disconnect from the former state of LEK, while young people grow up disconnected from the start, as consumeristic and materialistic values as part of the new state of LEK determine their lifestyles, which helps them to fit into the system. This makes the process of disconnection from the former livelihood defining natural resource two-fold: Firstly, one cannot solely count on it anymore and secondly, one does not need to solely count on it anymore.

It is important for adaptive planners to acknowledge that LEK does what it always has been doing. It is coevolving and adapting to modern societal and economic developments and changes in the environment, by discarding (e.g. old fishing methods, spiritual components, etc.) or taking up anything (e.g. plastic, fertilizer, destructive methods) that is necessary or beneficial for surviving and striving in the newly emerging characteristics of the system. It is not that LEK has not the capability to keep up with changes in the social-ecological system (as criticized by Fabricus, Scholes and Cundill, 2006). That would only be the case if one merely defines LEK by and reduces it to its ecological component, due to the slow disembedding process from its natural environment (Santasombat, 2011). However, if one looks at all the different constituent parts of LEK in a certain context of not only significant environmental constraints and variability, but also local and trans-regional social, economic, political, as well as formal and informal factors, one can discover a much higher degree of adaptive capacity and interconnectivity (see Figure 3). This has been attempted by the ethnographic approach and integrating the three different units into the research agenda. However, planners accessing LEK need to consider the dilemma of it being a consequence of system developments and relations, which makes the use of it as an information source problematic in the face of genuine adaptive resource planning. The resilience enhancing capacities are intrinsic, but the result of it might not be the result wished for. The abovementioned general lethargy, livelihood diversification out of economic necessity or the loss of spiritual components are all signifiers for this dilemma.

