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지리학석사 학위논문

Development by Cumulative Adaptation  
of Riverside Slums in Phnom Penh:  
Exploring Linkages between  
Adaptation, Coping, and Development

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Exploring Linkages between  
Adaptation, Coping, and Development

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# Abstract

Adaptation is increasingly discussed in inter-disciplinary research, due to the global threats from climate change. The development literature suggests that adaptation is a possible strategy for sustainable development, terming as 'development by adaptation'. However, 'development by adaptation' has been relatively under-researched at household level. This thesis argues that it could be examined by exploring linkages between short-term coping, adaptation and development at the household level. The purpose of the thesis is therefore to explore linkages between adaptation, coping, and development in order to unveil the process of development by adaptation at the household level, through the case study of Phnom Penh (the capital of Cambodia), riverside slum households and flooding.

Two research questions were set. First, how do the riverside slum households of Phnom Penh cope with flood vulnerability? Second, how is the short-term coping of the households related to long-term adaptation and development? The thesis introduces the concept of 'development by cumulative adaptation' to answer these research questions. The thesis applies mixed methods for analysis including both quantitative and qualitative methods, based on 119 questionnaire surveys and 26 interviews in the nine slum communities in Phnom Penh.

Chapter 4 answers the first question by examining flood vulnerability and the actual coping strategies used in riverside slum households in Phnom Penh. Flood vulnerability and coping are analysed with respect to exposure, sensitivity, and adaptive capacity. The households are sensitive and exposed to multiple issues, including food shortages, disease, injuries, disrupted education, income decreases, insufficient money, the destruction of houses, lost belongings, damaged infrastructure, and negative impacts on social capital. Slum households attempt to cope with each type of exposure with limited capital. Chi-square tests of

independence showed that changes in livelihoods have a significant relationship to certain coping strategies. This implies that successful coping is based on activeness, transformation, and social support from relatives, communities, and the government.

Based on the results in Chapter 4, Chapter 5 investigates the process of development by adaptation at household level and the concept of 'development by cumulative adaptation'. Unlike planned development at national level, households also need to face unexpected and unplanned development in their ordinary lives. In this sense, achieving successful coping, which would reduce exposure, reduce sensitivity, and increase adaptive capacity, is a key issue in reducing vulnerability at the household level. This successful coping has to take place not just once, but cumulatively so as to achieve adaptation in the long term. In other words, the process of development by adaptation is based on cumulative results of favourable coping over time.

The concept of 'development by cumulative adaptation' allows us to understand the reasons why the slum households are failing to adapt in two ways. First, most households fall into constant trajectories of 'underdevelopment by cumulative maladaptation' with inactive and path-dependent coping and a lack of social support. The second point is that successful coping is rarely performed continually and sustainably. An example is the single case support from the government and NGOs, erosive coping, and non-persistent transformation.

The thesis highlights successful cases, showing that collective action plays an important role in converting the downward trajectories into development by cumulative adaptation. First, unlike action taken by the government and NGOs, collective action is relatively common and sustainable in that communities can provide contextual support. Secondly, collective action can involve monitoring the erosive coping strategies of households. Thirdly, most of transformative measures tend to be informed or implemented by neighbours and communities in collective action.

This thesis contributes to current adaptation and development

debates in three ways. Firstly, it rediscovers the need for cumulative adaptation, countering a long indifference. Secondly, the study finds another factor of barriers to local adaptation actions. Lastly, the thesis provides policy implications for local development in slum communities in Cambodia and other urban slums in developing countries.

**Keywords** : climate change, development by adaptation, cumulative adaptation, coping, riverside slum, collective action, Phnom Penh

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# Chapter 1. Introduction

## 1.1. Research Background and Objectives

The concept of adaptation is increasingly discussed in inter-disciplinary research, due to the global threat of climate change (Smithers & Smit, 1997; Smit et al., 1999; 2000; IPCC, 2001; 2007a; 2014). Adaptation is defined as ‘the (long-term) process of adjustment to actual or expected climate and its effect’ (IPCC, 2014:5), including transformative changes (Garschagen et al., 2016:46). Adaptation is frequently used and compared with ‘coping’ which is defined as a short-term direct action to minimise negative impacts (Birkmann, 2011; Berman et al., 2012; IPCC, 2012; Garschagen et al., 2016). Among the various perspectives taken on adaptation in the climate change discourse, the vulnerability perspective is noteworthy as it sets a specific set of places, times and stresses with which to assess adaptation (Adger & Kelly, 1999; Yohe & Tol, 2002; Adger et al., 2004; Brooks et al., 2005; Adger, 2006; Smit & Wandel, 2006).

Adaptation is also frequently discussed in development discourse, including development geography. This suggests that adaptation is a process and practice that can result in sustainable development. In this view, adaptation is implemented in order to reduce vulnerability and to achieve sustainable development (Schipper, 2007; IPCC, 2014:1106; Lemos et al., 2016). This kind of a perspective could be termed ‘development by adaptation’. It is important to assess and introduce development by adaptation in developing countries where the vulnerability and development are close and mutually dependent (IPCC, 2014:1110; Castells-Quintana et al., 2018).

Although development by adaptation is often discussed theoretically at national and institutional scales in a developing countries context (Huq et al., 2003; Huq & Reid, 2004; Swart & Raes, 2007; Agrawala & van Aalst, 2008; Lasco et al., 2009; Ayers et al., 2014), the empirical evidence used to examine how long-

term adaptation processes are possible, has been relatively under-researched at local and household level. Unlike planned development at national level, households also need to face ‘unexpected’ and ‘unplanned’ developments in their ordinary lives (Rigg, 2012). Complex processes including unsuccessful and successful cases need to be considered to approach development alongside poverty reduction and livelihood changes in households. This thesis argues that such development is possible by exploring the linkage between coping and adaptation at the household level. This is because short-term and socially differentiated coping (Pandey et al., 2018:385) is connected to ordinary events and household strategies.

The purpose of the thesis is therefore to examine the relationship between adaptation and coping in order to unveil the process of development by adaptation at the household level through a case study. Phnom Penh, the capital city of Cambodia, riverside slum households and flooding are considered in this case study. The riverside slum households in Phnom Penh are highly vulnerable to the floods caused by climate change and other reasons (deforestation, massive urbanisation, and lake infilling) as they are located near the Mekong River (STT, 2012). They therefore need to cope annually with flood vulnerability (IPCC, 2007:327; WWF, 2009; Garschagen et al., 2016). They also need to adapt to climate change in order to reduce flood vulnerability in the long term and achieve further development.

The thesis thus set two research questions:

- 1) How do the riverside slum households of Phnom Penh cope with flood vulnerability?
- 2) How is the short-term coping of households related to long-term adaptation and development?

The first research question focuses on flood vulnerability and how riverside slum households cope in Phnom Penh. Flood vulnerability and coping strategies will mainly be dealt with through

the concepts of exposure, sensitivity and adaptive capacity (IPCC, 2001; 2007a). To understand the linkage between adaptation, coping and development, it is first necessary to unravel the actual coping strategies practiced by households in order to minimise impacts from flood vulnerability. The first question is thus a preliminary step in answering the second and major question.

The second question focuses on how short-term responses can lead to long-term processes. To conceptualise this complex relationship, the thesis utilises ‘adaptation pathways’ approaches (Haasnoot et al., 2013; Wise et al., 2014; Fazey et al., 2016; Magnan et al., 2016) to illustrate the relationship with figures. The thesis then proposes a concept of ‘development by cumulative adaptation’ to explain the linkage.

## 1.2. Research Subject

The main research subjects of the thesis are the slum households located along the riverside and subject to flooding in Phnom Penh, Cambodia.<sup>①</sup> The definition of slum households used in this thesis follows that of UN-HABITAT (2003; 2006; 2008; 2010). Accordingly, a slum household is defined as a group of individuals living under the same roof in an urban area who lack one or more of the following:

1. durable housing of a permanent nature that protects against extreme climate conditions.
2. Sufficient living space, which means not more than three people sharing the same room
3. Easy access to safe water in sufficient amounts at an affordable price
4. Access to adequate sanitation in the form of a private or public toilet shared by a reasonable number of people
5. Security of tenure that prevents forced evictions (UN-HABITAT, 2010:33).

The slums in Phnom Penh were formed at the end of the Pol Pot regime in 1979 (Fallavier, 2003). After the massive evacuation of the urban population from Phnom Penh by the regime, returnees to the city were allowed to occupy existing buildings on a first-come-first-served basis. When all existing buildings were occupied, informal and illegal housing began to be constructed in the central area. Since then, the slum has spread over the urban area and the riverside, including a number of rural-urban migrants. Although the number has decreased by 13% in last two decades, the 26, 207 slum households were still easily found in the city in 2017,

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<sup>①</sup> Numerous terms are used to refer to urban poor settlements, including (urban) slum, informal settlements, low-income settlements, squatters, and favelas (Davis, 2006; Roy et al., 2016). The thesis uses the term 'slum' to highlight the vulnerability of the urban poor.

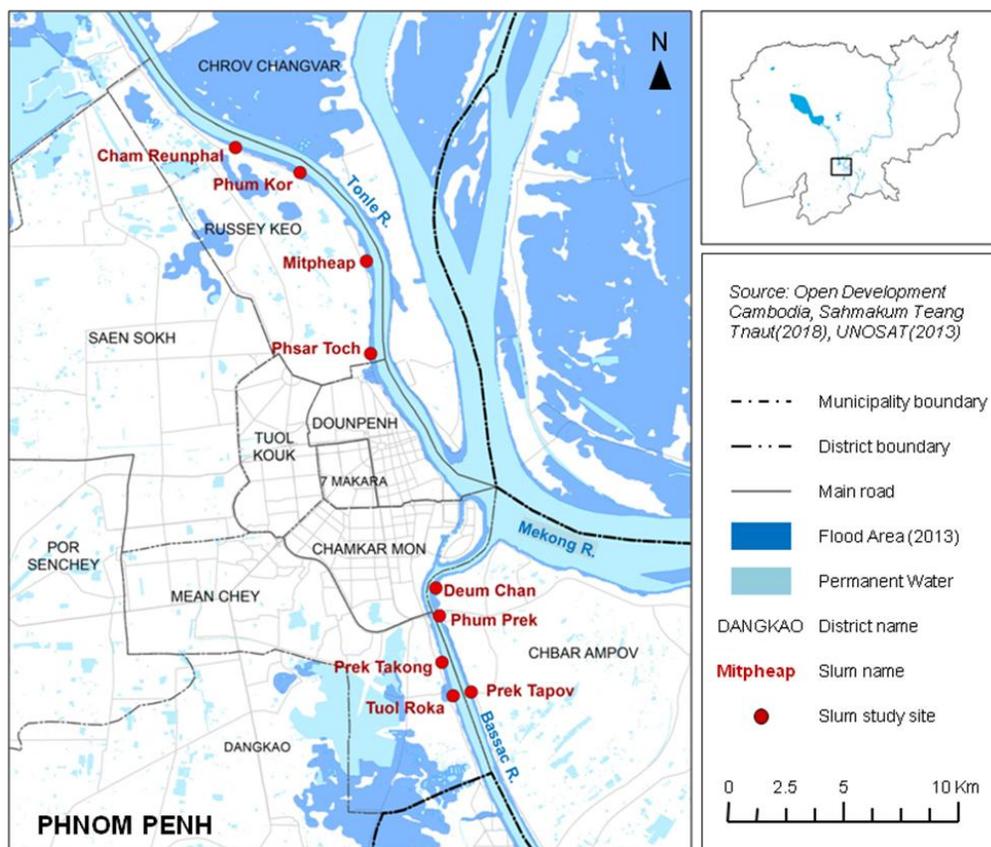
especially along the riverside (STT, 2018).

This thesis focuses on the riverside slum households in Phnom Penh for the following reasons. First, as Roy et al. (2016:3) pointed out, there has been a lack of effort to understand climate change impacts on the urban poor. Second, the riverside slum households are located in a place that is especially vulnerable to floods in the city (IPCC, 2001:719; 2007:373). Thirdly, the Lower Mekong Basin, which includes Cambodia and Phnom Penh, is highly vulnerable to extreme events caused by climate change and other reasons (IPCC, 2007:327; WWF, 2009; STT, 2012; Garschagen et al., 2016). Cambodia is considered one of the most vulnerable of the developing countries in terms of climate change (Kreft et al., 2014; Garschagen et al., 2016), and thus, it is possible to observe how households cope with and adapt to adverse climate events by focusing on the riverside slum households.

Flood events were chosen as a case study because floods occur and affect the riverside slum households annually, and so it is appropriate in that they use short-term coping and long-term adaptation. It is possible to observe the coping by focusing on each event and year, and it is also possible to observe adaptation by tracing the floods every year in the long term. To achieve the objectives, this study focuses on floods that occurred in last ten years. Given that the average annual maximum water level in Phnom Penh in last 10 years (9.13 m) is much higher than the average of elevation of slum communities (4.18 m) (MRC, 2007; 2008; 2009; 2010; 2011; 2015a; 2015b; 2015c; 2015d; STT, 2018), the decade of floods would have been a huge threat to the households, and can serve as an appropriate case for this study. The thesis does not include flash floods in the analysis.

### 1.3. Research Methods

Mixed methods, including the quantitative and qualitative methods, are used for analysis, which was conducted in May and June, 2018. Quantitative methods were applied to unravel the underlying socio-economic conditions in the riverside slum communities of Phnom Penh, and to reveal the vulnerability and coping activities of slum households during past flood events. Qualitative methods are used to enrich the results of the quantitative methods and uncover the linkages between adaptation, coping, and development.



**Figure 1.1. Location of the slum study sites**

Both methods were applied to nine flood-affected slum communities in Phnom Penh (Figure 1.1). The nine out of 277 slum communities (Fukuzawa, 2014; SST, 2018) were selected as study

sites because they are located in highly vulnerable areas and are frequently affected by flood events (UNOSAT, 2008; 2011; 2013). Furthermore, the sites are distributed among the rivers in Phnom Penh to represent diverse patterns of adaptation, coping, and development. Cham Reunphal, Phum Kor, Mitpheap and Phsar Toch are located on the Tonlé Sap River, which shifts its flow twice annually. Deum Chan, Phum Prek, Prek Takong, Tuol Roka and Prek Tapov are located next to the embankment of the Bassac River.

The quantitative methods are based on questionnaire surveys taken among 119 slum households in the nine communities in Phnom Penh (Appendix A). The questionnaire includes four topics: basic socio-economic conditions, slum conditions, flood vulnerability, and the coping activities of the households in floods. The first topic deals with basic questions such as ethnicity, income and so on. The topic of slum conditions is based on the guidelines from UN-HABITAT (2006; 2008; 2010), and thus includes questions about (1) housing materials, (2) living space, (3) access to safe water, and (4) access to sanitation, to determine whether a responding household is a slum household.<sup>②</sup> For the topics of flood vulnerability, the questionnaire uses a framework of vulnerability assessment from UN-HABITAT (2012). It concentrates on questions about exposure, sensitivity and adaptive capacity (financial, human, physical, and social capitals). Natural capital is excluded from adaptive capacity, as it is not usually available for slum households (Abheuer et al., 2013). The last topic treats coping activities during floods, respecting each capital.

The SPSS (version 21.0) and Microsoft Excel software applications were used to analyse the quantitative data. The analysis utilised descriptive statistics and chi-square tests of independence. The chi-square tests focused on findings that are robust: findings with an effect size  $\geq$  Cohen's definition of "small"

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<sup>②</sup> UN-HABITAT (2006) originally gave guidelines with five indicators, including 'security of tenure'. However, since information on secure tenure is not easily available for most countries, UN-HABITAT (2008:90; 2010:33) only gives these four indicators to define slum households.

(phi coefficient  $\geq 0.1$ ) (Cohen, 1992).

The qualitative methods are based on 26 semi-structured interviews in the nine communities, most notably with the community leaders and households who have been severely affected by floods. According to the principle of research ethics, the interviewees in this study are identified only by numbers, such as Interviewee 1 or Interviewee 2. Basic information about the interviewees is attached in Appendix B. The interviews provided supplementary data for the four topics of the surveys, and further information regarding the results and effects of coping activities during past flood events in respect of long-term adaptation and development. The interviews focused on tracing livelihood changes as identified through drawing graphs as per Rigg (2012:121), in order to find the linkage between adaptation, coping, and development. Examples of the livelihood change trajectories are attached in Appendix C.

Respondents for the surveys and the interviews were selected through a combination of random sampling and non-random snowball sampling. The respondents all met the definition of slum households, satisfying at least one of the four slum indicators. Of the respondents, 11.7% met one indicator, 43.7% met two, 30.3% met three, and the remaining 14.3% met all four. A survey or interview was classified as unreliable if it contained extraordinary outliers and inconsistent answers, or if the respondent appeared not to understand several questions and concepts. The surveys and interviews were both conducted in the Khmer language in cooperation with five assistants from the Royal University of Phnom Penh (RUPP). As they possessed a great deal of information about the area and local socio-economic conditions, the author was able to converse with survey respondents and interviewees in English. Finally, there was no conflict of interest between the investigation and the RUPP.

## 1.4. Organisation of the Thesis

In Chapter 2, the author reviews previous discussions of the linkages between adaptation, coping and development. It consists of three sections. The first section reviews the adaptation in climate change discourse and development discourse in order to position the study within the vulnerability perspective and the ‘development by adaptation’ perspective. In the second section, the author defines coping in comparison to adaptation, and critically reviews previous three approaches to the relationship between adaptation and coping. The study finds that the approaches to date do not fully explain the relationship. The third section describes the analytical framework of the thesis, based on the first and second sections.

Chapter 3 introduces the case study. The chapter consists of two parts, including information about increasing flood risks in the Lower Mekong Basin and the socioeconomic conditions of riverside slum households. The former deals briefly with climate change as seen in the basin and its impact on Cambodia, Phnom Penh and riverside slum communities. It briefly addresses the governmental interventions in climate change in Cambodia. The latter examines the short history of riverside slums in Phnom Penh, then introduces the socioeconomic conditions of survey respondents.

Chapter 4 deals with flood vulnerability and the coping of riverside slum households. According to IPCC (2001; 2007), vulnerability is a function of exposure, sensitivity, and adaptive capacity. The chapter therefore attempts to answer the question according to the concepts of exposure, sensitivity, adaptive capacity and coping with vulnerability. The first section focuses on flood vulnerability and the second section examines the actual coping strategies of the households. The latter section in particular also assesses the conditions under which coping succeeded. The chapter is a preliminary step to answering the second research question about the linkage between adaptation, coping and development.

Chapter 5 is the core chapter, and explores the linkages

between adaptation, coping and development. The thesis introduces a concept of ‘development by cumulative adaptation’ to answer the research question. Through this concept, the thesis attempts to determine how short-term coping is connected to long-term adaptation and development at the household level. The chapter consists of three sections. The first section deals how coping would affect subsequent vulnerability in terms of exposure, sensitivity, and adaptive capacity. The second section theoretically explains the concept using ‘adaptation pathways’ approaches, focusing on the cumulative features of adaptation. The last section applies the concept to the case of the riverside slum households in Phnom Penh.

## Chapter 2. Literature Reviews: Adaptation, Coping, and Development

### 2 . 1 . Adaptation in the Climate Change and Development Discourse

#### 2.1.1. Origins of adaptation

Even before climate change was a global issue, the term ‘adaptation’ could be found in a number of academic fields, both in the natural and social sciences. In natural science, mostly biology and ecology, adaptation refers to any change of structure or function in evolution, and dates back to the ideas of Darwin in 1859 (Hine, 2015). Early discussions in biology and ecology focused on clarifying the definition in evolution theory (e.g. Bock & von Wahlert, 1965; Brandon, 1978) and distinguishing adaptation from other biological terms such as natural selection, adaptedness or fitness (e.g. Bock, 1980; Burian, 1983; as cited in O’Brien & Holland, 1992).

On the other hand, adaptation discussions in the social sciences can be summarised from the perspective of two backgrounds. The first is their background in (ecological) anthropology (Rappaport, 1977; Hardesty, 1986) and archaeology (O’Brien & Holland, 1992), which focused more on cultural practices than the genetic characteristics recognised in natural science (Smit & Wandel, 2006:283). In other words, adaptation was defined as the processes (Denevan, 1983) or consequences (O’Brien & Holland, 1992) involved in changing cultural practices in response to socio-economic systems, which allows the survival of cultures. The other background is that within the sociology and business management literature (Engle, 2011). This focused more on organisational adaptation, which alters the structures and behaviours of organisations in order to adapt to existing circumstances and

challenges (Chakravarthy, 1982; Burgelman, 1991; Wiersema & Bantel, 1993).

Discussion based on the academic natural and social sciences has proliferated since the rise of climate change issues in the 1990s. The first paper to use adaptation in terms of global environmental change appears to be Butzer (1980), and the discussion then broadened into several fields, such as the agricultural sector (Rosenberg, 1992). It has now certainly become one of main issues in academia, with the publication of government reports, (e.g. U.S. Office of Technology Assessment, 1991; 1993) and the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992. Numerous early papers (Smith et al., 1996; Smithers & Smit, 1997; Smit et al., 1999; 2000) have contributed to debates on how adaptation could be defined. Definitions used within the papers differed slightly (see Klein & Tol, 1997), but all involved ‘adjustments in a system in response to climatic stimuli’ (Smit et al., 2000).

The earlier contributions and debates were consolidated into the assessment reports of the Intergovernmental Panel on Climate Change (IPCC). The IPCC ended the debate as it defined adaptation as:

Adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderated harm or exploits beneficial opportunities. (IPCC, 2001:982).

Based on this definition, adaptation in climate change discourse is comparable to the earlier discourses in the natural or social sciences in two aspects: (1) it includes adjustment in both natural and human systems, and (2) it puts emphasis on responses to human-induced climate stimuli. In this context, adaptation is also distinguishable from mitigation. Although both are implemented as options or strategies for human-induced climate change, mitigation is an anthropogenic intervention especially focused on reducing greenhouse gas (GHG) emissions (Smithers & Smit, 1997; Smit et

al., 1999; IPCC, 2001).

