



# Assessing Accommodation Suppliers' Perceptions of Climate Change Adaptation Actions on Koh Phi Phi Island, Thailand

Janto S. Hess<sup>1\*</sup>, Rachel Dodds<sup>2</sup> & Ilan Kelman<sup>1,3,4</sup>

<sup>1</sup> Institute for Risk and Disaster Reduction (IRDR), University College London (UCL)

<sup>2</sup> Ted Rogers School of Hospitality and Tourism Management, Ryerson University

<sup>3</sup> Institute for Global Health (IGH), University College London (UCL)

<sup>4</sup> University of Agder, Norway

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**Keywords:**

Tourism,  
Climate Change,  
Islands,  
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**Abstract.**

Koh Phi Phi Don is among the most visited island tourism destinations in Thailand. Due to the island's topography and development patterns, most accommodation suppliers on the island are likely to be exposed to a range of climate change impacts, particularly sea-level rise, which can pose a severe risk to the local tourism operations. This study aimed to explore perceptions of climate change adaptation actions in response to impacts typically associated with climate change. This study, furthermore, investigated possible obstacles, barriers, and incentives influencing decision-making processes of accommodation owner-managers (the private sector) to adapt to climate change. The investigation builds on 81 surveys and 12 in-depth interviews. The findings provide evidence that most of the sampled businesses already implemented (consciously or not) climate change adaptation measures, such as insurance coverage, water treatment appliances, and staff training on emergency responses. Through a concentration of power on the island, their action is hindered, which creates a barrier to a sustainable and climate risk-informed development pathway.

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**Kata Kunci:**

Parwisata,  
Perubahan iklim,  
Adaptasi Pulau,  
Koh Phi Phi

**Abstrak.**

Koh Phi Phi Don adalah salah satu tujuan wisata pulau yang paling banyak dikunjungi di Thailand. Karena topografi pulau dan pola pembangunan, sebagian besar pemasok akomodasi di pulau tersebut kemungkinan besar akan terkena berbagai dampak perubahan iklim, terutama kenaikan permukaan laut, yang dapat menimbulkan risiko yang parah bagi operasi pariwisata setempat. Studi ini bertujuan untuk mengeksplorasi persepsi tindakan adaptasi perubahan iklim dalam menanggapi dampak yang biasanya terkait dengan perubahan iklim. Lebih lanjut, studi ini menyelidiki kemungkinan hambatan, hambatan, dan insentif yang mempengaruhi proses pengambilan keputusan pengelola-pemilik akomodasi (sektor swasta) untuk beradaptasi dengan perubahan iklim. Investigasi ini didasarkan pada 81 survei dan 12 wawancara mendalam. Temuan ini memberikan bukti bahwa sebagian besar bisnis sampel telah menerapkan (secara sadar atau tidak) langkah-langkah adaptasi perubahan iklim, seperti perlindungan asuransi, peralatan pengolahan air, dan pelatihan staf tentang tanggap darurat. Melalui pemusatan kekuatan di pulau itu, tindakan mereka terhalang, yang menciptakan penghalang bagi jalur pembangunan berkelanjutan dan berbasis risiko iklim.

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\* Corresponding author.

E-mail addresses: janto.s.hess@gmail.com (Janto S. Hess).

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## 1. Introduction

This research aimed to examine accommodation suppliers' perceptions of climate change adaptation actions in an island destination in response to impacts typically associated with climate change. This study, furthermore, investigated possible obstacles, barriers, and incentives influencing decision-making processes of accommodation owner-managers (the private sector) to adapt to climate change.