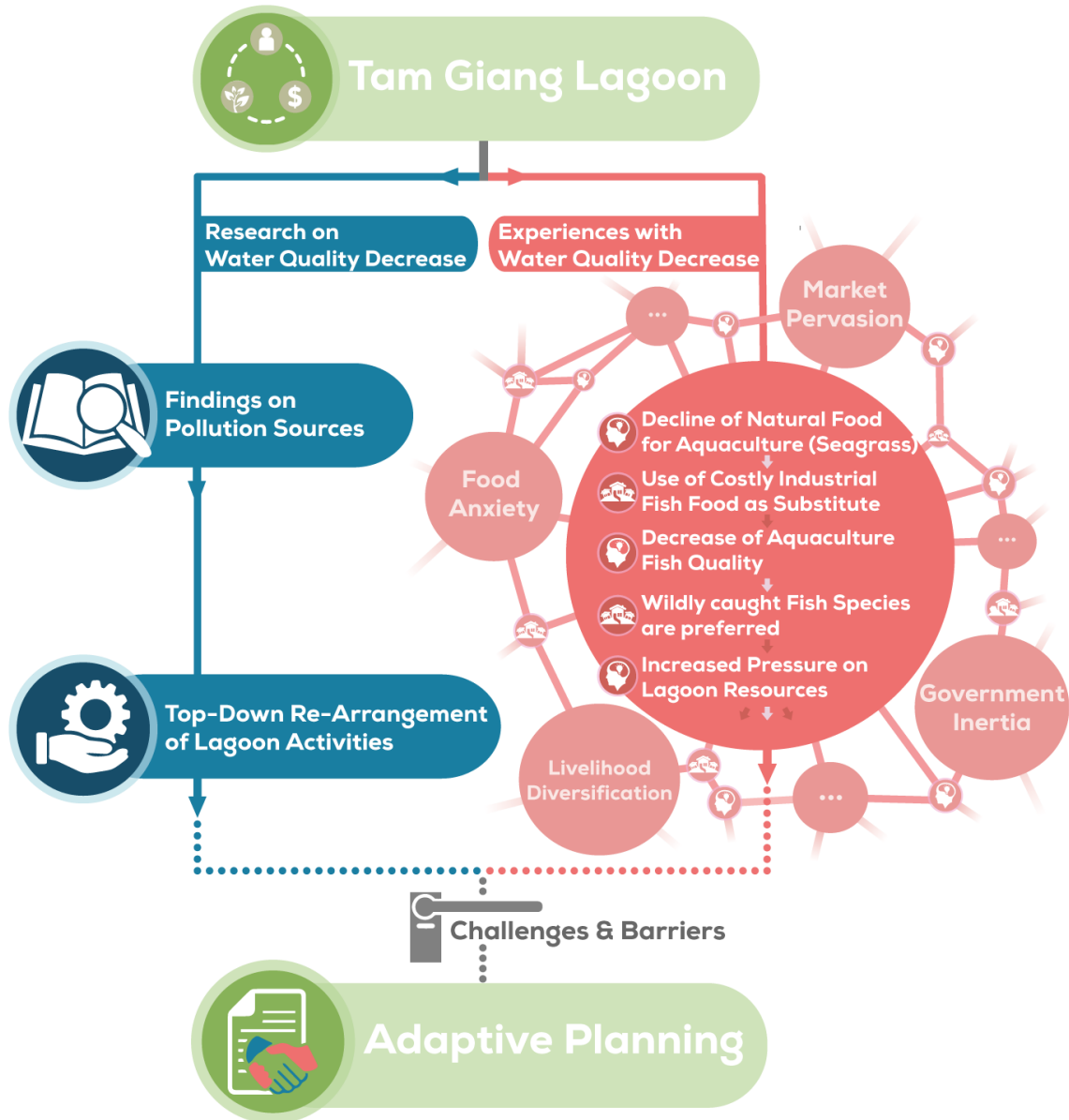


Figure 3. Example of Results

The case investigations of LEK with the aid of the above-explained conceptual framework led to a synoptic picture of mutually influencing and intertwined experiential knowledge and network adaptations. The above figure builds on the example of experiences with water quality decrease. In the background, various other interlinked examples that were mentioned above can be identified, such as food anxiety, livelihood diversification and government inertia. The pointer market pervasion can be attributed a special placement as it can be found pervading throughout the whole network.

8.3 The Ethnographic Participant Observer Approach

Despite increasing awareness about different types of knowledge, the lens of scientific knowledge is the most common type of perception through which researchers and managers explore their environments (Rathwell, Armitage and Berkes, 2015). While a formal process of knowledge integration, such as workshops, can be useful for the planning of resources in theory, the distinction of the two itself should be treated with caution in practice. In reality, they are not that distinct and often mingle with each other, merge and overlap into a form of hybrid knowledge (Raymond et al., 2010). Furthermore, the purely scientific standpoint of conceptualizing LEK as a static item, which can be integrated and exchanged without embracing underlying shifting perceptions and motivations, could lead to maladaptation over time. As Berkes (1998) and Gadgil et al. (2002), the standpoint in this thesis argues against the handling of this matter in such a rigid way. However, this thesis' goal is not to create a new way of categorizing knowledge but to accept the interrelatedness, dynamism and constant evolution of local knowledge and realize the consequent inconsistency of the attempt of unilateral knowledge integration.

Further, to address the fact that there is no universal truth but multiple valuable knowledge systems under the influence of continuous social and environmental processes and to enable negotiations on equal footing, Rathwell, Armitage and Berkes (2015) have introduced the epistemological arena as a possible setting for the exchange of knowledge. Before that, Miller et al. (2008) have already suggested a form of dynamic epistemological pluralism to overcome interdisciplinary difficulties in the research of social-ecological systems. One may see the ethnographic participant observer approach applied in this thesis as an extension of the epistemological pluralism in the field, suggesting to look at knowledge as a form of overlapping and intertwined 'spheres', from which individuals can draw information to make expressions and claims about their surroundings. Moreover, one sphere of knowledge can actually create new leeway for the expression of another and vice versa. However, this highly depends on the researcher/planner and his or her willingness to self-reflect, as well as the open-mindedness of the research subjects. Usually formal planners of resources are not resource users themselves and focus more on control and maintenance of predictable yields, than on ecosystem thresholds and social self-organized adaptations. Planners need to rethink the ways of how they conceptualize adaptive planning and instead of only focusing on predictions, data collection and other formal technicalities, combine these spheres of knowledge with what they can learn from local social and ecological contexts and interrelated adaptation processes. After all, if sustainable planning is supposed to direct the use of resources in way that they will be available for future generations to come, then why does it not take place on the local level? Applying an ethnographic lens may

provide the means to bring together the different knowledge spheres of formal adaptive planners and grass root actors as a cross-scale institutional link and help investigating LEK in a new dynamic light to overcome the barriers and challenges discussed earlier. It, for instance, allows for the access of informal information exchange places and processes, such as the café in the center of the village, which represents the first place of collective knowledge formation. Since formal places like the Nhà Văn Hóa are mostly not in use, the café is the place to feed in new ideas and potentially incite bottom-up changes.

The ethnographic approach also enables the planner to study and understand local interrelations in the same way LRUs came about to understand them themselves. Thus, interconnectivity, which before posed a hurdle in the planning process of adaptations, now becomes a potential source of information. Furthermore, a flexible approach like this creates a space for envisioning a future that is different from the present (Rathwell, Armitage and Berkes, 2015) and leaves the search for a static model of knowledge integration obsolete. The flexibility also allows it to be coupled with any form of adaptive planning and management in any environmental context, such as river basin management, co-management, EBAs and IWRM. In fact, the combination of different approaches that embraces multiple perspectives and appeal to different ways of knowing is more likely to be effective than a single universal remedy (Schoeman, Allan and Finlayson, 2014). It allows greater focus on the very early stages of the process of adaptive planning and helps ensuring that planning experts engaging in it will have a sufficient depth of experience directly relevant to the problem at hand. Hence, it potentially enables the combination of central guidance with bottom-up approaches, which proved to be difficult to achieve in Vietnam so far, as no delegation of decision-making power is necessary. Nevertheless, this does not mean that this approach is immune to power exploitation and reluctance to change.