Discussions to determine out the definition and measures of adaptation imply that it results in successful and unsuccessful outcomes. Indeed, there is a concept of the opposite of adaptation in terms of success, which is maladaptation. Well defined in an editorial by Barnett and O’Neill (2010:211), maladaptation is an action that increases vulnerability to climate change, despite originally being taken to reduce it. The IPCC (2012) has already warned that adaptation policies and measures could be maladaptive across sectors and scales, as maladaptation erodes sustainable development as well as increasing vulnerability in diverse manners (see Juhola et al., 2016; Magnan et al., 2016). Failures of adaptation were reviewed in a number of cases, that ranged from community actions (Fazey et al., 2011) to national policies (Granberg & Glover, 2014).

**Table 2.1. Several types and concepts of adaptation**

General Concept or attribute	Examples of term used		
Timing	Anticipatory	↔	Responsive
	Proactive	↔	Reactive
	<i>Ex ante</i>	↔	<i>Ex post</i>
Purposefulness	Autonomous	↔	Planned
	Spontaneous	↔	Purposeful
	Automatic	↔	Intentional
	Natural	↔	Policy
Duration	Passive	↔	Active
	Short-term	↔	Long term
	Tactical	↔	Strategic
Place	Instantaneous	↔	Cumulative
	In-situ	↔	Out-migration

Source: selected and adapted from Smit et al., 1999; IPCC, 2001

Numerous papers have suggested types and concepts of

adaptation, and these are summarised in Table 2.1. One of the most popular distinctions is based on timing: reactive versus proactive adaptation (Klein & Tol, 1997; Palmer et al., 2008). The main difference between reactive and proactive adaptation is whether it takes place after or before impacts of climate change effects. Adaptation also varies in purposefulness: autonomous versus planned adaptation (Carter et al., 1994; Klein & Tol, 1997; Smithers & Smit, 1997; Bryant et al., 2000; Thornton & Manasfi, 2010; Thorn et al., 2015). Planned adaptation is the implementation of intentional policies by public sectors, and autonomous adaptation is spontaneous and natural, as it is with the result of unintentional actions usually by private actors. Autonomous and planned adaptation is thus connected to private and public adaptation.

Another classification can be made according to duration, and involves short-term and long-term adaptation (e.g. Smithers & Smit, 1997; Smit et al., 1999; IPCC, 2001). An interesting thing about the temporal classification is that the papers describe long-term adaptation as a cumulative process (Smit et al., 1999:208; IPCC, 2001:884). Although this description has not been supported either theoretically or empirically, it implies that the results of short-term actions could affect subsequent actions, resulting in cumulative effects from adaptation. The cumulative feature of adaptation will arise in later discussion, in that it gives a key for connecting short-term coping and longer-term adaptation.

Although numerous other distinctions are possible, one of the most recent distinctions is based on place: in-situ versus transformative adaptation (Castells-Quintana et al., 2018). In-situ adaptation is defined as localised adaptation within existing places (Sakdapolrak et al., 2014; Sharma & Franks, 2013; Tan & Liu, 2013) or economic sectors affected by climate change. It is often compared with out-migration as adaptation, meaning adaptation by movement across places and sectors. Recently, the latter, and migration in general, has received considerable research attention (McLeman & Smit, 2006; Tacoli, 2009; Bardsley & Hugo, 2010; Black et al., 2013; Gemenne & Blocher, 2017) as it was considered

submission to existing climate change effects (Castells–Quintana et al., 2018).

As it has received much attention, the adaptation discussion has also received several criticisms. Bassett and Fogelman (2013) noted that much of the current adaptation discussion in climate change discourse is not new but a *déjà vu* of the natural hazards debate in the 1970s–80s. The notion of ‘response’ in the debate has much in common with that of adaptation in terms of ‘purposeful adjustment.’ The second point came from the urban poverty and ‘ghetto’ literature in urban studies, which criticised adaptation as ‘blind determinism’ (Wacquant, 1997; Venkatesh, 1997; Gotham & Brumley, 2002; Gotham, 2003). This is because adaptation (or other concepts related to adaptation such as resilience) tends to explain political–economic structures only as determined responses to the outer environment. Although the researchers originally intended to criticise ‘cultural’ adaptation in 1990s, it also inspired the current adaptation discussion in climate change discourse. In this respect, the work of Manuel–Navarrete et al. (2011) is meaningful, determining how adaptation is constrained by governance structures via the concept of ‘critical adaptation’. Finally, several scholars have questioned whether human society actually adapts to climate change or whether adaptation actually reduces risks from climate change. In other words, there are limits and barriers which restrict adaptation in systems (Adger et al., 2009; Berrang–Ford et al., 2011; Dow et al., 2013; Eisenack et al., 2014). When considered alongside increasing case studies (Laube et al., 2012; Islam et al., 2014), adaptation may not be as effective as it have been expected.

## 2.1.2. Adaptation from vulnerability and resilience perspectives

Climate change adaptation has been used within frameworks of vulnerability and resilience since it came to the forefront of global debates, as the terms used are relevant for social–ecological systems. Although the frameworks have different academic backgrounds, there have been numerous attempts to connect them in several reviews in the adaptation discussion.

Vulnerability simply means susceptibility to damage or harm, and it has roots in natural hazard research, development studies, political ecology, and so on (Adger, 2006; Eakin & Luers, 2006; Engle, 2011). The concept offered a new interpretation compared to earlier views on hazards or disasters, in that it emphasised not only physical conditions (e.g. famines) but also social conditions (e.g. entitlements) (Sen, 1981; Watts & Bohle, 1993). The concept has also emerged in the climate change discourse as change is inevitably accompanied by adverse hazards or perturbations along with social conditions (Turner II et al., 2003). It offers a conceptual model for processes and elements of adaptation (Adger & Kelly, 1999; Yohe and Tol, 2002; Adger et al., 2004; Brooks et al., 2005; Smit & Wandel, 2006).

Although challenged (O'Brien et al., 2007), the IPCC definition of vulnerability has often been used by researchers (e.g. UN–HABITAT, 2012). According to the IPCC (2001; 2007a), vulnerability is frequently defined as a function of exposure, sensitivity and the adaptive capacity of a system to climatic variances and stresses. Exposure is the nature and degree to which a system experiences significant climatic variances and stresses. Sensitivity is the degree to which a system is affected, either adversely or beneficially, by climate variability or change. The term susceptibility may also be used (Garschagen et al., 2016). Finally, adaptive capacity is defined as the ability of a system to adjust to climate change causing moderate potential damage so as to take advantage of opportunities, or to cope with the consequences.

As with vulnerability, the resilience framework has a long

history, with origins in ecology in the 1970s (Janssen et al., 2006). The framework has been noted for understanding the complex dynamics of social and ecological systems. Originally, resilience was defined as the ability of ecological systems to absorb external stresses and retain a steady status (Holling, 1973:14). Subsequently, the concept was extended to social systems and even to socio-ecological systems (SES), focusing on the external stresses caused by environmental changes (Adger, 2000). In this sense, adaptation is a measure or a process of managing resilience to climate change (Tompkins & Adger, 2004; Walker et al., 2004; Nelson et al., 2007; Nelson, 2010; Pelling, 2011).

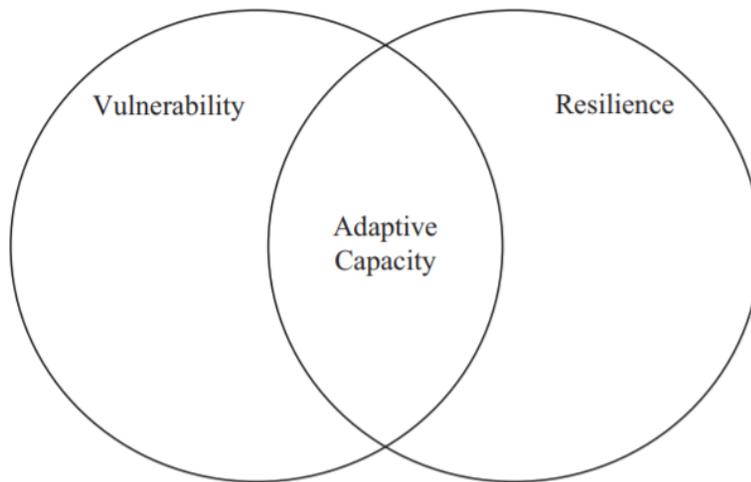
Since the two frameworks have different backgrounds and perspectives, they are often described as opposite sides of the same coin (Gallopín, 2006). Their main difference is that vulnerability is from an actor- and issue-based perspective while resilience focuses on general processes, interactions, and feedbacks between systems (Nelson et al., 2007; Maru et al., 2014). In other words, the former is interested in specific or singular situations of hazards, while the latter is interested in general interaction between long-term variables (e.g. power relationships) and short-term stresses (Miller et al., 2010). The advantage of the former is thus the disadvantage of the former, and vice versa. The most powerful advantage of vulnerability is that it is easily translatable to policies and implementations in specific situations (Turner II, 2010). This is a disadvantage of the latter in that generalisation of the framework is hardly achievable. Vulnerability is also often criticised for its singular scale, described as ‘snapshots’ (Vincent, 2007; as cited in Engle, 2011). This criticism is connected to the advantage of the resilience framework, which interprets systems as a whole.

Despite the contrasting views of the frameworks, there have been numerous attempts to link vulnerability and resilience (Adger, 2006; Gallopín, 2006; Vogel et al., 2007; Cutter et al., 2008; Miller et al., 2010; Turner II, 2010; Engle, 2011; Gotham & Campanella, 2011; Maru et al., 2014). Those attempts can be summarised into

two approaches. The first and simplest approach is to integrate the two frameworks as complementary parts of each other (Voger et al., 2007; Miller et al., 2010; Turner II, 2010; Gotham & Campanella, 2011; Maru et al., 2014). This approach tends to be used primarily for empirical case studies by addressing the trade-offs of the frames. The best example of this approach is a paper by Maru et al. involving cases of remote communities in Botswana, Brazil, and Australia. The paper used the frames as complementary response elements for adaptation pathways, focusing on feedback between issue-based vulnerability and system-based resilience.

The second approach is to find the overlapping point between the two frameworks: ‘adaptive capacity’ (Gallopín, 2006; Cutter et al., 2008; Engle, 2011). As mentioned above, adaptive capacity is the ability of a system to adjust to climate change. It differs from adaptation as it reflects the conditions and determinants of systems, while adaptation is a manifestation of adaptive capacity (Smit & Wandel, 2006). One of the strengths of the concept is that it gives direct indicators with which to measure adaptation (e.g. Eakin et al., 2014). Although there are several methods of measurement for capacity, the author focuses on a method from the sustainable livelihood approach (Krantz, 2001), as it is comprehensive and includes different kinds of determinants.

Adaptive capacity could work as the overlapping point, as it plays an important role in both vulnerability and resilience, but it is one of the three elements of vulnerability, along with exposure and sensitivity. Adaptive capacity affects vulnerability by reducing exposure and sensitivity (Engle, 2011). On the other hand, adaptive capacity is described as a component connecting interactions between human and environmental systems in the resilience framework (Walker et al., 2004). The more adaptive capacity a system has, therefore, the less vulnerability and more resilience the system will have in the circumstance of climate change (Engle, 2011). The basic relationship between vulnerability and resilience is shown in Figure 2.1.



**Figure 2.1. The conceptual relationship between vulnerability and resilience in adaptation discourse (Cutter et al., 2008; Engle, 2011)**

Despite efforts to connect the two frameworks, however, vulnerability and resilience still tend to be used individually (Boschma, 2015; Bristow & Healy, 2014; McCubbin et al., 2015; Tonmoy et al., 2014). This is because the gaps between the two frames have not been solved. The fact that they start with different aims (vulnerability at agents and resilience at systems) makes it difficult for them to converge (Miller et al., 2010). Vulnerability is still lacking a discussion of the environmental aspect of SES, while resilience is lacking in the social aspect (Adger, 2006; Engle, 2011). the temporal scales with which the frameworks are concerned are different, which makes it hard for them to converge. Resilience tends to consider longer term interaction inside systems, and vulnerability considers shorter time frames (Miller et al., 2010).

The author has therefore decided to position the study on the framework of adaptation in climate change discourse, which is vulnerability. There are three reasons for this positioning of the framework. The framework was chosen in light of the need to focus on a specific situation or an agent. This thesis aims to investigate the adaptation of riverside slum households to floods, and thus, vulnerability is a better basis, as it can provide a framework of exposure, sensitivity and adaptive capacity for the dominant hazard

(floods) to the agents (slum households). It is also far easier to find policy implications for the Mekong river basin area, based on vulnerability. Thirdly, a framework with a shorter time frame is more suitable considering that the research purpose is to examine the relationship between long-term adaptation and short-term coping at the same time.

### 2.1.3. Perspectives on the linkage between adaptation and development

The concept of adaptation in the vulnerability framework has been used not only in climate change discourse, but also in development discourse. This is because the concepts of adaptation and development have social processes of change, human agency, and vulnerability in common (Boyd, 2014). The concept is also seen as one of a development agenda, in that it presents insights into the root causes and processes of poverty related to the socio-ecological impacts of climate change (Smit & Wandel, 2006; Schipper, 2007; Lemos et al., 2007; Agrawal & Lemos, 2015; Lemos et al., 2016; Castells-Quintana et al., 2018). Adaptation is especially a key issue in sustainable development, which is concerned about balance between society and nature (IPCC, 2014). In this context, the Sustainable Development Goals (SDGs), the landmark global agenda within the framework of the 2030 Agenda set by the United Nations in 2015, which includes Goal 13 on ‘Climate Action’, show clear links between adaptation and development.

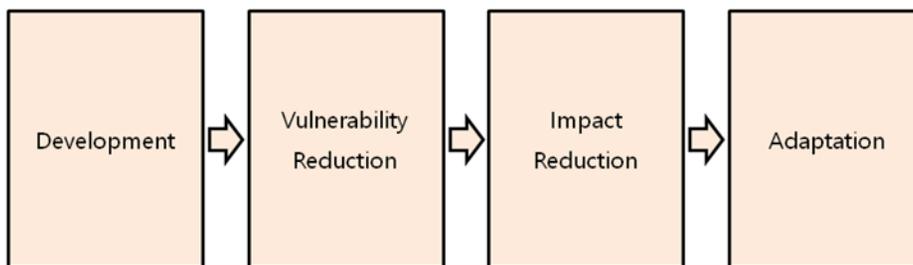
There have been many theoretical attempts to connect the concepts of adaptation and development (e.g. Ayers & Dodman, 2010). The various attempts can be summarised from two perspectives: ‘adaptation by development’ and ‘development by adaptation’ (Schipper, 2007).<sup>③</sup> The classification is based on the connection between adaptation and development; the former means that adaptation can be achieved by development and the latter means the opposite. The classification implies that there is dual relationship between adaptation and climate change (adaptation)

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<sup>③</sup> Schipper (2007: 8) originally called ‘adaptation by development’ as ‘vulnerability reduction approach’ and ‘development by adaptation’ as ‘adaptation approach’. Those names by Schipper could be confusing, however, as both approaches involve adaptation and vulnerability reduction. To avoid the confusion and emphasise the sequence, the author reclassified the approaches into ‘adaptation by development’ and ‘development by adaptation’.

(IPCC, 2007b:121). An alternative perspective combining the two perspectives is also possible, in which each affects the other (e.g. Chinvano & Kerdsuk, 2013; Salamanca & Rigg, 2017).

‘Adaptation by development’ is a simple perspective since it sets adaptation as the results of development which reduces vulnerability. In this view, development is placed ahead of adaptation (Figure 2.2). Vulnerability reduction through sustainable development, in turn, results in reducing impacts from climate change (Schipper, 2007). In this point of view, equitable, social and economic development is the key way to address environmental problems and facilitate adaptation. The view is well explained by Janetos et al. (2012:145), who note that development (for reducing poverty, improving governance and so on) is also seen as the key to increased resilience, reduced vulnerability, and adaptation.



**Figure 2.2. Adaptation by development (Schipper, 2007)**

The ‘adaptation by development’ perspective is meaningful in the following two aspects. First, there are clear relationships between vulnerability and the state of underdevelopment. Developing countries tend to be more sensitive to climate variability and have less ability to adapt (Beg et al., 2002; Garschagen et al., 2016). Poor households are subject to more severe vulnerability due to climate change (Castells–Quintana et al., 2018). Vulnerability reduction thus needs to be considered a more urgent issue with various promotions of sustainable development, such as poverty reduction (Berke, 1995; Beg et al., 2002; O’Brien et al., 2006; Brown et al., 2011). The second aspect, pointed out by Schipper (2007:7), is that the promotion of development would be a

more consistent way to achieve adaptation. This is because establishing distinct adaptation strategies for each climate event would conflict with other existing development trajectories. Sherman et al. (2016) successfully explain how adaptation could conflict with development in terms of design, implementation, funding, monitoring and evaluation, through a review of 30 articles. As a result, this perspective argues that adaptation should be not a process but the result of sustainable development with vulnerability reduction.

‘Development by adaptation’ sets the relationship in the opposite way (Figure 2.3). It suggests that adaptation is a process and a practice that can result in sustainable development. In this view, adaptation is implemented in order to reduce vulnerability and consequently achieve sustainable development (Schipper, 2007; IPCC, 2014:1106; Lemos et al., 2016). The perspective does not focus on general development but on adaptation to specific events and risks in order to reduce vulnerability.



**Figure 2.3. Development by adaptation (Schipper, 2007)**

The ‘development by adaptation’ perspective has been mainly applied in the name of adaptation mainstreaming (Huq et al., 2003; Huq & Reid, 2004; Swart & Raes, 2007; Agrawala & van Aalst, 2008; Lasco et al., 2009; Ayers et al., 2014). ‘Mainstreaming’ refers to integrating non-visible concepts into existing institutions and decision-making processes, especially related to development. Adaptation mainstreaming is thus the integration of the concept of

adaptation into development policies, programmes, and institutions in terms of decision-making planning and processes. It can be implemented by various agents including governments, international development agencies, non-governmental organisations (NGOs), civil society and so on (Huq & Reid, 2004). This perspective, along with mainstreaming, is noteworthy as it gives policy and practical implications to cope with specific cases (e.g. Lasco et al., 2009; Ayers et al., 2014). It also provides room for adapting development strategies depending on the situation (Agrawala & van Aalst, 2008), compared to ‘adaptation by development’ perspective.

Although both perspectives have pros and cons, this thesis is based on the latter for the following reasons. The ‘development by adaptation’ perspective is in a better position to explain the complexity of climate change as it sets adaptation not as a result but as a process. It can deal with various cases and complex impacts caused by environmental change. In comparison, it is difficult for the ‘adaptation by development’ perspective to understand complex socio-ecological systems because it limits solutions to the cases and impacts to a single means, development. This perspective will also allow focus on the specific case and vulnerability in the thesis, based on the perspective. Considering the purpose of the study, it should give richer results and more implications for the case. Although ‘development by adaptation’ possibly causes conflict between development trajectories (Schipper, 2007), numerous papers have showed that the conflicts can be resolved by monitoring, evaluation and trade-offs (Agrawala & van Aalst, 2008; Janetos et al., 2012; Sherman et al., 2016).

This study is distinguished from the previous studies about development and adaptation, however, in terms of unveiling the empirical process at the household level. The discussion until now has been limited, as it has focused on national or institutional scales. This trend is evident in the ‘adaptation pathways’ approaches, for example (Haasnoot et al., 2013; Wise et al., 2014; Fazey et al., 2016; Magnan et al., 2016). These approaches are a series of efforts to uncover the uncertainties of future development, planning,

and adaptation using simpler metaphors (e.g. Wise et al., 2014:333). The approaches originally focused on processes and effects at institutional level, however, and not on those at household level. Similarly, there have been few attempts to research the household level, and even these few attempts can be criticised, as they provide only descriptive results (e.g. Pouliotte et al., 2009).

Unlike planned development at national level, households also need to address ‘unexpected’ and ‘unplanned’ development in ordinary lives (Rigg, 2012). More complex processes, including successful and unsuccessful cases, need to be considered in order to approach such development along with poverty reduction and the livelihood changes of households. The author believes that this is possible by exploring the connection between coping and adaptation, because short-term and socially differentiated coping strategies (Pandey et al., 2018:385) are connected to ordinary events and complex cases of households. The connection between coping and adaptation will be described in the next section.

## 2.2. Exploring the Linkage between Adaptation and Coping

### 2.2.1. Defining adaptation and coping through a comparison

The origin of coping is rooted in development studies (Vincent et al., 2013). Coping has been discussed in several ways in previous studies, including coping ability (see Smit & Wandel, 2006), coping capacity (Cutter et al., 2008), coping strategies (Cooper et al., 2008), coping mechanisms (Watts and Bohle, 1993), coping range (Smit & Pilifosova, 2003), and simply coping (Birkmann, 2011). Coping was firstly used only for responses to food problems and security (Downing, 1991; Davies, 1993; Adger, 1996), then, the discussion gradually spread to floods (e.g. Rashid, 2000) and general hazards and impacts.

Coping is used with two meanings in the development literature. The first, which is most common, refers to coping as an immediate response to specific hazards or impacts such as droughts. It implies that coping includes complex kinds of ability, capacities, strategies, or measures in order to enable the survival of individuals, communities, societies, and systems. The second meaning refers to coping at the thresholds of the extreme events with which a system can deal, as in the expression ‘coping range.’ In this context, a coping range is described as fluctuating thresholds under economic, social, political and institutional conditions, in order to analyse adaptive capacity (Smit & Wandel, 2006). In this thesis, coping is used with the first meaning.

The concept of adaptation is frequently used and compared with that of coping (Davies, 1993; Adger, 1996; Kelly & Adger, 2000; Eriksen et al., 2005; Birkmann, 2011; Berman et al., 2012; Vincent et al., 2013; Garschagen et al., 2016). This is because both involve responses to climate variability and vulnerability. Nevertheless, coping often refers to more short-term processes, whereas adaptation is more long-term.