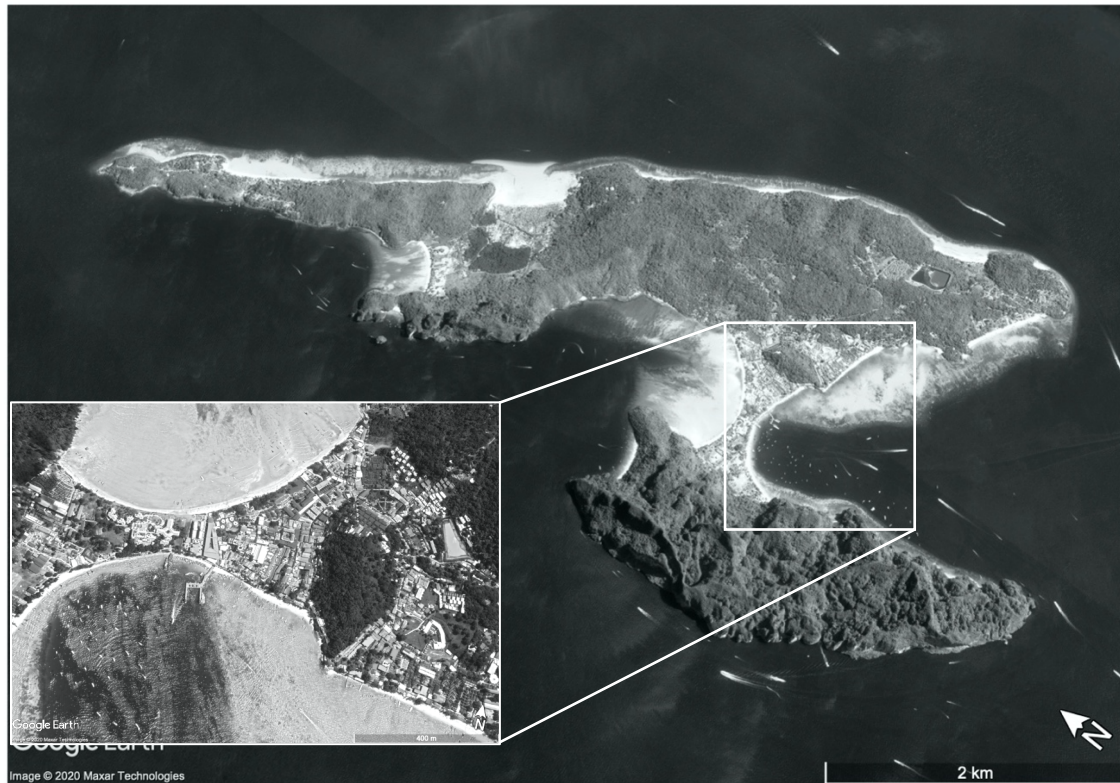
The investigation was conducted on Koh Phi Phi Don, a renowned tourism destination on Thailand's Andaman Sea coast. The coastal region of Thailand is projected to be affected by climate change impacts, such as sea-level rise, which could negatively affect the island's extensive tourism industry (Ritphring et al., 2018). Its natural beauty is shaped by its particular topography as the island is split into two parts that are connected by a narrow low-lying sandy strip. Due to the unfavourable conditions to build on the island's mountainous hills, nearly the entire tourism infrastructure is located on the sandy strip. This dense development in a low-lying area leads to the high exposure of the infrastructure to climate change impacts, such as the sea-level rise and storm surges.

There are no localised climate change impact studies for Koh Phi Phi. Related literature covering Thailand shows that the average annual temperature between 1955 and 2009 increased by 0.95 C, which is significantly above the global average of an increase of 0.69 C (TRF, 2011). The observed level of sea-level rise in Thailand, between 1985 and 2009 was on average 5 mm per year (Sojisuporn et al., 2013). The projected climate change trends show that Thailand is likely to face severe climate-induced risks in the future. The mean annual temperature is projected to rise between 1.7 to 3.4°C by late-century (compared with 1986-2005) and that total precipitation will increase (World Bank, 2019). Ritphring et al. (2018) found that sea levels along Thailand's coastline are projected to rise between 0.46 m and 0.61 m by the late century (relative to 1986-2005). The same study predicted that the overall national beach loss rates will be between 55.0 percent and 71.8 percent for 2081-2100 (ibid.). It can be assumed that these changes will bring challenges to businesses located on Koh Phi Phi. The negative projection for coastal beaches implies that there will be an increased risk for most coastal infrastructures, particularly those located on low-lying sandy areas.