Furthermore, some scholars argue that LEK is not suited to be combined with formal institutional sciences, as it would displace LEK from its place-based identity (Rathwell, Armitage and Berkes, 2015); and LEK informed planning could not address forces of change beyond local control (Bohensky and Maru, 2011). Ignoring this could lead to far reaching impact. It therefore depends on the planner's background and skills in engaging in the epistemological pluralism and allow for the necessary embeddedness. Moreover, bypassing the barrier of overwhelming interrelatedness and drawing from its potentials requires careful and time-intensive involvement and may seem a daunting task in the beginning. Especially since overlapping themes make it impossible to find clear-cut categories, as new knowledge leads to new adaptations and vice versa. Therefore, generalizability may be low and each context may require its own attempt to study it.

Concluding Thoughts

After reflecting upon the results of this case study one may better understand in practice what David Harvey (1993) had expressed in theory. The human and the natural worlds are inextricably connected through a complex network of tangible and intangible links, such as local ecological knowledge (LEK). One may consequently contemplate about the peculiarity of trying to understand changes in our natural environment by integrating LEK without understanding our own social and economic environment as well. This study has also shown that in doing so, one not only misses out on crucial information about local developments for planning purposes, but also potentially initiates emerging self-organized (mal-)adaptation. In the attempt to improve the way planning can access and utilize the connecting link of local knowledge to understand social-ecological system changes, this case study's objectives were twofold: Firstly, sub question one and two aimed for the creation of a synoptic image of LEK and its constituent parts, including adaptations and their underlying experiences and motivations, in order to get a solid comprehension of the case; and secondly, under the third sub question, particular attention was paid towards the method of accomplishing the first objective.

Many of the self-organized network adaptations in the village can be seen as a response to local resource user's (LRU) perception of inert authorities, and therefore already represent a form of adaptive planning. However, some of these adaptations led and will lead to maladaptation in the long-term, as their underlying interests are predominantly steered by livelihood concerns. The anxiety of LRUs about their degrading livelihood sources can be traced back to market pressures increasingly taking over local values and motivations involved in decision-making. Nevertheless, members of the community, which are not directly involved in the harvest of resources, have shown a broader oversight and initial approaches of proactive solution finding to various issues in community life, which are intertwined with the overarching issues of environmental degradation. It is therefore of importance to define these abovementioned values based on the whole community. In general, the combination of different units provided a greater and clearer picture of the overall situation, which investigations focusing merely on primary producers would not have been able to provide, due to the overwhelming interconnectivity of the issues. Planners of environmental issues therefore need to consider the far-reaching scope of LEK, as well as its coevolving nature to social system changes and economic developments. Interests and perceptions indicating and signifying these trends manifest the true potentials of LEK, which formal institutions have so far had difficulties to get hold of or neglected entirely. Hierarchical resource governance systems, such as in the case of Vietnam, are therefore often blocking local

voices from being heard, hold on to reductionist data collection methods and let co-planning efforts segue into applied tokenism.

A major part in this thesis was the testing of an ethnographic approach in practice as an extension of the epistemological arena in theory in a non-democratic socio-political environment. Combining traditional aspects of planning theory and procedures of anthropological research, the ethnographic participant observer approach offers a mechanism to bypass the rigidity of such conservative regimes. The approach paves a way to incrementally extract important LEK derived information about social-ecological system dynamics from the local level and potentially feed it into the running system without hurting existing hierarchies, delegating decision-making power or creating new barriers. At the same time, it offers the opportunity to introduce new ideas to local resource users in a mutually respectful manner and thus engage in genuine knowledge exchange that has the potential to incite changes from below instead from the top. Such procedure outlines the creation of an epistemological arena. There is no formal guideline and no guaranteed point in time in which such an arena can be established. Instead, the approach applied in this study supports the researcher/planner through embeddedness in the local life, access to valuable informal places and times of information sharing and a deeper understanding about local ideologies to build the arena over time and trust. This process highly depends on the character of the researcher, his background, skillset and the other individuals he is dealing with and how open they are to the process. Therefore, the researcher is required to be constantly and cautiously aware of different backgrounds, needs and epistemologies of the participants. Especially on the local level, this demands for expertise in both social and natural science as well as theoretical knowledge and open-mindedness to practical experiences. These demands and the high context-dependency of this approach does on the one hand pose a challenge to future research endeavors of this kind, as generalizations and guidelines can hardly be generated, on the other hand it offers the flexibility to experiment with different settings and combine it with methods from other scientific areas. In fact, it is highly recommended to experiment and combine in future studies, as no single approach can ever comply with the multi-faceted drivers of change in our complex social-ecological systems.