Table 2.2 shows the various definitions of coping and adaptation

**Table 2.2. Various definitions of coping and development**

Reference	Coping	Adaptation
Davies (1993)	a <i>short-term</i> response to an <i>immediate</i> decline in access to food	a <i>permanent</i> change in the mix of ways in which food is acquired
Adger (1996)	sequential actions taken by individuals or households when faced with potential famine.	Social and physical systems react to climate change in long <i>term</i> trends
Kelly & Adger (2000)	Ability to <i>respond</i> to an occurrence of harm and to avoid its potential impacts	Ability to <i>transform structure</i> , functioning or organisation to survive under hazards
Eriksen et al. (2005)	The <i>responses</i> that people employ in order to maintain well-being in the face of environmental stress <i>within the existing structures</i>	<i>Changing the framework</i> within which coping takes place
Birkmann (2011)	an <i>immediate response</i> and reaction to hazard events that impact societies or communities	medium and <i>long-term</i> strategies that lead to changes in institutional frameworks
Warner et al. (2012)	<i>short-term responses</i> to the impacts of sudden events	<i>longer-term</i> responses to more gradual changes
Vincent et al. (2013)	<i>short-term</i> mechanisms to ensure survival which do not affect underlying vulnerability	<i>longer-term</i> shifts in behaviour and practices which will reduce underlying vulnerability
Garschagen et al. (2016)	various abilities of societies and exposed elements to minimise negative impacts of natural hazards and climate change through <i>direct action</i> and the resources available	long-term process that also includes <i>structural changes</i> as well as strategies attempting to address the negative impacts of natural hazards and climate change <i>in the long term</i>

Source: adapted from Berman et al., 2012

that have been introduced so far. The table shows that there are clear distinctions between coping and adaptation in that the former involves more immediate (Davies, 1993), direct (Garschagen et al., 2016) and short-term (Warner et al., 2012; Vincent et al., 2013) actions within the existing structures (Eriksen et al., 2005), while the latter involves more long-term (Adger, 1996; Birkmann, 2011; Warner et al., 2012; Vincent et al., 2013) and permanent (Davies, 1993) changes or transformations (Kelly & Adger, 2000) with structural changes (Garschagen et al., 2016).

Adaptation is thus defined in this study as the long-term process of adjustment to actual or expected climate and its effect including transformative changes,<sup>④</sup> and coping as a short-term direct action to minimise negative impacts of specific climate events. Adaptation is long-term in that it is a process related to structural and systemic changes. Conversely, coping is short-term as it is a response to specific events and impacts with spatial and temporal settings, such as the 2000 floods in Cambodia. The distinction is consistent with a related report by IPCC (2012:51). The report explains that coping focuses on the moment, and survival and adaptation focuses on the future.

The author takes a sceptical position regarding Vincent et al. (2013)'s suggestion that coping is only a reactive response compared to adaptation. In fact, coping could also be proactive or strategic in the same way as adaptation, since some actions for survival are taken beforehand to minimise impacts from events. What is important in the discussion of coping is not the timing of responses, but whether they are focused on specific situations. In the same context, the author also disagrees with the idea that coping does not affect underlying vulnerability. Coping could well affect vulnerability both positively and negatively, as its results

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<sup>④</sup> The transformative changes, or transformation, generally refer to structural and fundamental changes of the nature of a system in adaptation literature (Nelson et al., 2007; Pelling, 2011; O'Brien, 2012; Park et al., 2014;). Transformation is the opposite of path-dependency which suggests sticking to the same processes (Barnett & O'Neill, 2010; Wise et al., 2014).

affect the subsequent exposure, sensitivity and adaptive capacity of a system or a household.

Examples of adaptation and coping also differ from each other based on the definitions used. On the one hand, examples of coping involve all actions or responses to events no matter whether the result is successful or unsuccessful, and no matter whether it is anticipatory or reactive. In an example of flooding, coping includes moving items to higher places, raising house floors before the flood, and even staying at home (Birkmann, 2011). On the other hand, as adaptation is related to better adjustment to vulnerability, it essentially includes examples with successful outcomes. The examples are also difficult to observe, as they are long-term and structural processes. They might include systemic changes in income production (e.g. diversification), resource use (e.g. intensification), technique (e.g. innovation) and movement (mobility).

Autonomous adaptation could not be excluded when discussing coping. This is because both are considered similar, as autonomous adaptation is often represented as the direct responses of the system to impacts (IPCC, 2001:245). It is therefore not surprising that examples have overlapped in previous papers (e.g. Birkmann, 2011:821–823; Thorn et al., 2015:126–128). The biggest difference is that autonomous adaptation focuses more on a lack of planning. This is why it is usually used together with planned adaptation. The earlier discussions tended to be more interested in autonomous adaptation rather than coping (e.g. IPCC, 2001). This was because it is easy to implement in cases at the national scale, by comparing them with planned adaptation.

It is better to use coping rather than autonomous adaptation, however, especially at the local level, for the following three reasons. It is hardly possible to divide actions by their planning or lack of planning at the local and household scales. This is in contrast to the national scale where actions can be sufficiently distinguished in terms of planned policies. As discussed earlier, adaptation is accompanied by transformative changes, but it is

questionable whether autonomous adaptation can guarantee changes only via direct responses to specific events. It is therefore inappropriate to use the long-term term, adaptation, when discussing a short-term situation. The term also could not involve unsuccessful cases and outcomes from responses, as adaptation assumes only successful adjustment, which reduces vulnerability.

### **2.2.2. Approaches to the relationship between adaptation and coping**

Although there is the clear distinction between the definitions of adaptation and coping, their relationship is still in dispute. How to set the relationship is theoretically important, as it presents guidelines for how to achieve long-term adaptation with short-term coping. So far, several approaches have been proposed, which can be summarised into three: approaches considering adaptation and coping that are (1) interchangeable, (2) distinct, and (3) interrelated (Table 2.3).

The first and most frequently found approach is to use the terms, adaptation and coping synonymously, both explicitly and implicitly. This is not surprising because the words ‘adapt to’ and ‘cope with’ have similar meanings in a dictionary. There was a tendency to use both terms to represent practices or conditions that address environmental risks and stresses in academic discussions (IPCC, 2012:73). Agrawal (2009) followed by Pauline et al. (2017) offered new insights regarding the tendency. Accordingly, even though it is possible to distinguish the terms conceptually, the distinction breaks down in reality. This is because the practices cannot be classified as short-term or long-term when climate hazards are repeated. In this context, a paper by Burnham and Ma (2016) offers a successful review of how often the terms are used synonymously in empirical case studies. A review of 35 papers in the field of smallholder adaptation concluded that most of the studies used adaptation and coping inconsistently and interchangeably.

This approach is also evident in the way that adaptation and coping were used interchangeably in earlier studies. For example, descriptions of coping as adaptation can be easily found in the disaster literature (e.g. Burton et al., 1993:220). In climate change discourse, a paper by Smit et al. (2000) is representative, referring to coping (ability) as the ‘degree to which a system can

successfully grapple with a stimulus, which is similar to adaptability.’ Even the third assessment report by IPCC (2001:982) defined adaptive capacity as the ability to adjust climate change to ‘cope with the consequences.’<sup>⑤</sup>

As pointed out by Birkmann (2011:815), however, the approach is problematic, as it cannot fundamentally differentiate between short-term and long-term processes in regard to climate change. As a result, it tends to describe only short-term examples and practices. In other words, the approach does not give any insights or room for long-term adaptation and transformative changes.<sup>⑥</sup> In order to achieve adaptation, it is necessary to understand how long-term adjustment is possible based on short-term actions. The author of his thesis also objects to Agrawal’s (2009) argument. Considering that climate variance is volatile and the impacts are complex, it is hard to imagine repeated cases of same events.

In this sense, the second approach argues that there are complete distinctions between adaptation and coping. It underestimates, or does not mention, the possibility of their connection or relationship. The approach is well found in earlier papers which limit coping to cases of famines and droughts (Downing, 1991; Davies, 1993). Even after coping has been expanded to general climate events, this distinction is often found in the literature (Adger, 1996; Kelly & Adger, 2000; Abheuer et al., 2013; Vincent et al., 2013; Alemayehu & Bewket, 2017).

The approach professed that adaptation and coping differ not only in terms of concepts, but also of measures, and components. A case study of floods in Vietnam by Birkmann (2011:822–825) explains how they differ by measures. It cites (1) lifting the ground floor level, (2) moving items to upper floor, (3) sending children to

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<sup>⑤</sup> The phrase in the definition, ‘cope with the consequences’ was changed to ‘to respond to consequences’ in the fifth assessment report by IPCC (2014:1758).

<sup>⑥</sup> For example, Hisali et al. (2011) takes short-term borrowing as an example of adaptation strategies as a response to extreme climate events, however, it does not explain any changes in borrowing systems in the long-term.

day care centres, (4) staying at home, (5) getting relief from kind people, (6) going to a village leader, (7) selling livestock, and (8) evacuating, as examples of coping. It notes (1) diversification, (2) houses on pillars, (3) dyke systems, (4) relocation, and (5) road systems as measures of adaptation. At the same time, a report by UNU-EHS (Garschagen et al., 2016:45) distinguishes coping and adaptation from components at national scales. On the one hand, coping (capacities) is comprised of medical services, material coverage, social networks, disaster preparedness, and government and authorities. On the other hand, adaptation (or adaptive capacity) consists of education and research, gender equity, ecosystem protection, and investment.

The second approach can be criticised in three aspects. In the first place, as per the problems of the first approach, it does not explain how long-term adjustments are achievable based on short-term actions. Although it successfully divides the concepts, the pathway for adaptation and development is still unknown, unless a connection is revealed. Secondly, the approach tends to limit adaptation strategies to mega events or construction. This is made explicit in Birkmann (2011) which took the construction of dykes, roads and physical buildings as examples. Thirdly, it often limits adaptation to anticipatory measures (e.g. Abheuer et al., 2013:27). As Smit & Wandel (2006) fully explained, adaptation measures are conducted both before and after an event takes place.

There have therefore been numerous attempts to suggest the necessity of the third approach to consider there a linkage between adaptation and coping. The basic idea of the approach is that short-term coping is a stepping stone toward long-term processes. However, there are contrasting views on the approach, in that coping could lead to either adaptation or maladaptation (IPCC, 2012:73).<sup>⑦</sup>

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<sup>⑦</sup> There is also an attempt to link adaptation and coping with a concept of the ‘coping range’ (see Hughey & Becken, 2014). It sets that successful adaptation measures are only viable within the coping range. In this context, a coping (range) is defined as zone of minimal hazard potential for systems

The majority of the attempts follow the view that coping contributes to future adaptation. The initial idea is found in Yohe and Tol (2002:39). They simply posed the possibility of the relationship, mentioning that improving coping (capacity) can build better adaptation (adaptive capacity). Eriksen et al. (2005:288) then made the idea more specific, using examples. Accordingly, the two processes of coping and adaptation could be linked, as coping is a prime means of adaptation. Cooper et al. (2008) and Liu et al. (2008) make similar comments suggesting that coping might switch to adaptation. Berman et al. (2012) asserted that the role of institutions is important for coping to become adaptation, calling this process ‘transformation’. Most recently, Roy et al. (2016:31) described coping as one part of the ‘ladder’ of adaptive capacity.

Some authors give different insights, allowing the other view that coping may lead to maladaptation. Based on insights from Tanzania, O’Brien et al. (2008) suggested that coping strategies would work against adaptation, because there is a conflict between their aims, coping for maintaining livelihood and adaptation to adjust to climate change. What is more, the policy report by UNU-EHS (Warner et al., 2012) argued that coping would have an adverse effect on future adaptation despite short-term merits, describing coping as erosive.

When it comes to the limits of the third approach, the first and obvious thing to mention is that there are conflicting points of views on it. One group argues that coping can perform a bridging role to adaptation sufficiently. The other group asserts that this can only lead to failure. There needs to be discussion of how to connect the two contrasting perspectives. Second, as Berman et al. (2012) have acknowledged, there is a lack of empirical evidence regarding the relationship between adaptation and coping. Rather, previous attempts merely present theoretical connections, without any evidence.

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(IPCC, 2001) not as short-term responses to negative impacts as in the thesis. It is therefore excluded in the review.

In summary, the author critically reviewed the previous three approaches to the relationship between adaptation and coping. The first approach, which considers them as interchangeable, is most popularly used. However, it has a critical limit in that it cannot distinguish between short-term and long-term responses with regard to climate change. Although the alternative approach offered such distinctions, it could not explain how long-term adaptation is achievable based on short-term coping. In this context, the third approach is noteworthy as it gives insights into the relationship between the two concepts. However, the approach is not yet complete as there are conflicting views and no empirical evidence. It is therefore necessary to discuss how adaptation and coping are interrelated in the two ways with the case studies.

**Table 2.3. The three approaches to the relationship between adaptation and coping**

Approach	Explanation	Articles	Limits
1. interchangeable	The approach uses adaptation and coping synonymously in both explicit and implicit ways	Burton et al., 1993; Smit et al., 2000; IPCC, 2001; Agrawal, 2009; Pauline et al., 2017; and papers reviewed by Burnham & Ma (2016)	<ul style="list-style-type: none"> <li>- It could not fundamentally differentiate short-term and long-term processes in regard to climate change.</li> <li>- It tends to describe only short-term measures.</li> </ul>
2. distinct	There are complete distinctions between adaptation and coping in terms of adaptation, measures, and components.	Downing, 1991; Davies, 1993; Adger, 1996; Kelly & Adger, 2000; Birkmann, 2011; Quinn et al., 2011; Abheuer et al., 2013; Vincent et al., 2013; Garschagen et al., 2016; Alemayehu & Bewket, 2017	<ul style="list-style-type: none"> <li>- It could not explain how long-term adaptation is achievable based on short-term coping.</li> <li>- It tends to limit adaptation to mega events or constructions.</li> <li>- It often limits adaptation to anticipatory measures.</li> </ul>
3. interrelated	a. Adaptation and coping are linked, as coping contributes to adaptation.	Yohe & Tol, 2002; Eriksen et al., 2005; Cooper et al., 2008; Liu et al., 2008; Berman et al., 2012; Wamsler & Brink, 2014; Roy et al., 2016	<ul style="list-style-type: none"> <li>- There are contrasting views in the approach.</li> <li>- It tends to point only theoretically to possibility that adaptation and coping are related without empirical evidence.</li> </ul>
	b. Adaptation and coping are linked, as coping leads to maladaptation.	O'Brien et al., 2008; Warner et al., 2012	

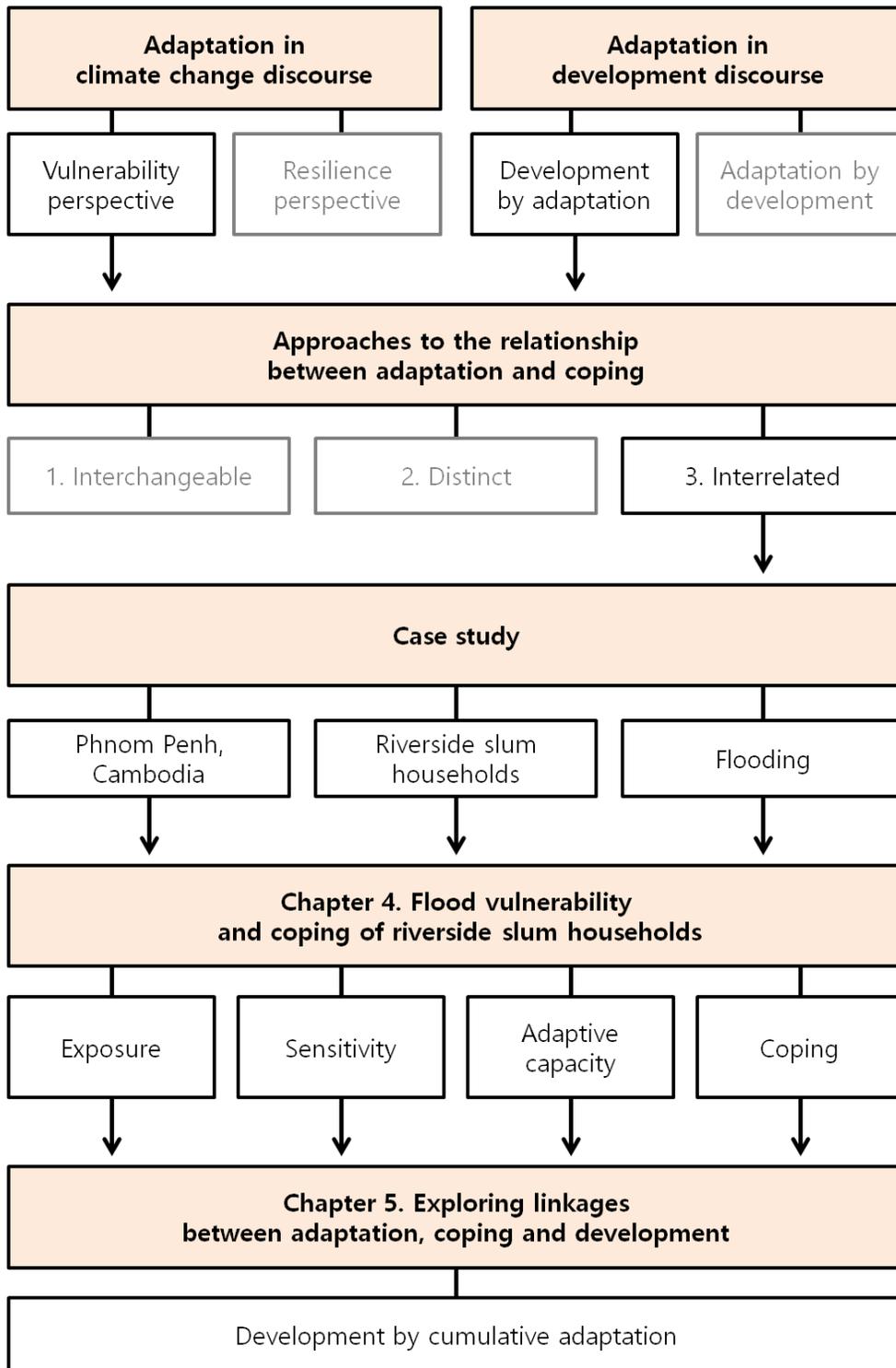
## 2.3. The Analytical Framework

The analytical framework of the thesis, as derived through a literature review, is as follows (Figure 2.4.). The thesis positions itself as accepting the vulnerability perspective and the ‘development by adaptation’ perspective in the climate change and development discourses respectively. There are three reasons for this positioning in the vulnerability perspective. It is needed to focus on a specific situation or an agent. It is far easier to find policy implications for the Mekong river basin area, based on vulnerability. The perspective enables the thesis to use a shorter time frame.

Similarly, there are three reasons for positioning within the ‘development by adaptation’ perspective. The perspective involves a better position from which to explain the complexity of climate change. The thesis can focus on the specific case and vulnerability based on the perspective. Despite some worries, the conflicts between development trajectories could be resolved by monitoring, evaluation and trade-offs. However, the study is distinguished from previous studies based on ‘development by adaptation’ in terms of unveiling the empirical process at the household level. This perspective has been limited until now, as it has focused on national or institutional scales and there have only been a few attempts to research at the household level.

Based on these perspectives, the thesis has reviewed the previous approaches to the relationship between adaptation and coping in the second section. As a result, the thesis uses the third approach, considering adaptation and coping as interrelated, because the other approaches could not fundamentally differentiate short-term and long-term processes in regard to climate change. The third approach needs to be supplemented in two aspects, however. First, there are contrasting views in the approach, and secondly, it tends to suggest the possibility that adaptation and coping are related theoretically without empirical evidence.

Based on the literature review, the thesis examines the relationship between adaptation and coping in order to unveil the process of development by adaptation at the household level using a case study. The thesis uses Phnom Penh, riverside slum households, and flooding to provide empirical evidence. Chapter 4 is a preliminary step which examines flood vulnerability and actual coping strategies practiced in the riverside slum. Chapter 5 introduces the concept of ‘development by cumulative adaptation’ to explore the linkage between adaptation, coping and development.

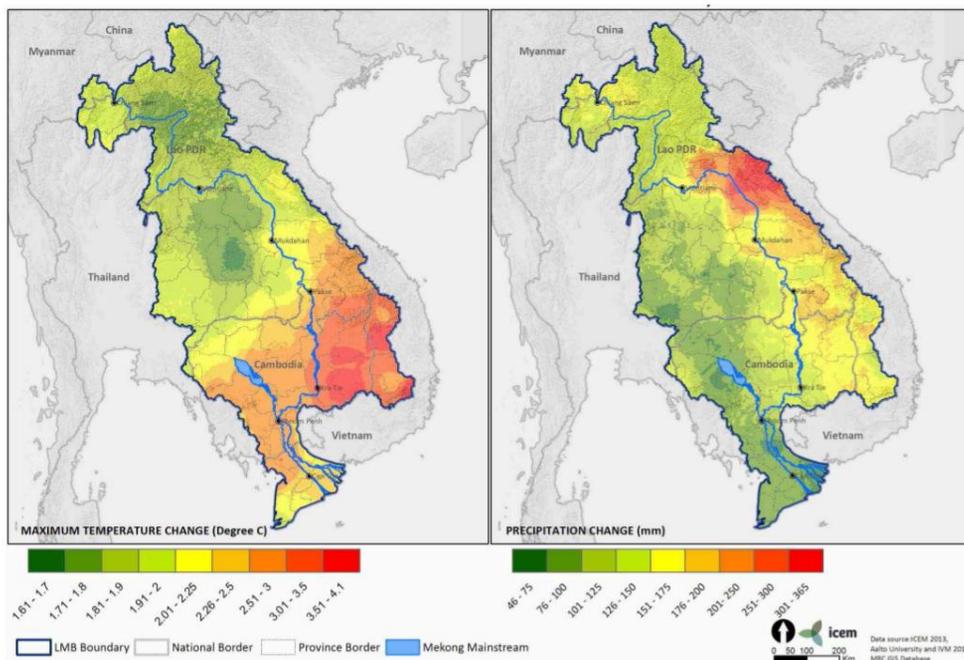


**Figure 2.4. The analytical framework**

## Chapter 3. Case Introduction

### 3.1. Increasing Flood Risks in the Lower Mekong Basin

The Lower Mekong Basin (LMB), which covers Cambodia, Laos, Thailand, and Vietnam, is considered one of the most vulnerable regions to climate change in the world (Ericson et al., 2006; IPCC, 2007:327; WWF, 2009; Garschagen et al., 2016). Numerous reports have already expected and observed increased temperatures and annual precipitation, deeper and longer floods, longer droughts, and higher sea level across the LMB (IRG, 2010; ICEM, 2013). Climate change in the LMB is estimated to have severe impacts on the livelihoods of people in many aspects, such as water management and agriculture (TKK & SEA START RC, 2009; Murphy et al., 2013).



**Figure 3.1. Projected annual daily maximum temperature and annual precipitation changes in the Lower Mekong Basin (ICEM, 2013:94)**

The LMB would experience higher flood risks in two specific

ways (ICEM, 2013:95), as consistent with hydrological models and projections using temperature and precipitation data (Figure 3.1). Significant changes in the duration of floods are predicted in the LMB. According to the projection by ICEM, flood seasons will start 1~2 weeks earlier and last 2~4 weeks longer in 2050. Higher precipitation will result in increased flow volumes in the LMB. The increases will be larger in flood seasons and in the downstream floodplains in Cambodia and Vietnam.

Cambodia thus scores highly on a number of vulnerability, adaptation and climate change indexes. The indicator introduced by Brooks et al. (2005) ranked Cambodia as a ‘moderately to highly vulnerable’ country. Focusing on the fisheries sector, Allison et al. (2009) included Cambodia in the top 30 vulnerable countries. Yusuf and Francisco (2009) considered Cambodia and the Philippines as the most vulnerable nations in Southeast Asia. Similarly, Cambodia was ranked second most vulnerable in the world by Kreft et al. (2014) and ninth by Garschagen et al. (2016).

Increasing flood risks in the LMB would have impacts on Phnom Penh and its slums, as Phnom Penh is located in the alluvial plain and is easily inundated. It is believed that climate change combined with deforestation, massive urbanisation, and lake infilling has contributed to the increased potential of floods in Phnom Penh (STT, 2012). These impacts are more severe in poor urban settlements as they are often located marginally, near the riverside. This is consistent with a survey conducted by Sahmakum Teang Tnaut (STT, 2018), showing that about 55% of the slum households in Phnom Penh were affected by floods at least once in the last three years.

The Royal Government of Cambodia (RGC) started to intervene in climate change and adaptation through policies in the 2000s. It established the first plan, the National Adaptation Plan of Action on Climate Change (NAPA) in 2006 (Ministry of Environment, 2006). As pointed out in the preface, floods are one of the most important issues in terms of climate change in Cambodia. Several other plans related to climate change, adaptation, and flooding were later

established, including the National Strategic Development Plan (NSDP) 2014–2018, Cambodia Climate Change Strategic Plan (CCCSP) 2014–2023, Green Growth Policy 2013–2030, National Green Growth Roadmap (2009), Strategic National Action Plan for Disaster Risk Reduction 2008–2013, and the National Social Protection Strategy for the Poor and Vulnerable (2011).

Those plans contained projects for preventing and mitigating the impacts of floods. For examples, NAPA included 5 out of 39 projects to address flood issues: (1) The Development and Rehabilitation of Flood Protection Dykes, (2) The Development of Community and Household Flood Safe Areas, (3) Vegetation Planting for Flood and Windstorm Protection, (4) Rehabilitation of the Upper Mekong and Provincial Waterways, and (5) Water Gates and Water Culverts Construction (Ministry of Environment, 2006). The projects planned to build dykes, drains, or gate systems in several villages in Kampong Cham province.

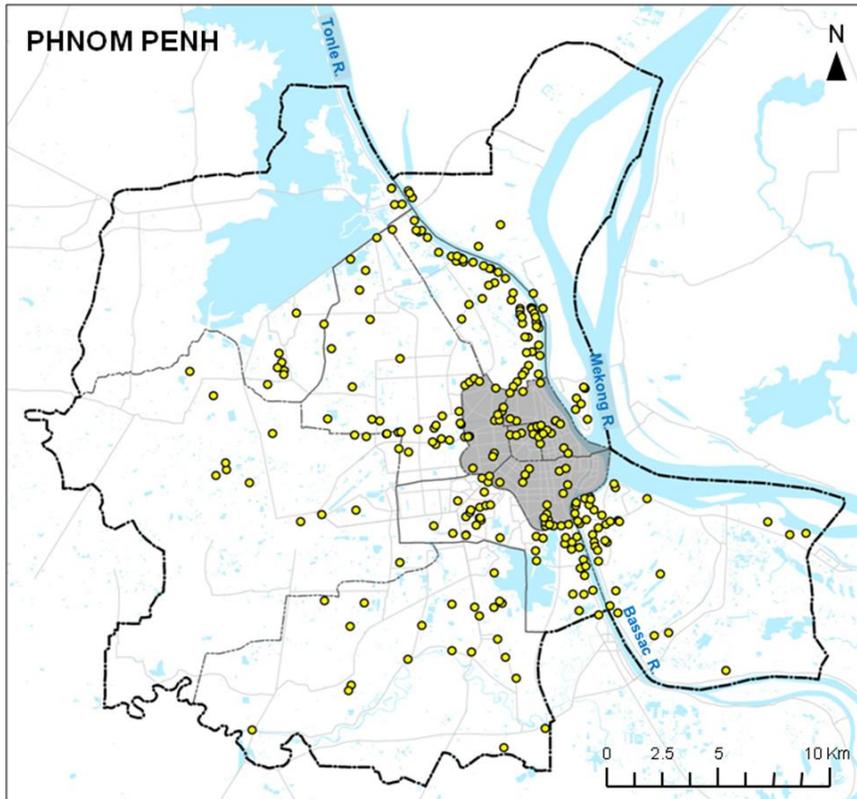
The interventions were limited in two ways, however. As Wee (2011) noted briefly, in actual practice the government ended up providing relief or reactive support after floods. Three million Cambodians were estimated to be impacted by flooding in 2000, which was 25% of the entire population of Cambodia (The Phnom Penh Post, 2000). The government policies supported only a few villages, and would not be enough to adapt to climate change.

## 3.2. Socioeconomic Conditions of Riverside Slum Households

The origins of the slums in Phnom Penh can be traced back to the Khmer Rouge regime (1975–79) led by Pol Pot (Fallavier, 2003:7). The regime was notorious for evacuating a tremendous number of Phnom Penh residents to rural areas. At the end of the regime, the city government needed to provide space for returnees, so it allowed them to occupy existing buildings on a first-come-first-served basis. When the buildings were all occupied, returnees, rural migrants and refugees started to settle in empty spaces, creating slum communities in Phnom Penh.

The population of Phnom Penh has exploded in the last four decades (from 32,000 in 1978 to 2 million in 2010), and the number of slum households also increased, especially in the 1990s. According to the first public survey by the Squatter and Urban Poor Federation (SUPF, 1997), there were 379 slum settlements and 180,000 people in 1997. They were mostly located on the roof-tops of buildings, on railway tracks, and in pagodas, and public spaces in the inner city centre (Khemro, 2000).

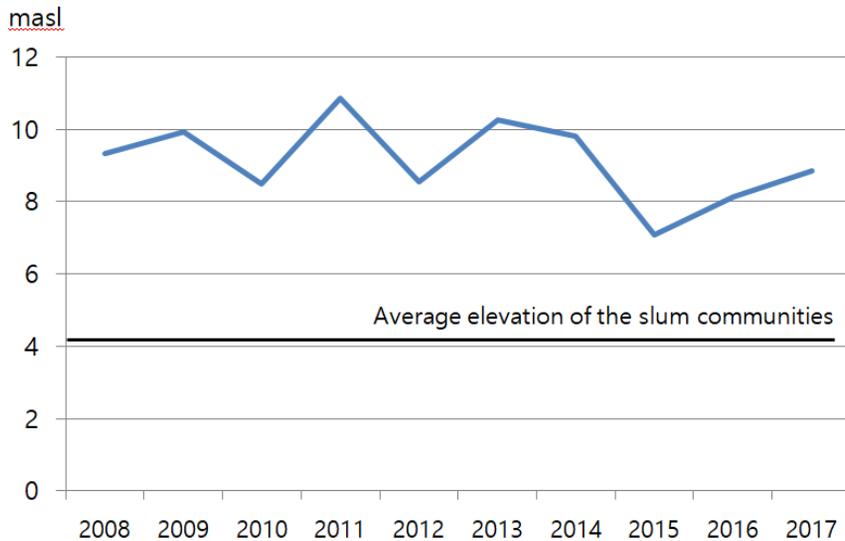
The slum population has reduced since 1990 when the city government started to displace and evict the slum communities. STT (2011) estimated that a total of 150,000 people were evicted during the period from 1990 to 2011. 19,964 people were expelled in 2012 alone (The Phnom Penh Post, 2013). The evicted households relocated from the city centre to outer peri-urban areas, riversides, and even outside Phnom Penh (Fukuzawa, 2014; STT, 2017). Although the number has decreased by about 13% in the last two decades, there were still 26,207 slum households in the city in 2017 (STT, 2018). The most recent survey by STT (2018) shows 277 slum settlements spread over the riverside and outer city centre of Phnom Penh (Figure 3.2).



**Figure 3.2. Distribution of slum communities in Phnom Penh. (The shaded area represents the inner city centre; STT, 2018)**

The relocated communities are subject to more vulnerable socioeconomic conditions, such as limited public services and lower incomes (Keo et al., 2015; McMahon, 2016). In the case of riverside slum communities, it is apparent that they are more vulnerable when it comes to flooding events. This is because the average elevation of the communities is only 4.18 masl (metres above sea level), while the average annual maximum river level in Phnom Penh was 9.13 masl over the past 10 years (Figure 3.3).<sup>®</sup> This means that they are heavily and annually exposed to flood vulnerability. The riverside slums include informal houses and boat houses on the rivers (Figure 3.4; 3.5).

<sup>®</sup> The author used the slum location data from STT (2018) and digital elevation model (ASTER GDEM 2) to calculate the average elevation of the slum communities.



**Figure 3.3. Annual maximum water level in Phnom Penh (measured at Phnom Penh Port station; MRC, 2007; 2008; 2009; 2010; 2011; 2015a; 2015b; 2015c; 2015d)**

Table 3.1 is a brief summary of the conditions of the riverside slum communities, based on the author’s own surveys. The first part of Table 3.1 shows how many of the surveyed households satisfy the four slum indicators. All the respondents meet the definitions of slum households, as they satisfy at least one out of the four indicators. The first indicator is related to the structural quality of housing. A house with non-permanent construction materials (e.g. wood) is classified as a slum that is not adequate to protect its inhabitants from extreme climatic events. The second indicator is how many household members share one room in a house. The number of three is a deadline for sufficient living area. The next indicator is access to improved water. A household is considered to be provided with improved water when it has protected sources such as a piped connection and public tap. The last indicator is access to improved sanitation, which requires a toilet shared with a reasonable number of people. Of the respondents, 11.7% meet one indicator, 43.7% meet two, 30.3% meet three, and the remaining 14.3% meet all four.

The second part of Table 3.1 summarises the basic socioeconomic conditions of riverside slum households. The

majority have Khmer ethnic backgrounds (63.9%), and Muslims (21.0%) and Vietnamese (11.7%) are ethnic minorities. Households consist of 5.6 members, who have lived in slum communities for 22.9 years on average. Almost half the respondents chose 'low cost of living' as their reason for living in the slum community. They mainly engaged in informal jobs, such as those of street vendors, construction workers and moto dup drivers, earning seven to eight dollars a day. All households had experienced flood damage at least once in the last five years. It is surprising that 76.5% of the respondents experience flood damage every year. This means that it is possible to observe how people cope with flood events in the slum communities in the short-term, on an annual basis.

**Table 3.1. Summary of the socioeconomic conditions of the slum households**

Construction materials	Concrete 2 (1.7%) Wood only 21 (17.6%) * Wood and metal 89 (74.8%) * Others 7 (5.9%)	
Household members sharing one room	No more than three 29 (24.4%) * More than three 90 (75.6%)	
Water sources	Surface 21 (17.7%) * Bottled 5 (4.2%) * Piped 85 (71.4%) Public tap 5 (4.2%) Others 3 (2.5%)	
Sanitation facilities	Bush and ditch 23 (19.3%) * Public toilet 9 (7.6%) * Private toilet 82 (68.9%) No toilet 5 (4.2%) *	
Satisfied slum indicators	One 14 (11.7%) Three 36 (30.3%)	Two 52 (43.7%) Four 17 (14.3%)
Gender	Female 84 (70.6%)	Male 35 (29.4%)
Ethnicity	Khmer 76 (63.9%) Vietnamese 14 (11.7%)	Islam 25 (21.0%) Others 4 (3.4%)
Average household size	5.6 members	
Average duration of living	22.9 years	
Reasons for living in slum community	Low cost of living 52 (43.7%) Family ties 25 (21.0%) Born in the community 24 (20.2%) Others 18 (15.1%)	
Top 3 jobs	Street vendor, construction worker, moto dup driver	
Average daily income	8.3\$ (33,265 KHR)	
Median daily income	7.4\$ (30,000 KHR)	
Flood damage frequency	Every year 91 (76.5%) Once in 2 years 16 (13.4%) Once in 5 years 12 (10.1%)	

Source: Own surveys 2018, N = 119 households.

\* A household with these conditions is considered a slum household (UN-HABITAT, 2003:19).



**Figure 3.4. Informal houses in the riverside slums of Phnom Penh (picture by the author)**



**Figure 3.5. Boat houses in the riverside slums of Phnom Penh (picture by the author)**

# Chapter 4. Flood Vulnerability and Coping of Riverside Slum Households

## 4.1. Flood Vulnerability of Riverside Slum Households

### 4.1.1. Adaptive capacity

The adaptive capacity of riverside slum households is one of the key components of flood vulnerability. It is defined as ‘the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences’ in the fifth assessment report of the IPCC (2014:1758). There are a number of abilities used to cope with exposure and sensitivity. If those abilities are constrained, then vulnerability increases. At the same time, the more a system is exposed and sensitive to climate change, the less it achieves development and adaptive capacity. This is obvious in the case of developing countries. Adaptive capacity, exposure, and sensitivity therefore have complex causal relationships (Adger & Vincent, 2005).

Numerous indicators are used when it comes to measuring and assessing adaptive capacity. Several distinct determinants were introduced to measure adaptive capacity; Yohe and Tol (2002) is a good example as it provided eight determinants of adaptive capacity. There was an effort to integrate the distinct determinants into types of livelihood assets. Social capital attracted attention firstly as the primary asset of adaptive capacity (Adger, 2003; Pelling & High, 2005; Adger, 2006). Adaptive capacity was extended to mean human, financial, physical, and natural capital in terms of sustainable livelihood approaches (Reid & Vogel, 2006; Below et al., 2012; Reed et al., 2013). However, natural capital is excluded in the case of slum households, considering the short duration of residence period and landlessness (Abheuer et al., 2013).

Human capital, meaning human resources and knowledge, takes

the form of education, capacity to work, and skills. Human capital is critical as it is required in order to use the other types of capital (Reid & Vogel, 2006). It is measured at the household level by the amount and quality of education and the occupations of household members. The first part of Table 4.1 shows the human capital of the households. The majority of the survey respondents and their spouses had received a low level of education, or had not received any at all: respondents (85.7%), spouses (85.8%). The low education level has been passed on to the next generation. 68.7% of slum children have been educated below primary school level.

The amount and quality of labour within household is also poor. As shown in Table 3.1, most inhabitants are engaged in informal occupations such as being street vendors. Such informal jobs are relatively sensitive to economic instability, creating fragility. This fragility is also found in the unemployment rate of household members (24.1%).

Financial capital is the amount of cash or stock that is held, in the form of wages, savings, pensions, remittances and debts. As shown in the second part of Table 4.1, household finances are also not good. Income is scarce and unstable because the inhabitants are engaged in informal jobs. The difference between daily income and expenditure is only 3.1\$. Most people thus spend their income on a daily basis, without saving. Only 18.5% of households save monthly, with an average amount of 39.9 U.S. Dollar. This is a small amount considering that they have borrowed an average of \$576.8. Their poor financial situations mean that it is difficult for households to recover from and cope with flood events, and to invest for better preparation.

Physical capital is composed of basic infrastructure and producer goods (tools and equipment for production). Producer goods are not easily available for slum households, and so their housing and means of transportation are their most important assets. These things both show that their physical capital is low. Although more than 70% own their housing, less than half have legal titles. Their possession is unstable, as there is also a risk of eviction.

Vehicles are important in that they provide mobility and income sources (e.g. taxi drivers), however, no one owns a car and 25% of people do not have a bicycle, a motorbike or a rickshaw.

**Table 4.1. Adaptive capacity of the slum households**

<b>Human capital</b>		
Education level	Not educated 55 (46.2%) Secondary 16 (13.5%)	Primary 47 (39.5%) College 1 (0.8%)
Education level of spouse	Not educated 54 (54.5%) Secondary 14 (14.2%)	Primary 31 (31.3%) College 0 (0.0%)
Education level of children over 18	Not educated 21 (41.2%) Secondary 12 (23.5%)	Primary 14 (27.5%) College 4 (7.8%)
Unemployment rate	24.1%	
<b>Financial capital</b>		
Daily income	8.3\$ (33,265 KHR)	
Daily expenditure	5.2\$ (21,128 KHR)	
Monthly saving	Yes 22 (18.5%, average=39.9\$)	No 97 (81.5%)
Debt	Yes 75 (63.0%, average=576.8\$)	No 44 (37.0%)
<b>Physical capital</b>		
Ownership of house	Own 90 (75.6%) Squatted 7 (5.9%)	Borrowed 22 (18.5%)
Official legal title	Yes 52 (43.7%)	No 67 (56.3%)
Main mean of Transportation	Motorbike 63 (52.9%) Bicycle 10 (8.4%)	Rickshaw 17 (14.3%) None 29 (24.4%)
<b>Social capital</b>		
Social support for floods	Yes 114 (95.8%)	None 5 (4.2%)
Providers of social support (Multiple choices)	Neighbour 102 (87.4%) Government 46 (38.7%) NGO 26 (21.8%)	Community 83 (69.7%) Relative 28 (24.4%)

Source: Own surveys 2018, N=119 households.

Social capital is related to social features such as networks, norms, memberships and trusts, which enable participants to obtain social benefits. As pointed out by Portes (1998) and then by ABheuer et al. (2013), there should be a distinction between

benefits and the ability to obtain them. Such abilities include being in diverse types of relationships and reciprocal arrangements in social networks (Pelling & High, 2005). These things determine what benefits are received. The important benefit is the immediate social support given by various providers when needed (Aßheuer et al., 2013:23). The last part of Table 4.1 shows how many slum households receive social support. Almost all households (95.8%) have providers on whom they rely in the case of flood events. Social support came from diverse providers, including neighbours, communities, the government, relatives, and NGOs.

In summary, there is a lack of adaptive capacity in households in general. Their education and occupational levels are low in terms of human capital. Given their savings and debt, their financial capital is also poor. Physical capital is also low in respect of infrastructure and producer goods, although social capital is better than other capital. Many inhabitants have diverse relationships which can offer social support to cope with extreme events. This finding is consistent with results in the literature on the coping and adaptation of the poor (Chatterjee, 2010; Aßheuer et al., 2013; Alam et al., 2016), which argue that the poor take advantage of social networks and relationships in order to deal with a lack of other capital and assets.

### 4.1.2. Exposure and sensitivity

Exposure and sensitivity are the other key components of vulnerability in the slum households. The riverside slum households are exposed and sensitive to various negative impacts from flood events. Exposure is defined as ‘the presence of people, livelihoods ... or economic, social, or cultural assets in places and settings that could be adversely affected’, and sensitivity refers to ‘the degree to which a system or species is affected ... by climate variability or change’ (IPCC, 2014:1765, 1772). Based on these definitions, exposure could be classified by the assets or adaptive capacity (human, financial, physical and social capitals), and sensitivity could be measured by how many households are affected.

The second column of Table 4.2 shows the top ten types of exposure of the riverside slum households, based on own surveys. The negative impacts on human capital include food shortages, disease, injuries, and disrupted education. Decreased nutrition is said to be the results of reduced income, lower accessibility to the work place and market, a lack of electricity and fuel for cooking and even fewer fish caught in flood seasons. Diseases include water-borne diseases (e.g. diarrhoea and skin rashes), vector-borne diseases (e.g. dengue), respiratory diseases, and other diseases from pests and animals such as mosquitoes, scorpions, snakes, scabies, flies rats, and other bugs. These diseases are normally common due to poor hygiene, but are more severe in flood seasons. Drowning and fractures are common in the slum communities. Finally, interruptions to education, caused by inundated roads and reduced income, are a long-term threat to the households.

Decreases in income and a lack of available money play a major role in financial capital. The former is usually caused by temporary and permanent unemployment, low accessibility to roads and working places, and fewer income sources, such as customers for street vendors, waste for waste pickers, and fish for fishermen. Furthermore, the households suffer from a lack of money as a result of preparing and recovering from floods. They need to buy

materials such as cables, wood, rice and other ingredients to prepare for floods, and to spend money to rebuild community bridges, roads, and their houses. The financial threats are more severe as they have negative effects on other assets, as mentioned regarding human capital.