Nevertheless, it is true that local adaptations, the visible outcomes of social-ecological system dynamics, which already give important insights about environmental change, can be observed by anyone and may not require a time intensive ethnographic approach. However, these represent only the visible tip of the iceberg of the concept of LEK. In order to be able to draw from its true potentials and utilize it for planning purposes we need to understand the underlying informal institutions of these adaptations as well. The approach here, although time intensive, is capable

of overcoming the internal challenges of understanding these informal institutions. Moreover, while it may not be able to provide a solution to the external barriers, it is at least not severely affected by them.

We are moving in a time of globalization from below (Santasombat, 2011), where people start questioning the traditional scientific mindset and scientists are questioning the paradigms of knowledge. Hence, if provided a chance to engage in epistemological pluralism and self-reflection, lower level government officials might start questioning the higher-up decision-making structures as well. In any case, scientific concepts for environmental resource planning are becoming more and more fluid between the subjective (local knowledge) and the objective (scientific knowledge). We are getting to that point where we will realize that there is no such duality, but something infinitely more challenging – no pure objectivity at all. In a way, holders of LEK are, though mostly unknowingly, a step ahead of scientists in embracing this.

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Interview Sources

Interviewee	Main Occupation	Age	Male/Female
1	Fishing/Aquaculture	59	M
2	Aquaculture	61	M
3	Fishing/Aquaculture	37	M
4	Fishing	32	M
6	Shop Owner	50	F
7	Fishing	75	M
8	Homemaker	66	F
10	Agriculture/Fishing	49	M
11 (Bí Thư)	Construction Worker	no data	M
12	Agriculture	48	M
13	Homemaker	48	F
14 (Trưởng Thôn)	Agriculture	63	M
15	Science Faculty Dean	no data	M

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Appendix 1: Semi-Structured Interview Protocol Example

Subjects of Analysis	Subcategories	Interview Questions
<i>Background</i>	Broad questions as a base for following in-depth questions.	<ol style="list-style-type: none"> 1. Personal details: Name and occupation 2. How long do you work in the lagoon? 3. Where do you work in the lagoon? → map 4. What do you do/catch/grow? 5. How much time do you spend in the lagoon?

<i>Quality of LEK: Experiences and perceptions</i>	Do LRUs see a connection between environmental change and their own situation?	<ol style="list-style-type: none"> 1. What does the lagoon mean to you? What is special about it? 2. Is it nowadays easier or more difficult to get by living of the lagoon?
	Are shared experiences/knowledge addressing personal, community or general issues? (context-dependent or generalizable)	<ol style="list-style-type: none"> 1. What has changed? (in case of young interviewee, what has he/she been told?) <ol style="list-style-type: none"> a. Are more people entering the lagoon to fish? b. Did the catch decrease? c. Did target resource change? d. Common health issues back then and now? 2. (also referring to connection to own situation & interests: asking about whether these changes are threats)
	Is the sharing process based on own experiences/external sources/both? (Outside influence)	By asking how or why he/she knows that.

<p><i>Local network adaptations and interests and motivations behind LEK sharing process</i></p>	<p>How do LRUs think about the impact change will have on their future? (long- or short-term thinking)</p>	<ol style="list-style-type: none"> 1. Do you see your children also work in the lagoon later? 2. Do you think you will continue being a (e.g. fisher) 3. What else are you doing apart from (e.g. fishing) and why?
	<p>Do LRUs adjust or put different emphasis on different aspects of LEK when talking to different people? (insiders vs. outsiders)</p> <p>(referring to all 3 subjects of analysis)</p>	<ol style="list-style-type: none"> 1. Do you talk about these changes with your friends/colleagues/neighbors? When/on what occasion do you usually talk about this? 2. Do they complain to you? If yes, about what? 3. Do you complain to someone? To whom? Outsider or insider? Authority? What is the main issue then?

What are potential points of departure for accessing LEK?	Who do LRUs hold accountable for these changes? And who is responsible dealing with them?	<ol style="list-style-type: none"> 1. Where do you believe these changes/threats are coming from? 2. Should something/someone change? Who/What? 3. Who is deciding authority about when/how/where to raise fish? You? Outsider? Are you ok with that way?
	Are LRUs willing to (continue to) contribute to adaptive co-management in the future by sharing LEK?	<ol style="list-style-type: none"> 1. Would you help out if someone asks for your advice? 2. Do you think you actually can help improve the situation?
	Are potential underlying interests a barrier to the sharing process?	<ol style="list-style-type: none"> 1. Why do you (not) want to help? 2. What would be a reason for you to decide to not help?
	What are potential boundary objects (or processes/organizations) of change which serve as mutual reference points for different holders of knowledge	<ol style="list-style-type: none"> 1. What would you do to avoid these threats? 2. If you could conserve a particular plant/animal/section/feature etc., what would you conserve? (also interest question)
	Is the current knowledge transfer in the lagoon one-way, bi-directional (genuine/tokenistic) or not happening at all, from the LRU's perspective?	<ol style="list-style-type: none"> 1. Have you participated in a workshop? <ol style="list-style-type: none"> a. If yes, was it just for information, or also for consultation (feedback)? b. If yes, what do they want from you and do you think they are right? 2. If no, do you think it would help?