Negative impacts on physical and social capital are also found among the slum households. Physical capital is affected, as houses, properties, and infrastructure (e.g. roads, bridges, drains, and dykes) are easily damaged in flood seasons. Those are partially and wholly destroyed by the floods themselves and also by land erosion after floods. Thieves are a serious socioeconomic problem in the communities. Social capital is also adversely affected by flood events. The majority of participants responded that they have experienced the loss of social networks due to conflicts, deaths and relocation.

The third column of Table 4.2 shows that the slum households are highly sensitive to each negative impact of exposure. Above all, almost all households have experienced income decreases (91.6%), a lack of money (89.9%) and food (82.4%), and the destruction of their houses (71.4%). The crisis in financial capital is the most urgent and sensitive issue that households have to cope with. More than half have suffered from damaged infrastructure (66.3%), diseases (63.9%), and negative impacts on social capital (58.8%). Fewer than half have dealt with the loss of properties (48.8%) and stopped education (39.8%). These households are relatively less sensitive because they tend to have fewer properties to lose and limited education levels.

In general, the urban poor in Phnom Penh are exposed to multiple threats in a number of respects due to increasing flood vulnerability and their residential location. The degree to which the households are sensitive is generally consistent with the biggest problems that they describe. According to the surveys, major problems include damaged houses (34.5%), food shortages (23.5%), and health problems (23.5%) in decreasing order.

**Table 4.2. Exposure and sensitivity of the slum households**

Adaptive capacity	Exposure	Sensitivity	Causes
Human capital	Food shortages	82.4%	- Reduced income - Lower accessibility to working place and market - Lack of electricity and fuels to cook - Less fish caught
	Diseases	63.9%	- Water-borne diseases (e.g. diarrhoea and skin rashes) - Vector-borne diseases (e.g. dengue and typhoid fever) - Respiratory diseases (e.g. flu and cough) - Diseases from pests and animals (mosquitoes, scorpions, snakes, scabies, and rats)
	Injuries	27.9%	- Fractures and drowning
	Disrupted education	39.8%	- Low accessibility to roads and schools - Reduced income which cannot afford school tuition fees
Financial capital	Income decreases	91.6%	- Temporary and permanent unemployment - Low accessibility to roads and working place - Fewer income sources (customers, waste, fish, etc.)
	Lack of money	89.9%	- Buying materials to prepare (e.g. cables, wood, and rice) - Spending to recover from floods (e.g. rebuilding bridges and roads)
Physical capital	Destruction of houses	71.4%	- Partially or wholly broken by floods and land erosion
	Lost belongings	48.8%	- Lost by thieves and floods
	Damaged infrastructure	66.3%	- Damaged roads, bridges, drains, dykes, etc.
Social capital	Negative impacts on social capital	58.8%	- Conflicts with neighbours, communities, and government - Loss of neighbours (deaths and relocation)

Source: Own surveys and interviews 2018

## 4.2. Coping of Riverside Slum Households

### 4.2.1. Coping of riverside slum households

This section delves into the actual coping strategies of the riverside households (Table 4.3). Strategies to cope with food shortages are important because they are associated with nutrition. The easiest and most immediate strategies are to reduce nutrition or change dietary habits. Reduction can involve both the number and size of meals. A change of diet might replace rice with pumpkin, beans and vegetables, which are comparatively easy to get. Other reactive strategies involve recycling rainwater or food waste and fishing illegally during flood seasons.<sup>⑨</sup> There are also proactive coping strategies such as farming livestock and planting pro-flood crops in order to prepare food shortages. There are also strategies using social capital: pooling food with neighbours and obtaining food aid from NGOs, government or others.

Coping strategies for diseases are classified into three categories: medical strategies, hygiene strategies, and pest control strategies. The most obvious strategies are medical strategies, such as visiting hospitals and pharmacies, however, those who cannot afford official medical centres depend on home remedies. Because of the poor hygiene in slum communities, improving hygiene with limited capital is an important task, so slum dwellers clean their houses, boil water, and wash children and more often than other people. As waste generated from floods has a negative impact on hygiene, coping strategies also include post-flood waste management such as collecting and burning waste. Innovate toilets or drainage systems are supplied with the help of NGOs. Finally, autonomous pest control plays an important role in coping strategies. Control methods differ depending on each pest. Lime is

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<sup>⑨</sup> Since fish may have not yet grown to a catchable size, use of medium and large-scale gears is not allowed during flood seasons (1 July to 31 October south of Phnom Penh, and 1 June to 30 September in the north) (Hortle et al., 2004).

used to protect household members against snakes. Cats and chickens are kept against bugs and rats. Mosquito nets, repellents, and smoke are used to prevent mosquitoes.

Coping with injuries during floods is not easy for households, because few can access services from official hospitals, and most cannot. Coping related to injuries tends to focus on proactive strategies. It involves teaching household members (especially children) how to swim, and taking care of village children in turns during flood seasons. Stronger houses and bridges are built with the help of neighbours and communities. This is because neighbours' houses and bridges are used communally in the villages for travelling during floods.

Several strategies are reported to cope with educational problems. Boats and makeshift bridges are used to overcome low accessibility to schools, and informal education systems are used to overcome the unaffordable tuition fees of official educational institutions. The Islamic community schools run by Muslim elders are an example of informal education in slum communities. As UNESCO (2012) argued, informal education can play an important role in vulnerable places that are affected by immediate impacts of flooding.

Exposure to vulnerability in terms of financial capital is divided into decreased income and lack of money. Strategies to cope with the former are concentrated on income diversification. The households reported that they have tried to diversify income sources by finding both formal and informal occupations. Waste can act as a source of income via collecting and recycling. Livestock farming and illegal fishing are also possible ways to earn income in an emergency. A few people reported that they divided their houses up to lend them to others for rent. In contrast, strategies to cope with rent are concentrated on increasing disposable money. Disposable money can be earned by selling belongings, reducing expenditure, obtaining humanitarian support, borrowing money from others, and saving money beforehand.

Households have several coping strategies in the case of

destroyed houses. They relocate their settlement both temporarily and permanently. Temporary settlements include shelters, pagodas, parks, the houses of neighbours or relatives, and even streets. Some build other settlements for migration in advance. A second strategy is to repair and rebuild the houses damaged by floods. Although most use this strategy, it is limited in that it does not address flood vulnerability. Next, the households reinforce houses using stronger construction materials and renovate them by lifting floors with pillars to avoid future damage. Finally, wooden dykes are built along the riverside to prevent land erosion.

The households attempt to cope with the issue of losing belongings, although it is less sensitive. The immediate and reactive coping would be to repurchase and to barter goods with others. Pooling goods among community members is also a good example of coping strategies. Proactive strategies include lifting or moving valuables to upper floors or safer houses. Despite the high cost, transportation must be parked in public parking lots, as it is a household's most important asset. Finally, households attempt to strengthen security with the help of communities and neighbours.

Social infrastructure such as roads, bridges, drains, and dykes is susceptible to floods because of poor management. Since this is not quickly fixed by the government, the households must respond on their own. They utilise boats, makeshift bridges, floating houses and boat houses to travel in flooded areas to overcome lower accessibility. There is often collective action in the case of restoring social infrastructure. The slum communities gather together to pool money and work to rebuild and reinforce roads, collect waste, and clear drains. Some ask NGOs to intervene.

Finally, several strategies are conducted to mitigate the adverse impacts on social capital. Conflicts and other threats within communities are mediated and coordinated by types of social capital including bonding ties, bridging ties and linking ties (Woolcock & Sweetser, 2002; Western et al., 2005; Aßheuer et al., 2013). Bonding ties are connections to a group in which members have homogenous socioeconomic backgrounds, such as neighbours and

relatives. Bridging ties are connections to different groups in which members have similar socioeconomic backgrounds, such as friends in other slum communities. Linking ties are connections to different groups in which members have heterogeneous socioeconomic backgrounds, such as NGOs, the government, employers, and landlords. These three types indicate there are different types of connection and coordination among different social groups. Households can consolidate their existing ties by holding community meetings or strengthening security. They can also diversify social networks (especially linking ties and bridging ties) by holding community leader meetings and connecting with NGOs and other institutions.

**Table 4.3. Coping of the slum households with flood vulnerability**

Adaptive capacity	Exposure	Coping
Human capital	Food shortages	<ul style="list-style-type: none"> <li>- Cutback in nutrition: Reducing the number of meals or eating less</li> <li>- Change diets</li> <li>- Collect rainwater</li> <li>- Find food in river and waste</li> <li>- Fish illegally during flood seasons</li> <li>- Farm livestock</li> <li>- Plant pro-flood crops in yard</li> <li>- Pool food with neighbours</li> <li>- Get support from NGOs, government, relatives, and neighbours</li> </ul>
	Diseases	<ul style="list-style-type: none"> <li>- Go to hospital</li> <li>- Buy medicine from pharmacy</li> <li>- Home remedies</li> <li>- Clean houses every day</li> <li>- Boil water every day</li> <li>- Wash children day and night</li> <li>- Collect and burn waste</li> <li>- Innovate toilets or drainage systems with help of NGOs</li> <li>- Use lime to protect against snakes and pest</li> <li>- Have cats and chickens to protect against bugs and rats</li> <li>- Use mosquito nets</li> <li>- Use a mosquito repellent</li> <li>- Make smoke</li> </ul>
	Injuries	<ul style="list-style-type: none"> <li>- Go to hospital</li> <li>- Teach children how to swim</li> <li>- Take care of village children in turns</li> <li>- Build stronger houses and bridges</li> </ul>

Adaptive capacity	Exposure	Coping
Human capital	Disrupted education	<ul style="list-style-type: none"> <li>- Use boats to take children to school</li> <li>- Build makeshift bridges from houses to roads</li> <li>- Obtain informal education from NGOs or neighbours</li> </ul>
Financial capital	Income decreases	<ul style="list-style-type: none"> <li>- Find alternative formal jobs (e.g. security guards)</li> <li>- Find alternative informal jobs in community</li> <li>- Collect and recycle waste</li> <li>- Livestock farming</li> <li>- Fish illegally during flood seasons</li> <li>- Work interchangeably with household members</li> <li>- Rent house to others</li> <li>- Beg money</li> </ul>
	Lack of money	<ul style="list-style-type: none"> <li>- Sell goods and livestock</li> <li>- Reduce expenditure</li> <li>- Obtain support from NGOs, government, relatives, neighbours, and communities</li> <li>- Borrow money from neighbours, banks, money lenders, NGOs, and relatives</li> <li>- Save money</li> <li>- Beg for money</li> </ul>
Physical capital	Destruction of houses	<ul style="list-style-type: none"> <li>- Evacuate to street, pagoda, park, etc.</li> <li>- Move to another house temporarily</li> <li>- Relocate to safer place to live permanently</li> <li>- Build another house beforehand</li> <li>- Repair house</li> <li>- Rebuild house</li> <li>- Reinforce house by stronger construction materials (e.g. concrete and metal)</li> <li>- Renovate house by lifting floors with pillars</li> <li>- Build wooden dykes</li> </ul>

Adaptive capacity	Exposure	Coping
Physical capital	Lost belongings	<ul style="list-style-type: none"> <li>- Repurchase goods</li> <li>- Barter goods</li> <li>- Pool goods with neighbours</li> <li>- Lift goods and valuables on upper floors</li> <li>- Move goods and valuables to houses of neighbours or relatives</li> <li>- Park transportation in public parking lots</li> <li>- Strengthen security with communities and neighbours</li> </ul>
	Damaged infrastructure	<ul style="list-style-type: none"> <li>- Use boats to travel</li> <li>- Move to floating houses or boat houses</li> <li>- Build makeshift bridges from houses to roads</li> <li>- Pool money with neighbours</li> <li>- Pool labour with neighbours</li> <li>- Rebuild and reinforce roads</li> <li>- Collect waste and clear drains</li> <li>- Obtain support from NGOs</li> </ul>
Social capital	Negative impacts on social capital	<ul style="list-style-type: none"> <li>- Mediate conflicts with bonding ties</li> <li>- Mediate conflicts with bridging ties</li> <li>- Mediate conflicts with linking ties</li> <li>- Consolidate existing networks (e.g. holding community meetings and strengthening security)</li> <li>- Diversify social networks (e.g. holding community leaders meetings and connecting with NGOs)</li> </ul>

Source: Own surveys and interviews 2018

#### 4.2.2. Assessing coping of riverside slum households

This section assesses the conditions under which riverside slum households cope. There is no doubt that the results of coping with flood events vary from household to household, and the results are generally negative. This are evident from Table 4.4, which explains livelihood changes before and after the last severe flood event. The majority responded that their livelihood had deteriorated (78.2%). This shows that the households are highly vulnerable to flood damage, however, this thesis focuses on the fact that a few have managed to retain (19.3%) or even improve their livelihood (2.5%). Being able to explain the different results of coping would have implications for better and more effective strategies and development. This paper argues that such differences arise from three conditions: active coping, transformative coping, and social support.

**Table 4.4. Livelihood changes before and after the last severe flood event**

Better	The same	Worse
3 (2.5%)	23 (19.3%)	93 (78.2%)

Source: Own surveys 2018, N=119 households.

##### *Active and inactive coping*

McLean (2015) argued that there are inactive adaptation and livelihood strategies versus proactive or reactive strategies. This thesis similarly separates inactive coping from active coping, where the latter is important for resilience. ‘Inactive coping’ refers to households who cope non-actively without any strategies. Inactive coping is evident in answers such as ‘we never cope with it’, ‘we do nothing’, and ‘I have no solution.’ On the other hand, ‘active coping’ refers to any strategies used to deal with vulnerability, no matter how successful it is. The proportion of inactive coping depends on the type of exposures (Table 4.5). The proportion of inactive coping is higher than that of active coping in cases of disrupted

education, lost belongings, and negative impacts on social capital. This means that it is relatively difficult to cope with such types of exposure in a situation of insufficient adaptive capacity, however, the households struggled more actively in the case of income decreases, food shortages, diseases, and so on.

**Table 4.5. Active and inactive coping of the slum households**

Exposure	Active coping	Inactive coping	Not exposed
Food shortages	71 (59.7%)	27 (22.7%)	21 (17.6%)
Diseases	69 (58.0%)	7 (5.9%)	43 (36.1%)
Injuries	18 (15.1%)	14 (11.8%)	87 (73.1%)
Disrupted education	12 (10.1%)	26 (21.8%)	81 (68.1%)
Income decreases	73 (61.3%)	36 (30.3%)	10 (8.4%)
Lack of money	72 (60.5)	34 (28.6%)	13 (10.9%)
Destruction of houses	70 (58.8%)	15 (12.6%)	34 (28.6%)
Lost belongings	16 (13.5%)	26 (21.8%)	77 (64.7%)
Damaged infrastructure	57 (47.9%)	22 (18.5%)	40 (33.6%)
Negative impacts on social capital	25 (21.0%)	45 (37.8%)	49 (41.2%)

Source: Own surveys 2018, N=119 households.

\* Active coping included answers with all coping strategies.

\* Inactive coping included answers such as ‘never coped’, ‘do nothing’, and ‘I do have no solution.’

The first part of Table 4.6 shows the results of chi-square tests of independence between active/inactive coping and livelihood changes. ‘Inactive coping’ in this analysis refers to households who cope non-actively with at least three types of exposure. The variables of livelihood changes are reclassified into two values (not worse and worse), because ‘the same’ is considered a successful result of coping with flood vulnerability. It turned out that the relationship between active/inactive coping and livelihood changes was significant,  $\chi^2(1, n = 119) = 5.7745, p < 0.025$ . The households who coped with flood vulnerability more actively were

more likely to avoid worse livelihoods than those who continued to cope non-actively.

**Table 4.6. Results of chi-square test of independence 1**

Coping	Livelihood changes <sup>a</sup>			Chi-square test of independence
	Not worse	Worse	Total	
Active	22 (48.6%)	55 (51.4%)	77 (100.0%)	N = 119 $\chi^2(1) = 5.7745$ p < 0.025 $\phi = 0.220$ <sup>b</sup>
Inactive	4 (9.5%)	38 (90.5%)	42 (100.0%)	
Total	26 (21.8%)	93 (78.2%)	119 (100.0%)	
Transformative	11 (42.3%)	15 (57.7%)	26 (100.0%)	N = 127 <sup>c</sup> $\chi^2(1) = 5.0785$ p < 0.025 $\phi = 0.199$ <sup>b</sup>
Path-dependent	21 (20.8%)	80 (79.2%)	101 (100.0%)	
Total	32 (25.2%)	95 (74.8%)	127 (100.0%)	

$\phi$  = effect size (phi coefficient).

a The variables of livelihood changes are reclassified into two values (not worse and worse) because ‘the same’ is considered a successful result of coping with flood vulnerability.

b Significant difference with an effect size  $\geq$  Cohen’s definition of ‘small.’

c The second test is based on the results of the surveys and interviews.

### *Transformative and path-dependent coping*

Wise et al. (2014) argued that transformative actions are important for achieving adaptation. Transformative actions generally refer to structural and fundamental changes to the nature of a system (Nelson et al., 2007; Pelling, 2011; O’Brien, 2012; Park et al., 2014). Transformative actions are compared to path-dependent actions which involve adhering to the same responses to climatic impacts (Barnett & O’Neill, 2010). Similarly, transformative coping is important in that such coping would increase flexibility to cope with unexpected changes.

An operational definition is used for measuring the transformative coping of the households in the thesis. The thesis determined that transformative coping took place when there was a change in the coping strategies of a household. Similarly, path-dependant coping refers to the same coping that a household has always used. Examples of transformative coping include renovating

sewage systems, changing trade products, income diversification, and renovating houses. Path-dependency is evident in answers such as ‘we always cope the same’, ‘we do the same as before’, and ‘we have no other option because we are poor.’

The second part of Table 4.6 shows the results of chi-square tests of independence among the transformative/path-dependent coping and livelihood changes. The test was based on the results of both surveys and interviews. It turned out that the relationship between transformative/path-dependent coping and livelihood changes was significant,  $\chi^2(1, n = 127) = 5.0785, p < 0.025$ . The households who coped more differently with flood vulnerability were more likely to avoid worse livelihoods than those who adhered to the same coping strategies.

#### *The role of social support*

Social support is one of the most important benefits of social capital. In the absence of other capital, the role of social capital is significant because households are able to obtain limited resources with the social support. The various types of social support depend on ties and providers. ABheuer et al. (2013:23) reported that bonding ties tend to provide easily shared resources, and bridging or linking ties are more likely to provide limited shared resources.

**Table 4.7. Social support from various providers**

Social support	Yes	Examples
a. Relatives	28 (24.3%)	Loans, food, etc.
b. Neighbours	102 (87.4%)	Loans, rice, labour, childcare, etc.
c. Communities	83 (69.7%)	Information, labour, security, etc.
d. Government	46 (38.7%)	Rice, ingredients, blankets, money, etc.
e. NGOs	26 (21.8%)	Loans, information, education, skills, etc.

Source: Own surveys 2018, N=119 households.

Table 4.7 gives a detailed description of the social support

given by various providers. The first providers to consider are relatives. Family ties are the most basic bonding ties, however, their support is limited as relatives are likely to be in the same situation. The providers on which the households depend most are neighbours (87.4%) and communities (69.7%). Although both are bonding ties, the support offered is slightly different. As the relationship with neighbours is private, support is concentrated on individual goods such as loans, rice, labour and childcare, however, the benefits from communities are more collective and public. For example, information is given in community meetings, and residents work together to build community infrastructure. Bridging ties include the government and NGOs. Although enjoyed by relatively fewer households, these ties are important as they offer less limited solutions. The government tends to provide flood victims with relief goods such as blankets, ingredients, tents and so on. NGOs are more likely to provide intangible goods such as information, skills and education.

**Table 4.8. Details on loans available for slum households**

Loan provider	Percentage of Loan user	Average amount	Monthly interest rate	Months for repayment
Moneylenders	29.3%	426.7\$	21.4%	6.3
Relatives	5.3%	78.1\$	2.5%	7.7
Neighbours	34.7%	79.5\$	8.0%	3.9
Banks	22.7%	1,501.5\$	2.2%	18.1
NGOs	4%	621.5\$	2.3%	8.8
Others	4%	134.0\$	1.7%	10.5

Source: Own surveys 2018, N=75 households.  
The method was adopted from ABheuer et al. (2013)

The role of social support is obvious when discussing available loans for the households. As shown in Table 4.8, there are various routes to obtaining loans. A bank is the most formal way, but many households cannot access banks because of low credit. They

therefore obtain loans from local moneylenders who have high monthly interest rates (21.4%). Social support thus plays an important role in providing alternative loans. Most inhabitants reported that they had made loans to neighbours with relatively low interest rates (8.0%) compared to the moneylenders. These loans are small amounts (\$79.5 on average), which are used in an urgent situation. NGOs provide larger loans for households (\$621.5 on average). Although not popular, NGOs are alternatives to the banks, for those who need a larger loan.

Table 4.9 analyses the relationship between livelihood changes and the social support from the various providers. The first three rows show bonding ties, including relatives, neighbours, and communities. The relationship between livelihood changes and support from relatives was significant,  $\chi^2(1, n = 119) = 4.1226, p < 0.01$ . It is assumed that the support is effective as relatives tend to know what exactly is needed. The relationship with neighbours was not significant. It is presumed that such support is concentrated on easily shared goods which are less likely to provide lasting solutions, however, there was a significant relationship with communities,  $\chi^2(1, n = 119) = 5.5216, p < 0.025$ . It is noted that although neighbours and communities are both kinds of bonding ties, the latter has the advantage of giving not only easily shared goods, but also scarce goods with collective action. The scarce goods involve giving information, building infrastructure, strengthening security, or pooling labour for residents. These things are not available from individual relatives or neighbours.

The next two rows show bridging ties, including those with the government and NGOs. The relationship of the government was significant,  $\chi^2(1, n = 119) = 7.3464, p < 0.001$ . The relationship between livelihood changes and NGOs was not significant. It is assumed that this difference comes from the goods provided. The government focuses on offering relief goods, and NGOs provide intangible goods. The former would have the short-term effects for overcoming the negative impacts of flood events, but since the

latter involves long-term solutions, it is not effective in the short term.