Is there someone else you would recommend us to talk to? Thank you very much!

Appendix 2: Secondary Interview Protocol

Secondary Interview Protocol Nr.

Place:

Time:

Duration:

Name:

Age:

Male/Female

Contact: _____

Occupation in the lagoon: _____

Other background data: _____

Degree of recognition: _____

Did they mention: trash, overexploitation, climate change, water quality change?

Atmosphere during the interview:

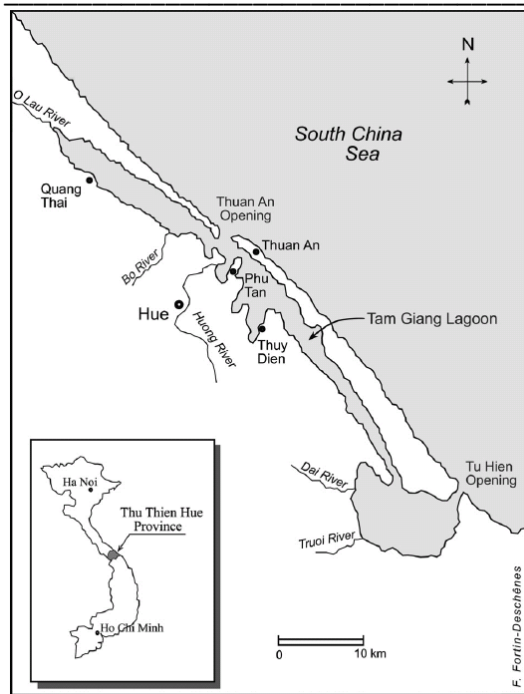


Fig. 1. Tam Giang Lagoon, Viet Nam. Source: Adapted from Cartographic Publishing House, 2002.

Appendix 3: Summary of Findings

Unit of analysis ↓	Dimension of analysis →	Local Experiences with Social-Ecological System Changes	Underlying Interests and Motivations	Village-level Adaptations	(Government) Responsibility
		<p>Water quality decrease (everyone mentions fish dying events and seagrass decrease, N.4 named this as the main reason to quit, N.11 precisely names Formosa and another unknown factory upstream and destructive fishing methods as reasons) everyone believes it is caused by a factory upstream but no one is sure about it, they complain that they are left in the dark some mention Formosa as the main cause (Nr. 4, 6, 8, 11) farmers experience the same problems with fresh water pollution for irrigation</p>	<p>interests associated with livelihood concerns</p>	<ul style="list-style-type: none"> • some have actually increased the size and in-between distance of net enclosures in aquaculture for improved water flow, while others do it the other way around for more profit to make up for the loss and by that actually contribute to water quality decrease (mentioned by N.1) • experimenting with fish species (mentioned by N.1 and 2) • since harvest yields and seagrass resources and consequentially incomes are lower, they need to grow more and use industrial fish food • unlike fishers, farmers say they can resort to pesticides and fertilizer, that in turn, however, creates a dependency on those. N.10: “if we do not use them, there will be diseases, which means no harvest” • discuss (pollution) problems internally (in work breaks or in main hang out spots) and then talk to village/association leader (N. 1 and 2) • plus there are internal farmer meetings two or three times a year during harvest times, to discuss plans for 	<p>general opinion: it’s the authority’s task! N.4: it’s not a task for simple villagers, especially not in the face of a powerful company separation of people and authorities “everyone has their own job to do, you know”</p>

			the upcoming season (observation, N.6)	
	<p>Fishery/Aquaculture are not stable anymore (mentioned by everyone) Combined factors:</p> <ul style="list-style-type: none"> • Low income • price for raised fish decreased, due to use of industrial fish food • Lack of natural resources (mainly seagrass and wild fish species, especially migratory species) • Costly industrial fish food as substitute • Fish dying events lead to loss of whole harvests • Strong price variations (N.2 and 3) 	interests associated with livelihood concerns (especially younger generation)	<ul style="list-style-type: none"> • Change or add to their jobs (tailor, farmer, driver, etc.) (job change mentioned by everyone) • a diversified livelihood does not fit with the lifestyle of aquaculture/fisheries as it is very time intensive, leading to the abandonment of this job as a whole or distribution of tasks among all family members; some have their future covered already, even if aquaculture goes down completely (N.1 and 2) plus observation of all the necessary tasks to complete throughout the year • earlier there was a clear distinction of two groups (fishers and farmers) in the village now there is a shift from fishers to farmers (N.10) • young people are moving to cities • more services in the area than before • because of the younger generation change their jobs and leave, they are not worried about the future as their own lives are figured out "I'll just sell or rent out my land" (N.10) 	some wait for/rely on government incentives to continue or change methods (mentioned by young fishermen, N. 4)
	<p>trash as an influencing factor</p> <ul style="list-style-type: none"> • affects species, therefore affects income (N.1; seen as a problem by everyone, but 	interests associated with livelihood concerns	self-organized garbage collection by village (starting 3 years ago)	<ul style="list-style-type: none"> • government induced green Sunday programme (happens rarely or perfunctory) • before the 3 years complaints

	<p>mostly never mentioned on their own only after reminded)</p> <ul style="list-style-type: none"> propellers of motor boats often get stuck in plastic in shallow waters (observation) negative impact on plowing the fields and growing of plants (N.10 and 12) 			<p>were made but no change</p> <ul style="list-style-type: none"> (N.10 and 12) complain that they have to pay more because it is self-organized (confirmed to be wrong by dean)
	<p>After dam (dap cua lac) was built, lots of changes (N.1)</p> <ul style="list-style-type: none"> more control on salinity no more gradual changes when change, then abruptly and extreme (e.g. flood) leading to loss of fish disappearance of migratory fish 	interests associated with livelihood concerns	experimenting with fish species (N.1 and 2) cannot do anything but work with the changes and make the best out of it	
	<p>industrial fish food</p> <ul style="list-style-type: none"> costly makes fish grow bigger faster impact on taste and texture 	interests associated with livelihood concerns	<p>communicate and explore where seagrass beds are still available going longer distances by boat compared to earlier to harvest seagrass (observations, N.1)</p> <ul style="list-style-type: none"> more time and gasoline (and money) spent on the same activity compared to earlier less revenue do not want to use it but have to as it is the reason for the price of raised fish going down but no choice as natural resources are limited 	
	<p>destructive fishing methods (mentioned by everyone) (electric fishing, new small-gilled nets, scraping off mussels destroying sea bed)</p> <ul style="list-style-type: none"> illegal but still in use 	interests associated with livelihood concerns	<p>everyone who does aquaculture, sleeps outside in the lagoon during the night to protect the fish from these illegal activities</p> <p>the problem is that those who use destructive methods actually can</p>	common opinion: it is the government task to install more regulations

	<ul style="list-style-type: none"> • destroy healthy conditions for seaweed to grow • overexploitation of fish resources, young and small fish also taken out • plus fish theft is also common 		<p>earn more money in the short-term in exchange for fear (N.7)</p> <p>complain a lot, but voices are not heard (all of them) need to deal with it alone as far as possible people who use it are ashamed to admit (observation) socially frowned upon “khong tot” “very cheap”</p>	
	<p>the old ways are vanishing the old ways of fishing (e.g. chuom) are better for the environment but are not used anymore as it is way too hard to make a living like this (older generation, N.7)</p>	<p>interests associated with livelihood concerns</p>	<p>switch to new fishing methods and aquaculture (mostly since the mid-nineties) (N.1 and 7) some switch to destructive methods to have a better life at the cost of others (N.7)</p> <p>‘all in all life is better, but environment is worse, therefore we can’t be fishers anymore’ (N.7) people who use illegal methods live more in fear of controls and punishment (N.7)</p>	<p>controls and punishment</p>
	<p>as for the weather situation, the past 2-3 years were quite suitable for farming, therefore farmers said that the situation was better now, however, draughts and floods are more frequent now than in the past, while storms and rain is less. (N.10 and 12)</p>	<p>interests associated with livelihood concerns</p>	<p>floods are a major barrier for sustainable farming methods (e.g. mushroom method) in this village (N.10 and 12)</p> <p>people are more scared and under pressure to harvest and dry the rice (N.10 and 12)</p>	
	<p>continuous use of environmental unfriendly farming methods</p> <ul style="list-style-type: none"> • overuse of fertilizers and pesticides • slash and burn harvest method 	<p>interests associated with livelihood concerns</p>	<p>they do see the air quality problems though and complain about cough during harvest period (N.12) but they see no other option or required actions</p> <p>“we either use pesticides and fertilizers or we cannot harvest” (N.10 and 12) “burning the leftover grass is the most practical way to deal with it” as there is no kettle to use it for in this village, it costs</p>	

			money/time/work force to transport it to another place, and people hope to kill the disease with the fire	
	experiences with government inaction (regarding e.g. use of destructive fishing methods or water quality decrease)	interests concerning resource management, regulations and governance	<ul style="list-style-type: none"> • some reach out in their complaints to the Bi Thu (with no success) (N.1) • willing but passive “sharing knowledge with anyone who asks, but nobody is asking” • stopped to reach out “because nothing ever changes anyway” • young people are rarely involved in talks and mostly wait for the authorities to take up something (N.4) “villagers do not care about the plans but just follow” (N.7) • ‘we have to let it be’ since they do not know what to do on their own and they do not see authorities stepping in, most of them lost trust and hope that it is going to change; ‘nothing ever changes’ • information crucial for livelihood is shared mostly on relative-only basis “if you are my family member of course I will give you advise, otherwise it is your own responsibility”(N.7, 8) information crucial for survival spreads more quickly “word on pollution spreads quickly” (N.9) 	<ul style="list-style-type: none"> • strong wish for more government intervention within this group (as they do not know how to deal with these issues themselves). especially in regards of environmentally degrading behavior