The results of the surveys and analysis offer two implications for the role of social support. First, it is important for households to have diverse social networks and relationships in order to cope with flood vulnerability, as other capital is limited. Various benefits and support can be expected, depending on the providers, in order to overcome various situations. This is consistent with the claims of ABheuer et al. (2013). Second, the thesis emphasises the importance of community or collective action. Considering floods cause damage to about 25% of the entire population (The Phnom Penh Post, 2000), support from the government or NGOs is limited. According to the chi square results, support from neighbours is less effective, as they only provide homogeneous goods. Thus, collective action needs to be fostered in the case of riverside slums, as communities provide community-specific and accessible solutions for households.

**Table 4.9. Results of chi-square test of independence 2**

Social support		Livelihood changes <sup>a</sup>			Chi-square test of independence
		Not worse	Worse	Total	
a. Relatives	Yes	18 (64.3%)	10 (35.7%)	28 (100.0%)	$\chi^2(1) = 4.1226$ $p < 0.01$ $\phi = 0.186^b$
	No	75 (82.4%)	16 (17.6%)	91 (100.0%)	
	Total	26 (21.8%)	93 (78.2%)	119 (100.0%)	
b. Neighbours	Yes	24 (23.5%)	78 (76.5%)	102 (100.0%)	$\chi^2(1) = 1.1811$ $p > 0.1$ $\phi = 0.099$
	No	2 (11.8%)	15 (88.2%)	17 (100.0%)	
	Total	26 (21.8%)	93 (78.2%)	119 (100.0%)	
c. Communities	Yes	60 (72.3%)	23 (27.7%)	83 (100.0%)	$\chi^2(1) = 5.5216$ $p < 0.025$ $\phi = 0.215^b$
	No	33 (91.7%)	3 (8.3%)	36 (100.0%)	
	Total	26 (21.8%)	93 (78.2%)	119 (100.0%)	
d. Government	Yes	30 (65.2%)	16 (34.8%)	46 (100.0%)	$\chi^2(1) = 7.3464$ $p < 0.001$ $\phi = 0.248^b$
	No	63 (86.3%)	10 (13.7%)	73 (100.0%)	
	Total	26 (21.8%)	93 (78.2%)	119 (100.0%)	
e. NGOs	Yes	5 (19.2%)	21 (80.8%)	26 (100.0%)	$\chi^2(1) = 0.1335$ $p > 0.5$ $\phi = 0.033$
	No	21 (22.6%)	72 (77.4%)	93 (100.0%)	
	Total	26 (21.8%)	93 (78.2%)	119 (100.0%)	

$\phi$  = effect size (phi coefficient).

a The variables of livelihood changes are reclassified into two values (not worse and worse) because ‘the same’ is considered a successful result of coping with flood vulnerability.

b Significant difference with an effect size  $\geq$  Cohen’s definition of ‘small.’

# Chapter 5. Exploring Linkages between Adaptation, Coping, and Development

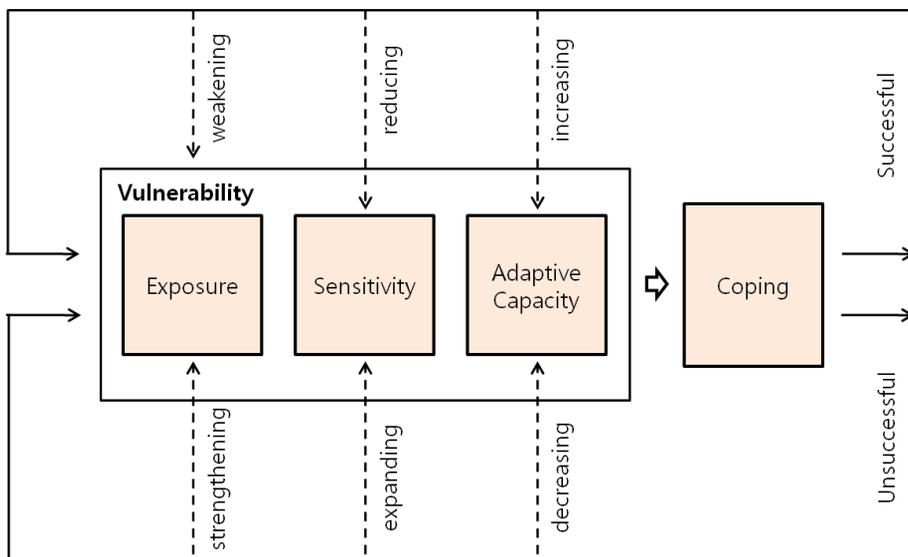
## 5.1. Impacts of Coping on Subsequent Vulnerability

Chapter 4 dealt with the way that riverside slum households in Phnom Penh cope with flooding. Chapter 5 aims to delve into how the long-term adaptation of households is connected to short-term coping and development, using the ‘development by cumulative adaptation’ concept. In order to achieve its purpose, adaptation needs to be interpreted on a longer temporal scale, compared to Chapter 4 which looked at a single period of coping. This is because the thesis considers adaptation as a cumulative result of the series of coping, occurring in the long term.

There is increasing empirical evidence that climate variance and extreme events might increase vulnerability, and that governmental intervention might decrease it, however, relatively little attention has been given to the way that coping (strategies) have positive or negative impacts on vulnerability, with both planned and unexpected effects. Although most of the previous studies have only provided partial examples of specific coping strategies (e.g. Tarhule, 2005:366), Magnan et al. (2016:655) is noteworthy as it suggests a general process for the way in which initiatives could affect vulnerability. It argues that there are several temporal periods, and institutional initiatives do not end with a single period but rather affect subsequent periods. Similarly, coping in previous periods can change vulnerability in later periods at the household level. The approach fits well with the case of riverside slum households and flood events because flood events occur on an annual basis, and because the impacts of previous floods continue into the next year.

Magnan et al. (2016) is limited, however, in that it focused solely on a negative aspect, maladaptation. This thesis argues instead that vulnerability fluctuates in both positive and negative ways by successful or unsuccessful coping. In a similar way to what

Adger et al. (2005:79) noted about successful adaptation, successful coping involves three things: weakening exposure, reducing sensitivity, and increasing adaptive capacity. Unsuccessful coping results in strengthening exposure, expanding sensitivity, and decreasing adaptive capacity. The framework is drawn in Figure 5.1. This refutes opinions that coping would not affect underlying vulnerability (e.g. Vincent et al., 2013). Interviews with riverside slum households offer empirical evidence about how their coping could affect subsequent exposure, sensitivity, and adaptive capacity.



**Figure 5.1. Impacts of coping on subsequent vulnerability**

*Impacts on subsequent exposure*

As mentioned in Chapter 4, households are significantly exposed to various kinds of risks and effects during flooding. This is mainly because they are located along the riverside. However, their exposure might increase or decrease according to their own efforts to cope with vulnerability. Strengthened exposure involves a state in which households are affected by more types of risks and effects than previously. Conversely, weakened exposure refers to a state in which they experience fewer types than previously.

Interviewee 7 gives a good example of strengthened exposure

due to her unsuccessful coping strategies. She lives in a boat house on the river. Although moving to solid ground would have been the best way to cope with flood events, this was not possible due to lack of adaptive capacity. Instead, she coped by using small ropes to tie her house to land and prevent it drifting away. However, this was not successful this time. Consequently, her household was exposed to another risk (their electricity was cut off) for a few months.

I don't want to live on the water because we are damaged so easily by floods. I really want to live on the ground. But I have to buy the land that costs maybe \$1,000–1,500. ... but I do not have money. ... My house drifted around or moved to other places at night because the small ropes were cut. [As a result] Our house was broken, ... [and] electricity ran out during the flood. We could not use electricity then [for a long time]. [We could] not charge phones.

– Interviewee 7

Interviewee 26 managed to cope better and avoid various risks afterward. Similarly to interviewee 7, her household once lived on a boat house, however, she has coped successfully for the last four years by moving to land, which weakened her exposure. This was possible as she had better adaptive capacity (financial capital to purchase the land) than Interviewee 7. As a result, she was less affected by rubbish, snakes, mosquitoes, mice, and so on.

In 1986, I bought a floating house (a boat house) and we lived in the house on the river. ... four years ago, I bought the land (\$1,100) but we haven't built a new house yet on the land. I am living on the land by renovating the floating house. ... There [used to be] a lot of rubbish, snakes, mosquitoes, mice [when living on the river], and children fell into the water [easily]. But for last four years no children have fallen into the water. ... Living on the land is

better.

– Interviewee 26

*Impacts on subsequent sensitivity*

The degree to which households are sensitive to the many types of exposure differs depending on several determinants, including socioeconomic, geographical, and political conditions. Even though they are exposed to the same flood event, the extent to which people are affected is different. For example, households with less adaptive capacity might be more sensitive to the a flood event. Vietnamese households might be more sensitive as they cannot obtain official support from the government and NGOs compared to Khmer households, however, sensitivity is not fixed, and it may also expand or reduce due to the consequences of coping. Expanded sensitivity is a state in which households are affected more by specific types of risks and effects. Reduced sensitivity is a state in which they are affected less. It is not the same as exposure, as sensitivity has nothing to do with states in which new kinds of exposures emerge or existing exposures disappear. Rather, it indicates being more or less susceptible to the existing types of exposure.

Interviewee 2 shows how unsuccessful coping might result in being more sensitive. Her household is affected by floods every year, and she copes by living on the roadside because her house is fully submerged. Every year, she becomes more sensitive to inundation, because her house is being gradually more damaged.

[We] are impacted by the floods every year because my house is near the water. [During floods], we have to stay near the street every year because we can't stay in the house anymore. ... Every year, wood [of the house] is removed and damaged. ... [As] I spent too much after the floods, [So] I didn't have enough money for repairing and rebuilding the house for the next flood.

– Interviewee 2

Conversely, Interviewee 4 became less sensitive to the destruction of her house by coping differently from Interviewee 2. In 2015, her house was totally destroyed, so she built a new house with higher pillars the next year. She also built another house as a shelter during flood seasons. Consequently, her household and house have been subject to less impact and damages from flood events since 2016.

In 2016, we built a new house because ... my house was broken by the flood [in 2015]. I built a new one higher than before. ... [So] I have two houses. If a big flood comes and I cannot live in my house, I will move to the [another] one so I'm not affected by the flood. ... Yes. [I am prepared better than before.] I have [fewer] impacts from the flood [not] like before.

– Interviewee 4

#### *Impacts on subsequent adaptive capacity*

As noted in the interviews, adaptive capacity works as human, financial, physical, and social determinants for a range of coping strategies. At the same time, coping enables adaptive capacity to increase or decrease. Households might have more capacity to cope with the next flood event if they choose effective coping strategies. This is evident in the case of Interviewee 9. Becoming a community leader in 2008 meant that she could obtain more human, financial, physical and social capital to use in the flood. She managed to obtain education from a NGO called UPDS, in order to earn income, to build a new house, and to create better and more diverse social networks compared to the previous flood in 2003 or 2004.

In 2003 or 2004, my house collapsed into the water, but no one helped us. ... After I became a leader in the community in 2008, our livelihood was better than before. Working as the leader, I [could] earn [more] money to support my

family. I built a new house in 2017 by borrowing money from the community. ... I [could] have meetings with UPDS for education about how to prepare for flooding. ... When I was sick, [neighbours] also helped me too.

– Interviewee 9

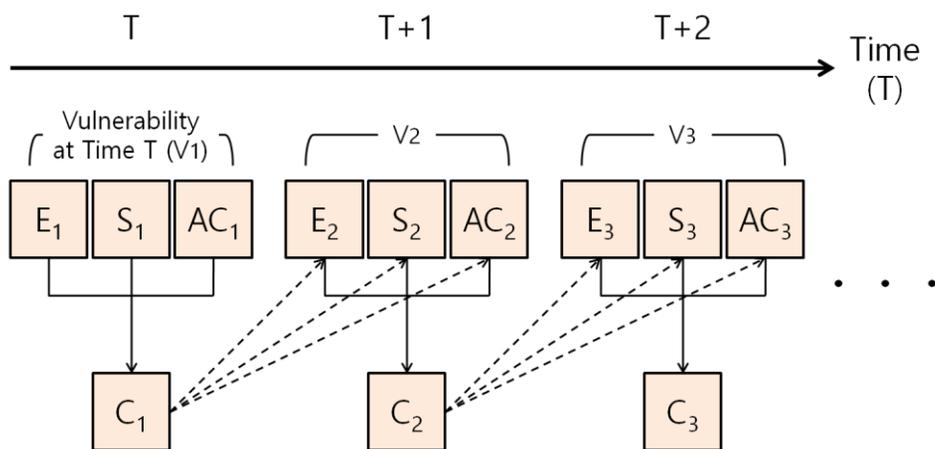
The opposite case is found in Interviewee 19. This interviewee migrated from Kandal province to Phnom Penh following marriage in 2013. For the last six years, her livelihood grew gradually worse because of big flood events in 2013 and 2016. The adaptive capacity of her household decreased because she could not cope well with decreased income, disease, and other risks. Her financial situation, in particular, deteriorated greatly.

[My livelihood] became worse and worse since I came here. ... The house was broken in 2013. ... My husband could not work. There was no electricity and we needed to spend a lot to buy water at that time. ... We spend about \$50 per month [usually] ... [but] we spend 500,000 to 600,000 Riel (\$125–150) per month during floods. ... [Did the impact of one flood affect the next flood?] Yes. It became difficult for us to live and to earn money.

– Interviewee 19

## 5.2. Development by Cumulative Adaptation

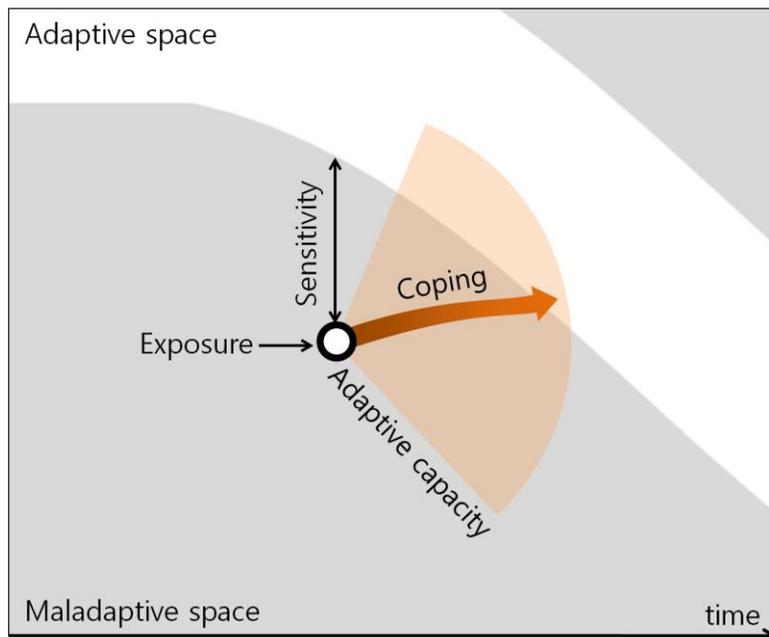
Previously, the thesis determined how coping strategies could affect subsequent vulnerability by strengthening/ weakening exposure, expanding/reducing sensitivity, and increasing/decreasing adaptive capacity. As a result, the coping has effects on further coping, because it is based on the fluctuating vulnerability. The results of extending the time scale are shown in Figure 5.2. Vulnerability of Time T ( $V_1$ ) is a function of exposure ( $E_1$ ), sensitivity ( $S_1$ ), and adaptive capacity ( $AC_1$ ) in the figure. Coping with current vulnerability ( $C_1$ ) has impacts on subsequent vulnerability ( $V_2$ ), and it is repeated in turn. Through this process, coping produces a variety of pathways of livelihood changes and adjustment. In other words, the process is a key to explaining how short-term coping is linked to long-term adaptation.



**Figure 5.2. The process of fluctuating vulnerability by coping (adapted from Magnan et al., 2016)**

In fact, attempts to explain adaptation through the pathways, are not new. As mentioned in Chapter 2, they are found in a series of ‘adaptation pathways’ approaches (Haasnoot et al., 2013; Wise et al., 2014; Fazey et al., 2016; Magnan et al., 2016). These approaches are noteworthy as they conceptualise a complex

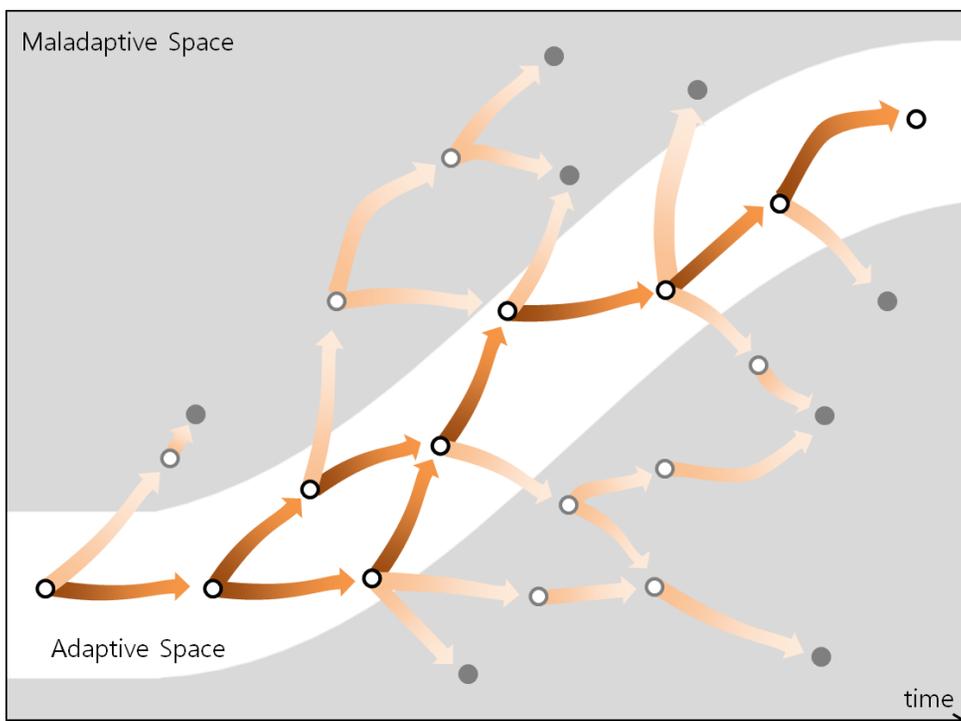
adaptation process with simpler metaphors (e.g. Wise et al., 2014:333), however, the approaches originally focused on the processes and effects of decision making at institutional level, not on those of coping at household level. This thesis therefore reinterprets the ‘adaptation pathways’ approaches from the perspective of coping at household level, and illustrates the linkage between adaptation, coping and development using their metaphors.



**Figure 5.3. Vulnerability and coping in pathways approaches**

The results of redrawing Figure 5.1 using the adaptation pathway approaches are Figure 5.3. First, there are virtual spaces representing adaptive space and maladaptive space. Adaptive space involves both goals (Wise et al., 2014) and the thresholds of adaptation (Smit & Wandel, 2006). It is not fixed over time, so it can fluctuate according to climate change variance, greenhouse gas mitigation, and other governmental policies and interventions. The term ‘adaptive space’ is replaced by the term ‘coping range’ in numerous papers (Yohe & Tol, 2002; Hughey & Becken, 2014). Represented as a point in the figure, exposure can be positioned both inside and outside adaptive space. Extreme events, which

exceed the threshold, lie outside the space. Sensitivity is then measured by the distance between exposure and adaptive space. Adaptive capacity refers to the range of possible coping strategies to choose from. It is depicted as a semicircle. If one's adaptive capacity is limited, the semicircle in the figure will be reduced and the options for overcoming maladaptive space will also decrease. Finally, coping occurs based on exposure, sensitivity and adaptive capacity. As a result, it changes its position and the degree of vulnerability.



**Figure 5.4. The process of fluctuating vulnerability by coping using pathway approaches (adapted from Wise et al., 2014)**

The result of redrawing Figure 5.2 with the pathways metaphor is Figure 5.4. It is also the result of expanding a number of strategies for coping with vulnerability over time. The figure contains complex pathways. The pathways provide a description of the relationship between coping and adaptation. The darkly-painted arrows represent pathways that are continuously adaptive and, in other words, a household achieves adaptation in the long term. The

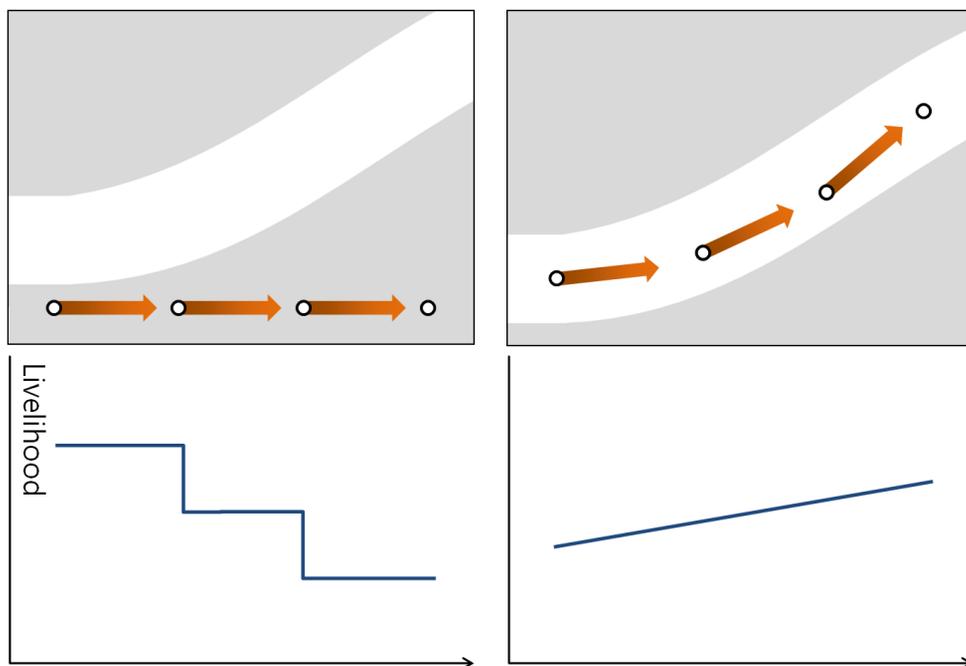
adaptive pathways are not the results of one successful coping, but the cumulative results of successful coping over time. Conversely, the lightly-painted arrows represent pathways which fell into maladaptive space. The maladaptive pathways are cumulative results of unsuccessful coping over time. This thesis focuses on the cumulative features of adaptation when it comes to explaining the linkage between adaptation and coping. This can be called cumulative adaptation for the adaptive pathways. In the opposite pathways, it can be called cumulative maladaptation.