Social and Economic System (Women Union, Traders, Teacher) (6)	Garbage in the village	interests associated with community welfare	<ul style="list-style-type: none"> informal organization of trash collection and recycling to support poor people Individual women also advise to deal with trash in a more environment friendly manner also spread information on speakers (N.6) every household has 1-2 pigs to reduce organic waste 	
	modernization and education has made life better but different (mentioned by everyone)	interests associated with economic situation (strive for more, e.g. comfort, safety)	we now have the means to buy things for comfort and safety etc. (shop owner)	
	“poisoned food” caused by <ul style="list-style-type: none"> polluted water (fish and other sea food) industrial fish food overuse of chemicals in agriculture 	interests associated with family or community welfare	<ul style="list-style-type: none"> quality difference between raised and caught fish results in price difference, making caught fish more valuable and asked for (mentioned by all traders) more people rely on own poultry and fresh water fish (N.8) “you have to choose your food carefully when going to the market, but most of the time you do not have a choice anyway.” (Nr. 6) Locals know which fish comes from aquaculture (mostly grass carp) and which fish was caught in the wild Unlike earlier wild fish (e.g. pangasius or mullet) nowadays is preferred, as it does not feed on the industrial fish food. Outsiders do not know about this difference (mentioned by everyone) After Formosa event sea food was off the list (same goes for 	

			<p>pork for a while after swine flu) (N.8) or at least avoid certain species (N.9)</p> <ul style="list-style-type: none"> • Women walk very selectively through markets now (N.8) and deliberately buy “low value”, slow growing products like pumpkins, gourds and zucchini which cannot be planted extensively, as they know that farmers will not use pesticides on • Once the fish is up for sale, it is very hard to find a cause or someone responsible regarding fishing methods, as it is not possible to see by which way the fish was caught “a dead fish looks like a dead fish” (N.9) • has a big impact on daily life quality “if you do not eat you will die, and if you eat you will also die.” (N.6) 	
	<p>Overexploitation (quantity, size and age of fish, rarity of certain types), season, increased competition of traders (due to more people changing to this job), pollution and rumors have a combined impact on the price of the fish (mentioned by traders)</p>	<p>interests associated with livelihood concerns</p> <p>interests associated with economic situation (strive for more, e.g. comfort, safety)</p>	<p>strong price variations; better change to tailor with less variations (N.9)</p> <p>“if the lagoon is not healthy, the fish is not healthy, means the fishers cannot sell their products, which means they do not have money to buy in my shop, and we do not have anything to eat”(N.6)</p>	
	<p>computer skills are most popular, most kids have a smart phone already curriculum is fixed, government steered also more school projects on environment friendly behavior (recycling, green Sunday, etc.)</p>	<p>interests associated with family or community welfare</p> <p>interests associated with social learning and innovation</p>	<p>due to educational prospects in the village, teacher says out of 100 students only 5-10 stay in the village after graduating from secondary school</p> <ul style="list-style-type: none"> • new demands are hard to satisfy as trained staff and equipment is lacking (N.5) 	<p>authorities are responsible for schedules and equipment</p>

	in commune there is only school till secondary school (N.5)		<ul style="list-style-type: none"> students who want to continue studying have to leave to city school trips outside to clean environment 	
	more frequent, longer and unpredictable flood and heat periods (N.13)	interests associated with economic situation (strive for more, e.g. comfort, safety)	<p>build new two story houses with stairs and solid roofs (N.13, 5, observation, confirmed by dean)</p> <ul style="list-style-type: none"> a lot of construction jobs at the moment in the village safe place to go during floods quiet now during rain (different roof) can watch TV uninterruptedly vegetable farm had to be sacrificed for that, so now vegetables have to be bought outside 	
	experiences with government inaction (regarding e.g. provision of information or public services)		<ul style="list-style-type: none"> Woman union as a place of information sharing, discussion and filing complaints, feedback and complaints plus charity projects (clear ideas, but not much impact, as authorities do not give them much voice) (N.6) The teachers home is a café and offers the main gathering spot for free time activities and local knowledge hub (especially morning time 5am – 7am, afterwards mostly for younger generations, in afternoon the working generation gathers to play) this is the first place where information is shared (regarding prices of fish, amount of catch, pollution problems, dying events, sightings of sea grass, daily plans are made and a collective opinion is formed) 	<p>Woman union often forced into a passive role, no voice but still receive info and plans from government “plans for changes or initiatives usually come from the outside. When we file a complaint or report about a problem, it is usually too small or not urgent enough for them” plus it was mentioned that after environmental crisis started opportunities to give feedback on that seized completely (N.6)</p>

			(observation and N.5) <ul style="list-style-type: none"> • TraderS often take up the role of communication in the trader-fisher communication web (N.9) 	
Formal Institutional System Internal and External Issues, Science (Village Chief, Political Leader, Professor at University) (3)	job changing situation (info by Bi Thu 11) <ul style="list-style-type: none"> • Encouraged by authorities in 2012 to free up space in the lagoon (especially sao area decreased by 50%) • New bigger export- or service oriented companies move in and privileged by government (SCAVI, CP) • Most popular jobs to change to are: construction worker and tailor (14) 	interests associated with community welfare interests associated with resource management, regulations and governance	decision making power lies outside the commune (nothing we can do) new companies can offer new jobs for younger generation <ul style="list-style-type: none"> • Compensation • Opportunity to start a new job, get rid of lagoon dependency, stable income 	“it is good, as this diversification relieves pressure on the lagoon caused by population growth” plus it keeps the poverty level low (10% according to Bi Thu)
	population growth in the area (info by Bi Thu 11) <ul style="list-style-type: none"> • increase of birthrate • government forced resettlement of boat people to the land 	interests associated with resource management, regulations and governance	increases pressure on village and lagoon <ul style="list-style-type: none"> • more jobs needed • more mouths to feed, more trash 	need for more and better regulations
	city regions are privileged over country side (info by Bi Thu 11) <ul style="list-style-type: none"> • investments in the city are 100% covered by government • investments in the countryside need to be 50% supported by the people 	interests associated with resource management, regulations and governance		need for more equity

	<p>trash due to (info by bi thu and truong thon)</p> <ul style="list-style-type: none"> • higher consumption rate due to more products and more money available • population growth • different packaging methods now compared to past (Banana leaves) convenience 			
	<p>more developments within the village, due to</p> <ul style="list-style-type: none"> • more money available coming in from the outside • option nowadays available to pay by installments 	<p>interests associated with economic situation (strive for more, e.g. comfort, safety)</p>	<ul style="list-style-type: none"> • more developments means changing life conditions, demands and more work • new technologies, like fans, fridges and TV enable new activities for leisure but also longer indoor work times, faster work processes or better storage of food, water filtrations allows for not having to rely on natural water reservoir, so pollution of it not so grave anymore • having a bathroom was uncommon 10 years ago, changed the need for water sewage system • spatial conflicts occur more often now 	<p>Changing needs need to be accounted for. But are mostly Internally managed</p>
	<p>Flow of information on environmental situation is practically non-existent (Dean)</p>		<p>local people get to know about an issue only after there already has been an impact</p> <p>Every information is useful and crucial for local people to avoid extra costs, consequent health issues and further environmental degradation. (Dean)</p> <p>Village head (Truong Thon) is the first person to address for locals in</p>	<p>need for closing the gap between the commune (local people) and district level (government) so far it only works in urgent cases and pollution is not enough. The impact is not sudden enough, statistics do not work. (Dean)</p> <p>More collaboration with the university needed (Dean)</p>

			<p>case of internal issues such as theft, conflicts or any kind of turmoil or questions. He also is responsible of advising people in their flood preparation and monitoring the progress. He can coordinate between people of various functions in the village.</p>	<ul style="list-style-type: none"> • Political leader Bi Thu is first person to address for outsiders, when information needed from district level or information needs to be shared from government side (11) • Information requested from Bi Thu by government is mostly about whether prior government implementations are working or not. Other internal developments are not considered. Bi Thu is restricted in his reporting on those in his annual reports on only social economy, security and well-functioning of “the system”(11) • Truong Thon has a good overview over current developments and needs, but there is no formal knowledge exchange
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Appendix 4: Illustrative Pictures



Illustration 1. Drying rice in front of the Nhà Văn Hóa.



Illustration 2. Resting area in the shade near the village's mooring spaces.



Illustration 3. Placing Lùr to fish for small fish, crab and shrimp.



Illustration 4. Harvesting sea grass as natural food for aquaculture fish.



Illustration 5. Propeller getting stuck in trash and other fishing gear.



Illustration 6. Weighing and preparing the fresh catch to be sold in the early morning at the lagoon's shore.

Declaration of Authorship

I hereby declare that the thesis submitted is my own unaided work, all direct or indirect sources used are acknowledged as references and it was not previously presented to any other examination board.

Henner Leithäuser, Groningen, 14.08.2019