To achieve cumulative adaptation, it is important for households not to adhere to the same coping strategies as in the past (path-dependent coping). This is because adaptive space fluctuates over time according to climate change variance. In the figure, changing the direction of the arrow means that a household has implemented different coping strategies (transformative coping) from those in the past (Wise et al., 2014). Changing the direction indicates there were transformative changes, such as income diversification. Maintaining the direction implies that the path-dependent strategies have been implemented without any transformation.

The concept of cumulative adaptation thus fits well with the definition of adaptation. In Chapter 2, the thesis defined adaptation as the long-term process of adjustment to actual or expected climate and its effect including transformative changes. Cumulative adaptation is a long-term process, as a cumulative result of short-term coping over time. Moreover, it adjusts to climate variance by maintaining its position in the adaptive space. Finally, it includes transformative changes by changing coping strategies. It is consistent with the case of maladaptation, as defined as a process that results in increased vulnerability (Juhola et al., 2016). Cumulative maladaptation means falling far from the adaptive space, with strengthening exposure, expanding sensitivity, and decreasing adaptive capacity.

The approach of cumulative adaptation successfully explains the linkage between adaptation and coping, distinguishing itself from the previous three approaches. First, cumulative adaptation

fundamentally differentiates short-term and long-term processes in regard to climate change, unlike the first approach (which considers coping and adaptation interchangeable). Second, it explains how long-term adaptation is achievable based on short-term coping, unlike the second approach (which consider coping and adaptation distinct). Lastly, it successfully explains how coping results in both adaptation and maladaptation. It is compared with the third approach (which consider coping and adaptation interrelated), which has contrasting viewpoints.



**Figure 5.5. Underdevelopment by cumulative maladaptation (left) and development by cumulative adaptation (right)**

Cumulative adaptation also explains the linkage with development. Cumulative maladaptation means to be located continuously in the maladaptive space; household livelihoods are vulnerable to shock, and as a result, they would show downward shifts cumulatively with increased vulnerability (underdevelopment by cumulative maladaptation, Figure 5.5, Left). Those who adapt to climate change cumulatively are less likely to experience severe shocks from flood vulnerability. This implies that they concentrate

on other livelihood issues with increased or, at least, undamaged adaptive capacity. This would lead to development through improving livelihoods and reducing vulnerability (development by cumulative adaptation, Figure 5.5, right). According to Rigg (2012:115–122), downward movements of livelihoods tend to be sudden and ‘lumpy’, and upward movements tend to be gradual.

### 5.3. Development Pathways Linked with Vulnerability, Coping, and Cumulative Adaptation in Riverside Slums

The previous section introduced the theoretical concept of ‘development by cumulative adaptation’, aiming to understand how long-term adaptation is connected with short-term coping and development. This section considers the empirical insights into development by cumulative adaptation in the riverside slum households.

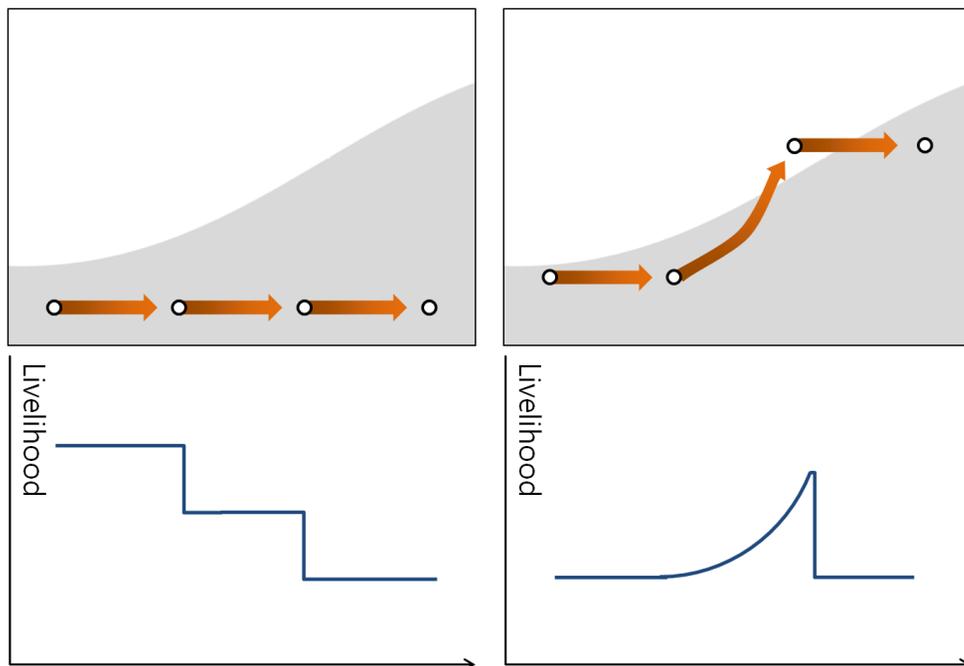
First of all, there are increasing uncertainties in Phnom Penh due to climate change variance and ineffective governmental intervention. This is expressed as a shrinking and fluctuating adaptive space in the pathways approaches. In accordance with Chapter 3, the Phnom Penh area is facing increased flood risks caused by higher temperatures and more precipitation in LMB (ICEM, 2013; STT, 2012). Efforts to mitigate the variance are limited at the national level, as the Cambodian government concentrates only on emergency relief and support (Wee, 2011).

In this situation, there is a growing need for households to cope successfully with higher flood vulnerability by themselves. As mentioned, successful coping involves three things: weakening exposure, reducing sensitivity, and increasing adaptive capacity. The analysis in Chapter 4 implies that successful coping has a significant relationship with activeness, transformation, and certain types of social support (especially support from communities), however, there remains a question about why the majority are still not overcoming the impact of floods, and why their livelihoods are even worsened after flooding (78.2%, Table 4.4) without adaptation.

#### *Underdevelopment by cumulative maladaptation of riverside slums*

The thesis finds answers in the two dominant pathways of ‘underdevelopment by cumulative maladaptation’. Most households unfortunately fall into constant trajectories of unsuccessful coping over time with path-dependant and inactive measures and insufficient social support (Figure 5.6, left). This is mainly because

households do not have enough human, financial, and physical capital (Table 3.1; 4.1). Obviously, their levels of education are low and their debts are high. Their livelihoods are fragile, with high unemployment rates and weak ownership of housing. Even though social capital has been described as better, it is often limited for ethnic minorities such as Vietnamese. In a situation where capital is limited, transformative measures are hard to come by.



**Figure 5.6. Two dominant pathways of underdevelopment by cumulative maladaptation in riverside slum in Phnom Penh**

A clear example is well illustrated in an interview with a Vietnamese woman (Interviewee 7). As she lives on a boat house, her household has suffered from severe damage during flood seasons every year. Livelihoods have become worse cumulatively, as she needed to pay her whole income (\$2,000–3,000) to recover, and as her debt increased. Her coping strategies are path-dependant (borrowing money to repair her house) and not adequately supported by the government or NGOs, at least within the last 10 years. As the price of land is about \$1,000–1,500, she might have a better chance to buy land if she spent less recovering

from the damage.

Because flood occurs frequently, my house has been broken again and again. I had to borrow money from neighbours ... and in the next flood, I had to borrow more money from them, which makes my debt increase. ... I borrowed about \$1,000 for my family during one flood, and I pay back \$20 per month. ... I think I spend about \$2,000–3,000 during flood seasons. ... I never save because we don't have enough money to save. The NGOs or government never help me because I am a Vietnamese.

– Interviewee 7

The concept of cumulative adaptation implies that it is necessary for successful coping to occur not just once, but to accumulate when it comes to achieving long-term adaptation. It is connected to the second pathway in which the majority are still suffering from underdevelopment (Figure 5.6, right). The main idea is that successful coping is often performed only once, or, in other words, unsustainably. The right side of Figure 5.6 illustrates the second pathway appropriately; successful coping occurred once and it quickly returned to the past conditions.

There are three common cases of the pathway in the riverside slum. The first case is single support from the government or NGOs. Many complained that they provided relief goods only once, and not annually. Although one-off support or charitable grants may work at the time, it is hard to expect them to help during floods in the future.

More than 10 years ago, I was supported by rice and money from the government and other organisations. But not recently.

– Interviewee 12

The second pathway happens when households practice unsustainable coping, or ‘erosive coping’, to use Warner et al.’s (2012) term. Erosive coping refers to measures which have adverse effects in the long term despite having short-term advantages. As Warner et al. found, the measures are erosive when they threaten future livelihood sustainability. An example of erosive coping was reported by Interviewee 22, who was engaged in urban fisheries. According to the interviewee, there are a number of fishermen who fish illegally during flood seasons. Although it offers short-term benefits, it is not sustainable because it has negative impacts in the long term.

My husband is a fisherman. We do not fish during flood seasons. ... We fish during dry seasons and save money for flood seasons. ... [But] our livelihood got worse and worse, because my family cannot fish like before. Because there are a lot of people using big nets and fishing during flood seasons. [As a result,] the fish catch decreased.

– Interviewee 22

Thirdly, the second pathway occurs when transformative coping is not persistent. In other words, it occurs when households adhere to path-dependent coping. This usually happens because households lack the capacity to continue transformative measures, as evident in the case of Interviewee 17 who once succeeded in diversifying income sources in 2016, but could not succeed in continuing income diversification afterwards, as he was fired.

I work as a moto dup driver. In 2016, my wife and I also worked in the factory for maybe two or three months (during the flood). But we had a problem with the company. So we could not continue working as a factory worker. ... (When working in the factory) I could save \$100 per month. (But after stopping it), I cannot save money like before.

– Interviewee 17

Based on the interviews, the concept of ‘underdevelopment by cumulative maladaptation’ gives insights into the question of why the majority of slum dwellers are still not overcoming flood impacts. On one hand, the majority have failed to cope appropriately at all. On the other hand, even if they have once succeeded in coping, households are not aware of how to sustain this.

*Development by cumulative adaptation of riverside slums*

Conversely, a few households have managed to follow pathways of development by adaptation. In those pathways, it is important for favourable coping to be sustained in the long term. Cumulative adaptation requires active coping, sufficient support based on social networks, and transformative coping for flexible responses to each situation. Households would therefore be able to store their assets for further development without losing them due to flooding. This thesis has operationally considered pathways in which households have coped successfully for the last 10 years as development by cumulative adaptation.

One example is Interviewee 4, who is one of community leaders in Mitpheap. She reported that her households have been impacted very little by flooding. This is not only because she copes actively (having a community meeting about flood preparation once a month), but also because she has diverse social networks, including NGOs (e.g. UPWD and SST), government offices (based on her employment experiences), and other communities (community leaders meeting once a month). She also introduced transformative measures such as building a reserve house, having workshops for legal education (supported by UPWD), and not allowing vessels to travel near riverbanks in order to prevent land erosion. She has not spent a lot on flooding, which means that she could accumulate adaptive capacity to invest in other issues such as renovating her house in 2016.

I am working as a community leader. I got to know UPWD when I worked in a [government] office. UPWD taught us

about the law with workshops since 2008. Also, STT educates me about environment. ... During floods, I move assets to another house. Also, we don't allow vessels to travel near my community [preventing impacts from waves]. There is a community meeting once a month about how to prepare for flooding. I also hold meetings with other community leaders once a month. It started in 2008. ... Every year, I used a little [money] because of flooding. In the last 10 years, the lack of flood impacts made my livelihood better. ... I built a new house with \$6,000 in 2016.

– Interviewee 4

This thesis argues that collective action plays an important role in promoting development by cumulative adaptation in Phnom Penh's slums with three reasons. First, unlike the government and NGOs, collective action is relatively prevalent and sustainable, in that communities could give contextual support depending on situations, whereas external support is fixed and limited. A number of interviewees (e.g. 4, 9, 16, 17) reported that collective support was steady and flexible depending on the impacts of flooding. Social support from neighbours and communities overlaps greatly with that from the government and NGOs (Table 4.7). The former could thus be an alternative to the latter in the riverside slums.

Collective action has the capacity to monitor the erosive coping strategies of the households. This is evident in the different responses of communities to illegal fishing. On the one hand, Interviewees (22, 23) in Prek Tapov reported that a number of residents engage in illegal fishing without community-wide monitoring. On the other hand, according to a community leader in Cham Reunphal (Interviewee 24), erosive fishing is banned at village level. The difference shows the necessity for collective action because it is difficult in practice for the municipal government to monitor all erosive coping strategies.

Third, most transformative measures tend to be informed or implemented by neighbours and communities. This means that

collective action plays an important role in spreading transformative coping among households. The measures require a certain level of education and information which is not obtainable by someone's own efforts. This inevitably results from chatting with neighbours, community meetings, or other informal/formal social contacts. Relatively large scale measures require cooperative labour and capital in communities. All the communities reported that they often pool labour or capital to build bridges and renovate sewage systems, houses, and roads. Although a few are supported by NGOs, most have to cope collectively on their own.

The comparison between communities reinforces the argument about the role of collective action. Table 5.1 compares collective action in three communities: Mitpheap, Phsar Toch, and Prek Tapov. Most households in the three communities are affected by flooding every year or once in two years. External support is homogeneous (e.g. rice, ingredients, and money) and relatively insufficient compared to internal efforts in the communities.

Mitpheap implements the strongest collective efforts (90%) including transformative measures such as building shelters, holding community meetings to share information, having workshops for education, and even hiring private cleaners. All villagers should be involved in repairing and constructing houses. As a result, Mitpheap features solid and tidy buildings with higher floors than in other communities. Those measures are transformative, as they were implemented within last 10 years. As a result, it is not surprising that the percentage of households whose livelihood deteriorated due to the last severe flood is low (10%).

A Muslim community, Prek Tapov, demonstrates weak cooperation between community members. The only reported effort is building bridges between housing for better accessibility. Some residents reported that they clean street by themselves and even complained about the inactive community. The weak cooperation appears to have produced unsuccessful results of coping; all respondents reported that their livelihoods became

worse after the last flood, without exception. As most are engaged as street vendors selling fish, the decreased catch due to erosive illegal fishing would be a crucial factor. Insufficient external support (25%) due to their being an ethnic minority is another factor. The lowest income level reflects both underdevelopment and the lack of opportunity for collective action.

**Table 5.1. Comparison of collective action between communities**

	Mitpheap (N=10)	Phsar Toch (N=14)	Prek Tapov (N=12)
Daily income	\$13.4	\$8.3	\$5.6
Population	17 households	50 households	20 households
Average household size	6.4 members	5.9 members	5.8 members
Main ethnic groups	Khmer	Khmer	Muslim
Worse livelihood after the last flood	1 (10%)	8 (57.1%)	12 (100%)
Support from neighbours	9 (90%)	12 (85.7%)	8 (66.7%)
Support from community	9 (90%)	13 (92.9%)	5 (41.7%)
Support from the government	7 (70%)	6 (42.9%)	4 (25%)
Support from NGOs	1 (10%)	8 (57.1%)	4 (25%)
Examples of collective action	Building bridges Building shelters Holding meetings Having workshops Hire cleaners Repairing houses Renovating houses Sharing information Forbidding vessels from travelling near the land	Building bridges Cleaning streets Providing education	Building bridges

Source: Own surveys and interviews 2018.

The level of collective action in Phsar Toch is between that of Mitpheap and Prek Tapov. It enjoys intermediate amounts of both external and internal support. Although less than Mitpheap, it uses

several collective strategies: building bridges, cleaning streets together, and providing education with the help of NGOs. Similarly, an average number of households overcame the impacts of the floods (57.1%), however, there are limits in that the measures are not diverse and transformative.

The comparison gives an insight into the role of collective action in promoting development through cumulative adaptation. The three communities had similar flood impacts, considering the elevation data (ASTER GDEM 2) and the flood water extent in 2013 (UNOSAT, 2013). The flood water extended to Phsar Toch, Mitpheap, and Prek Tapov, in that order (most to least affected), nevertheless, Prek Tapov faced the worst impact due to the weakness of its collective action.

The argument corroborates the empirical findings of Chapter 4 which stresses the role of favourable coping. It is also consistent with other empirical evidence in the Global South (Rodima–Taylor, 2012; Karlsson & Hovelsrud, 2015; Thorn et al., 2015; Paul et al., 2016) which highlights collective action when it comes to the adaptation of the poor. At the same time, it contrasts with Aßheuer et al. (2013) who evaluated all kinds of social capital as a whole. While Aßheuer et al. described multifaceted social capital allowing slum dwellers to overcome the crisis, this thesis focuses on collective cooperation in communities, which enables long–term adaptation and development.

## Chapter 6. Conclusion

Adaptation is increasingly discussed in inter-disciplinary research, as a result of the increasing global threats from climate change. The development literature suggests that adaptation would work as a possible strategy for sustainable development, terming it 'development by adaptation', however, 'development by adaptation' has been relatively under-researched at household level. This thesis argues that it could be uncovered by exploring linkages between short-term coping, adaptation and development at the household level.

The purpose of the thesis was therefore to explore the linkages between adaptation, coping, and development in order to unveil the process of development by adaptation at the household level. The capital city of Cambodia (Phnom Penh), riverside slum households and flooding were examined as a case study in this thesis. To achieve the purpose of the case study, the thesis set two research questions. How do the riverside slum households of Phnom Penh cope with flood vulnerability? How is the short-term coping of the households related to long-term adaptation and development?

Chapter 2 reviewed previous discussions on the linkages between adaptation, coping and development. In the chapter, the thesis positioned the study according to the perspectives of vulnerability and 'development by adaptation'. This was for focusing on a specific situation, for finding policy implications, for using a shorter time frame, and for explaining the complexity of climate change. The chapter then critically reviewed previous approaches to the relationship between coping and adaptation. As a result, three approaches were categorised, considering adaptation and coping as: (1) interchangeable, (2) distinct, and (3) interrelated. Although the third approach is noteworthy in that it gives a room to link adaptation and coping, the study also found that the approach to date does not fully explain two aspects of the relationship in: theoretically contrasting arguments and a lack of empirical evidence.

Chapter 4 answered the first question by examining flood vulnerability and the actual coping strategies of riverside slum households in Phnom Penh. The households are exposed and sensitive to multiple exposures: food shortages, diseases, injuries, disrupted education, decreased income, insufficient money, destroyed houses, lost belongings, damaged infrastructure, and negative impacts on social capital. There is also a lack of adaptive capacity in general, except in the case of social capital. In this situation, slum households attempt to cope with each type of exposure with limited capital. Chi-square tests of independence demonstrated that livelihood change has a significant relationship with certain sorts of coping strategies: activeness, transformation, and social support from relatives, communities, and the government.

Based on the empirical results of Chapter 4, Chapter 5 investigated the process of development by adaptation at household level by introducing the concept of 'development by cumulative adaptation'. Achieving successful coping, which would weaken exposure, reduce sensitivity and increase adaptive capacity, is a key issue in reducing vulnerability at household level. However, this successful coping has to occur not once, but cumulatively, in order to achieve adaptation and reduce vulnerability in the long-term. In other words, the process of development by adaptation is based on the cumulative results of favourable coping over time.

The concept allows us to understand the reasons the slum households are failing to cope successfully without adaptation in two particular aspects. Firstly, most households fell into constant trajectories of 'underdevelopment by cumulative maladaptation' with inactive and path-dependent coping without sufficient social support. The second point, which is more important, is that successful coping is not often performed continuously and sustainably, although some households managed to cope successfully once. This is evident in the case of single instances of support from the government and NGOs, erosive coping, and non-persistent transformation.

The thesis highlights the positive examples showing that

collective action can play an important role in converting trajectories into ‘development by cumulative adaptation’. Unlike the government and NGOs, collective action is relatively prevalent and sustainable, in that communities can give contextual support. Collective action has the capacity to monitor the erosive coping strategies of the households. Most transformative measures tend to be informed or implemented by neighbours and communities. The implications are consistent with other empirical papers (Rodima–Taylor, 2012; Karlsson & Hovelsrud, 2015; Thorn et al., 2015; Paul et al., 2016) which highlights collective action when it comes to adaptation in developing countries.

The thesis contributes to current adaptation and development debates in three ways. Firstly, it rediscovers the need for cumulative adaptation, countering a long indifference. This thesis is the first empirical research after the concept was introduced in Smit et al. (1999). The reason to focus on cumulative adaptation is that, otherwise, it creates many misuses of coping and adaptation. There is an ongoing debate on defining the two concepts; there has been no standard in presenting their examples. As a result, the categorizations of coping and adaptation differed from each paper (cf. Pauline et al., 2017:218–219). In addition, they frequently overlapped each other. It is clear in those of Birkmann (2011:821–823) and Thorn et al. (2015:126–128). The misuses are the result of uncertain distinction between short–term and long–term responses. Instead, cumulative adaptation provides a precise linkage between them; long–term adaptation is cumulative results of short–term coping. However, long–term does not refer to long periods in time, but to systemic changes accompanied with transformation.

Secondly, the study finds another factor of barriers to adaptation actions. The previous papers have the tendency to argue that the reasons for the barriers are countless, but unpractised or insufficient adaptive capacity plays a major role (Adger & Barnett, 2009; Biesbroek et al., 2013; Islam et al., 2014). Hence, the suggestions to overcome the barriers are focused on how to

effectively translate adaptive capacity into adaptation actions with, for examples, “concerted effort, creative management, changed ways of thinking, political will, and reprioritization of resources, land uses and institutions (Eiseneck et al., 2014:867).” However, from the perspective of development by cumulative adaptation, another factor comes from non-persistent adaptation actions. Although adaptive capacity may be sufficient, actions tend to end at once without sustainable implementation. Thus, the study urges the importance of cumulative adaptation to maintain current adaptation strategies without interruption.

Lastly, but not leastly, the study provides three policy implications for local development in slum communities in Cambodia and other urban slums in the developing countries. The external supporters, such as NGOs and the government, are required to avoid short-term and erosive programmes, because these only end at unsustainable coping without cumulative adaptation. The relatable case is that of NAPA in 2006 which ended at providing short-term relief or reactive support after floods without monitoring. The second implication is related to community leaders. According to the presented interviews, the leaders played an important role in connecting residents with other social supporters: the government, NGOs, and other communities. It would therefore be more effective for the government or NGOs not to support all slum households, but to create networks with the community leaders, providing education and information first. The last point is about the networks between communities. Apart from the vertical networks with the government and NGOs, horizontal networks are also required in the form of the community leader meetings. This would contribute to spreading the desirable collective action among the communities.

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# Appendix A: Survey Questionnaire

This study is a study of the adaptation of riverside slum in Phnom Penh, Cambodia. You are asked to participate in this study because you are living in a riverside community. This study is assisted by Department of Geography, Royal University of Phnom Penh(RUPP) and consulted by UN-HABITAT Cambodia office.

**Date...../...../20....**

Household number..... Village name.....

Sangkat name ..... Khan name.....

## Part A - Basic Information

A-1. What is your gender? male..... female.....

A-2. How old are you? .....years

A-3. What is your ethnicity?

a. Khmer or Cambodian    b. Vietnamese    c. Chinese    d. Other.....

A-4. How many members does your household have? .....

A-5. What is your main occupation?

a. government worker    b. office worker    c. factory worker    d. construction worker  
e. street vendor    f. motodup/tuk tuk    g. cyclo-driver    h. home business owner(small shop)  
i. waste picker    j. beggar    k. unemployed    l. other.....

A-6. What is the main occupation of your spouse? (if applicable)

a. government worker    b. office worker    c. factory worker    d. construction worker  
e. street vendor    f. motodup/tuk tuk    g. cyclo-driver    h. home business owner(small shop)  
i. waste picker    j. beggar    k. unemployed    l. other.....

A-7. Do you own the house?

a. Yes, I am the owner    b. No, I borrowed from landlord    c. No, I just live here without paying.

A-8. Do you own the land?

a. Yes, I am the owner    b. No, I borrowed from landlord    c. No, I just live here without paying.

A-9. What is the main mean of transport for your household members?

a. motorbike    b. bicycle    c. motodup/tuk tuk    d. car    e. No vehicle    f. other.....

A-10. Education level?

a. No formal education    b. primary    c. secondary    d. college or university

- A-11. Education level of your spouse? (if applicable)  
 a. No formal education    b. primary    c. secondary    d. college or university

A-12. Education level of children? (if applicable)

#	M/F	Age	Education Level
1	M/F		a. No formal education b. primary c. secondary d. college or university
2	M/F		a. No formal education b. primary c. secondary d. college or university
3	M/F		a. No formal education b. primary c. secondary d. college or university

**Part B–Slum Conditions**

- B-1. What construction material is used for the majority of the house?  
 a. Concrete/cement    b. Wood    c. Metal    d. Straw or thatch    e. other.....

B-2. How many household members share the one room? ..... members

- B-3. How do you get drinking water?  
 a. surface water(river, dam, lake, pond, stream, and canal)    b. dug well    c. bottled water  
 d. rainwater    e. piped water    f. public tap    g. other.....

B-4. Do you boil the drinking water? Y/N

- B-5. Which toilet do you use?  
 a. street    b. yard or bush    c. ditch or drainage    d. open pit or bucket    e. public toilet  
 f. private toilet with sewer system    g. river    h. other .....

**Part C–Flood Events**

- C-1. How long has your household been living in your present house? ..... years  
 C-2. What are the reasons for living in this community?  
 a. Born in the community    b. Family ties    c. Low cost of living    d. other.....

- C-3. How often have you been affected by flooding since you came this community?  
 a. Never been affected    b. Once in five years    c. Once in two years  
 d. Every year (only in rainy seasons)    e. Every year (all seasons)

C-4. Which year did you experience floods for the last 10 years? (multiple responses)  
 2008    2009    2010    2011    2012    2013    2014    2015    2016    2017

C-5. When was the biggest flood for the last 10 years? .....

- C-6. Please identify whether floods have changed in your opinion in the last 10 years?  
 Flood frequency :    a. more often    b. no change    c. less often  
 Flood Strength :    a. stronger    b. no change    c. weaker

**Part D–Floods : Please identify your experiences of the biggest flood.**

a. Human Capital

Impact	Y / N	Please Explain (who, how, when, why)	How did you cope with this impact?			
Did your household experience food problems during floods?	Y / N		<table border="1" style="width: 100%; height: 100%;"> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> </table>			
Did your household experience disease during floods?	Y / N		<table border="1" style="width: 100%; height: 100%;"> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> </table>			
Did your household experience injuries during floods?	Y / N		<table border="1" style="width: 100%; height: 100%;"> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> </table>			
Did your household stop going school during floods?	Y / N		<table border="1" style="width: 100%; height: 100%;"> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> </table>			

Impact	Y / N	Please Explain (who, how, when, why)	How did you cope with this impact?			
Did your household experience food problems during floods?	Y / N		<table border="1" style="width: 100%; height: 100%;"> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> </table>			
Did your household experience disease during floods?	Y / N		<table border="1" style="width: 100%; height: 100%;"> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> </table>			
Did your household experience injuries during floods?	Y / N		<table border="1" style="width: 100%; height: 100%;"> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> </table>			
Did your household stop going school during floods?	Y / N		<table border="1" style="width: 100%; height: 100%;"> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> <tr><td style="height: 25px;"></td></tr> </table>			

b. Financial capital

Impact	Y / N	Please Explain (who, how, when, why)	How did you cope with this impact?
Did household income decrease during floods?	Y / N		<div data-bbox="1156 334 1846 405"></div> <div data-bbox="1156 405 1846 476"></div> <div data-bbox="1156 476 1846 544"></div>
Could your household continue to work during floods?	Y / N		<div data-bbox="1156 544 1846 615"></div> <div data-bbox="1156 615 1846 686"></div> <div data-bbox="1156 686 1846 753"></div>
Did your household spend your savings during floods? (How much?)	Y / N  (Riels)		<div data-bbox="1156 753 1846 825"></div> <div data-bbox="1156 825 1846 896"></div> <div data-bbox="1156 896 1846 963"></div>
Did your household experience money problems during floods?	Y / N		<div data-bbox="1156 963 1846 1035"></div> <div data-bbox="1156 1035 1846 1106"></div> <div data-bbox="1156 1106 1846 1158"></div>

c. Physical capital

Impact	Y / N	Please Explain (who, how, when, why)	How did you cope with this impact?			
Was your house damaged during floods?	Y / N		<table border="1" style="width: 100%; height: 100%;"> <tr><td style="height: 20px;"></td></tr> <tr><td style="height: 20px;"></td></tr> <tr><td style="height: 20px;"></td></tr> </table>			
Did you lose any valuables or assets during floods? (damages, thief...)	Y / N		<table border="1" style="width: 100%; height: 100%;"> <tr><td style="height: 20px;"></td></tr> <tr><td style="height: 20px;"></td></tr> <tr><td style="height: 20px;"></td></tr> </table>			
Were streets or dikes damaged during floods?	Y / N		<table border="1" style="width: 100%; height: 100%;"> <tr><td style="height: 20px;"></td></tr> <tr><td style="height: 20px;"></td></tr> <tr><td style="height: 20px;"></td></tr> </table>			
Were village assets damaged during floods? (wells, bridges ...)	Y / N		<table border="1" style="width: 100%; height: 100%;"> <tr><td style="height: 20px;"></td></tr> <tr><td style="height: 20px;"></td></tr> <tr><td style="height: 20px;"></td></tr> </table>			

d. Social capital

Impact	Y / N	Please Explain (who, how, when, why)	How did you cope with this impact?
Was your household disappointed with neighbors during floods?	Y / N		<div style="border: 1px solid black; height: 20px; width: 100%;"></div> <div style="border: 1px solid black; height: 20px; width: 100%;"></div> <div style="border: 1px solid black; height: 20px; width: 100%;"></div>
Was your household disappointed with government or NGOs during floods?	Y / N		<div style="border: 1px solid black; height: 20px; width: 100%;"></div> <div style="border: 1px solid black; height: 20px; width: 100%;"></div> <div style="border: 1px solid black; height: 20px; width: 100%;"></div>
Was your household disappointed with Landlord during floods?	Y / N		<div style="border: 1px solid black; height: 20px; width: 100%;"></div> <div style="border: 1px solid black; height: 20px; width: 100%;"></div> <div style="border: 1px solid black; height: 20px; width: 100%;"></div>
Did your household lose any neighbors during floods? (death, migration...)	Y / N		<div style="border: 1px solid black; height: 20px; width: 100%;"></div> <div style="border: 1px solid black; height: 20px; width: 100%;"></div> <div style="border: 1px solid black; height: 20px; width: 100%;"></div>

**Part E–Social Support**

E-1. Who helps your household after floods? (multiple responses)

- a. relatives in Phnom Penh    b. neighbors    c. friends in Phnom Penh
- d. government    e. NGOs    f. landlord    g. money-lender    h. others.....

E-2. Who helps your household most actively after floods?

- a. relatives in Phnom Penh    b. neighbors    c. friends in Phnom Penh
- d. government    e. NGOs    f. landlord    g. money-lender    h. others.....

Please explain (how, when)

.....

.....

.....

E-3. What kind of social supports did your household receive during the floods?

- a. food    b. information    c. clothes    d. money.....(Riels)
- e. shelter    f. child-care    g. Help to repair house    h. others.....

Please explain (what, when)

.....

.....

.....

E-4. Do your village get together to do something for floods? Y/N

If yes, please explain (what, when)

.....

.....

E-5. Who do your household borrow money mostly after floods?

- a. relatives in Phnom Penh    b. neighbors    c. friends in Phnom Penh    d. bank
- e. NGOs    f. landlord    g. money-lender    h. others.....

please explain why

.....

.....

.....

E-6. How much did you borrow money after the biggest floods? .....(Riels)

E-7. How much was interest rates per month for the money? .....(%)

E-8. How long did you spend to repay the money? ..... (months)

**Part F-Final Questions**

F-1. What is the biggest two problems during floods?

1.....

2.....

F-2. What would you like the government or NGOs to do for floods in your community?

Please explain why

.....  
.....  
.....

F-3. How are you going to prevent floods and to cope with floods in the future?

.....  
.....  
.....

F-4. Daily household Income: .....(Riels)

F-5. Daily household Expense: .....(Riels)

F-6. How much do you save per month? .....(Riels)

F-7. Was your total household income higher or lower after floods?

Lower, because.....

Higher, because.....

F-8. Have you relocated your house because of floods before? Y/N

If yes, please explain (where to where, when, why)

.....  
.....  
.....

F-9. If yes, did relocation contribute to cope with floods? Y/N

Please explain (why)

.....  
.....  
.....

F-10. Do you think you are better prepared to floods compared to 5 years ago? Y/N

Please explain (how, why)

.....  
.....  
.....

F-11. What is your community still missing in order to be better prepared for floods?

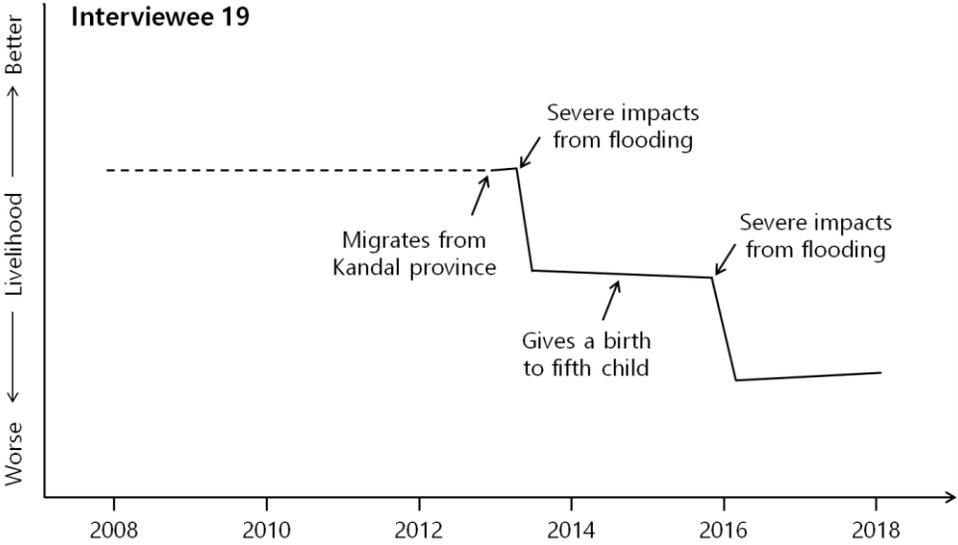
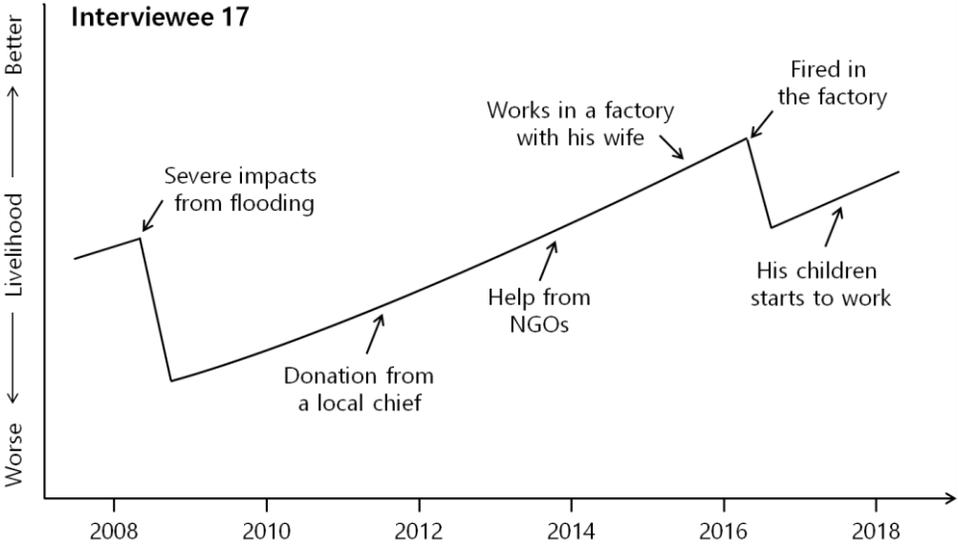
Please explain (why)

.....  
.....  
.....

## Appendix B: Interviewee Lists

Interviewee	Date	Village	Residence Period
1	30/05/2018	Phsar Toch	19 years
2	30/05/2018	Phsar Toch	40 years
3	30/05/2018	Phsar Toch	36 years
4	31/05/2018	Mitpheap	35 years
5	31/05/2018	Mitpheap	35 years
6	01/06/2018	Phum Kor	35 years
7	01/06/2018	Phum Kor	25 years
8	01/06/2018	Phum Kor	37 years
9	03/06/2018	Phum Prek	40 years
10	03/06/2018	Phum Prek	31 years
11	04/06/2018	Prek Takong	16 years
12	04/06/2018	Prek Takong	37 years
13	04/06/2018	Prek Takong	27 years
14	05/06/2018	Toul Roka	11 years
15	05/06/2018	Toul Roka	40 years
16	05/06/2018	Toul Roka	37 years
17	06/06/2018	Deum Chan	More than 20 years
18	06/06/2018	Deum Chan	40 years
19	07/06/2018	Deum Chan	6 years
20	07/06/2018	Deum Chan	26 years
21	07/06/2018	Deum Chan	19 years
22	08/06/2018	Prek Tapov	28 years
23	08/06/2018	Prek Tapov	29 years
24	10/06/2018	Cham Reunphal	N/A
25	10/06/2018	Cham Reunphal	11 years
26	10/06/2018	Cham Reunphal	35 years

# Appendix C: Examples of Livelihood Change Trajectories



## Abstract in Korean

기후변화가 전세계적으로 주목 받음에 따라, 적응(adaptation)에 대한 학제 간 연구가 활발히 진행되고 있다. 여러 발전학 연구들은 적응이 지속 가능한 발전을 위한 통로가 될 수 있다고 주장하며, 이러한 주장은 ‘적응에 의한 발전’이라 칭할 수 있다. 하지만 ‘적응에 의한 발전’ 이론은 미시적인 가구 스케일에서 연구된 바가 적다. 본 연구는 가구들의 단기적인 대처(coping), 장기적인 적응 및 발전의 관계를 탐구함으로써 이러한 한계를 극복할 수 있다고 주장한다. 그러므로 본 석사학위논문은 캄보디아의 수도인 프놈펜의 강가 슬럼의 가구들과 홍수들을 사례로, 가구 차원에서의 ‘적응에 의한 발전’을 밝히는 것을 목표로 한다.

연구 목표를 달성하기 위하여 논문은 두 가지 연구 질문을 채택한다. 첫째, 프놈펜의 강가 슬럼 가구들은 어떻게 슬럼 취약성에 대처하는가? 둘째, 가구들의 단기적인 대처는 장기적인 적응과 발전과 어떤 관계를 가지는가? 본 논문은 ‘누적적 적응에 의한 발전’이라는 개념을 제시함으로써 앞선 연구 질문에 답하고 있다. 논문은 양적, 질적 방법을 채택했으며, 연구 결과는 9곳의 프놈펜 강가 슬럼 공동체에서 진행된 119개의 설문과 26개의 인터뷰를 바탕으로 한다.

본문 4장은 슬럼에서의 홍수 취약성과 대처 방안들을 분석함으로써 첫 번째 연구 질문에 답하고 있다. 4장에서의 핵심 개념은 노출(exposure), 민감도(sensitivity), 그리고 적응능력(adaptive capacity)이다. 설문 결과, 슬럼 가구들은 식량난, 질병, 상해, 교육 중단, 소득 감소, 가용소득 부족, 주택 파괴, 재산 분실, 인프라 파괴, 사회 자본 손상 등 다양한 문제에 노출되고 민감하게 반응한다는 것이 나타났다. 또한, 슬럼 가구들은 이러한 문제들마다 제한된 자원을 사용하여 다르게 대처하고 있는 것으로 나타났다. 카이제곱 독립성 검정은 슬럼 가구들의 생계 변화와 특정한 대체 방안들 사이에 유의미한 관계가 있음을 보여주었다. 이는 성공적인 대처가 적극적인 대처, 혁신적인 대처(transformation), 그리고 친척, 지역 사회 및 정부의 원조에서 비롯됨을 암시한다.

4장의 결과를 바탕으로, 5장은 누적적 적응이라는 개념을 제시하고 ‘적응에 의한 발전’을 가구 차원에서 분석하였다. 국가 스케일에서의 계획적인 발전과는 달리, 가구들은 비계획적이고 예상치 못한 발전

문제들을 일상에서 직면해야 한다. 이러한 측면에서, 성공적인 대처는 노출과 민감도를 줄이고 적응능력을 높여 취약성을 줄이는 것에 중요하다. 하지만 이러한 성공적인 대처가 장기적인 적응으로 이어지기 위해서는 일회성으로 행해져서는 안되고 누적적으로 실천되어야 한다. 즉, 가계 차원에서 ‘적응에 의한 발전’은 성공적인 대처의 누적적인 결과로 해석될 수 있다.

‘누적적 적응에 의한 발전’ 개념은 왜 지금까지 슬럼 가구들이 적응에 실패하였는지를 두 가지 이유로 설명 가능케 한다. 첫째, 슬럼 주민들은 비활동적, 경로의존적인 대처와 사회 원조의 부족으로 인해 계속적으로 효과적인 대처에 실패했으며, 이는 누적적인 부적응 (maladaptation)의 결과를 낳았다. 둘째, 슬럼 주민들의 성공적인 대처는 단발적이었으며 오래 지속되지 못했다. 이는 정부와 NGO들의 일회성의 원조와, 지속 가능하지 못한 대처 방안 등에서 잘 나타난다.

논문은 누적적 적응에 성공한 사례들 또한 제시한다. 연구 결과는 위 사례들에서 슬럼 공동체의 집합 행위(collective action)가 큰 역할을 하였다고 세 가지 측면에서 주장한다. 첫째, 정부와 NGO들의 원조와는 달리, 집합 행위는 지속적으로 상황에 맞는 지원을 제공할 수 있었다. 둘째, 효과적인 집합 행위는 지속 가능하지 못한 대처를 감시·조정할 수 있었다. 셋째, 혁신적인 대처와 적응 방안은 공동체의 집합 행위를 통해 전파되고 이행되는 경향이 있었다.

본 논문은 최근 적응과 발전학 논의에 다음과 같은 측면에서 기여한다. 첫째, 본 연구는 오랫동안 주목 받지 못한 누적적 적응 개념의 필요성을 재발견한다. 둘째, 연구 결과는 왜 지역사회에서 적응에 실패하는지 새로운 관점을 제시한다. 셋째, 논문은 캄보디아와 다른 개발도상국 내 도시 슬럼의 지역 발전에 관련하여 정책적 시사점을 제공한다.

**핵심어** : 기후변화, 적응에 의한 발전, 누적적 적응, 대처, 강가 슬럼, 집합 행위, 프놈펜

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