Given this background, Koh Phi Phi is a useful case study site to examine how locally bound tourism actors, such as accommodation suppliers, already adapt to impacts commonly associated with climate change and investigate their perceptions towards it. This can provide the research community and decision-makers with relevant information on the potential to engage the accommodation sector in the adaptation.

## 2. Literature Review

Koh Phi Phi Don has a total area of 12.25 km<sup>2</sup> and is located 24.8 km away from mainland Thailand. Its topography is particular as the island is split into two parts that are connected by a narrow low-lying sandy strip (see Figure 1). The island is dominated by high limestone hills with the highest point of around 192m. The partly steep hills are covered by tropical forests. This topography led to the dense development of nearly the entire infrastructure (village, accommodations, restaurants, etc.) of the island on the sandy strip that connects the two hilly limestone islands, giving access to the beaches of Ton Sai Bay and Loh Dalum Bay. Koh Phi Phi Don is the only island of the Phi Phi group of islands with some private property rights and that is not officially administered by the Department of National Park, Wildlife and Plant Conservation (DNP) of Thailand. In 2013, Koh Phi Phi Don had a population of 2,500 people, but it can be assumed that the actual population figure is higher when considering seasonal workers (Dodds et al., 2010).



**Figure 1.** Koh Phi Phi Don map and picture of main tourism infrastructure

*Source:* (Google Earth, 2020).

Initially, tourism started to establish itself in Koh Phi Phi around the 1980s, initially with simple beach bungalows that allowed daring adventurers to stay on the island. The sector gradually developed in the following decades. After the release of the movie ‘The Beach’ (in the year 2000), the group of Phi Phi islands received international recognition as an ‘island paradise’ and visitor numbers increased drastically (up to 1.2 million visitors per year in subsequent years (Taylor, 2018; Dodds, 2010)). In 2004, Koh Phi Phi Don was badly impacted by a Tsunami damaging nearly the entire tourism infrastructure located on the sand strip connecting the two islands. The waves of the tsunami approaching Koh Phi Phi were up to 6 metres above normal sea level, leading to the destruction of or severe damage to all houses situated below 5 metres of altitude (Gilli, 2010). Local houses made of light materials were swept away and even concrete houses suffered severe impacts (Gilli, 2010). The event led to a loss of around 70% of all previously available guest rooms on the island (Calgario et al., 2009). After a period of rapid reconstruction, tourist numbers recovered within a few years (Calgario, 2010). When this study was conducted, approximately 120 accommodation suppliers offered tourists lodging on Koh Phi Phi Don. Tourism generated an estimated US\$ 113 million per annum in revenue around 2005, which now potentially has multiplied considering that accommodation businesses more than doubled since (Department of Public Works and Town and Country Planning, 2005). An estimated 10,000 guests visit the Phi Phi Islands per day during the high season, which includes day tourists from Phuket and other nearby destinations (GoKohPhiPhi, 2007).

The largely unregulated tourism development on the island led to many environmental and development issues, including coral reef and beach degradation, freshwater scarcity, and expensive electricity (Dodds, 2010). After the tsunami, a range of people highlighted the opportunity this event created to redevelop Koh Phi Phi Don’s tourism infrastructure in a sustainable and resilient manner (Dodds, 2010). However, eight years after the event it was concluded that the “tsunami did not cause

any significant reassessment of the tourism development trajectory” (Taylor, 2012). For example, newly imposed regulations that buildings needed to be at least 30m distance from the high tide line were not strictly implemented and “over 40 additional bungalows had been built under the 30-metre limit” (Dodds, 2010, p. 257). In the aftermath of the tsunami, the island received extensive assistance from non-governmental organisations and the international donor community for reconstruction, education, and environmental rehabilitation (Calgaro et al., 2009). International donor funding allowed the construction of a new sewage water treatment plant at the main sandy Tongsai beach. With steadily increasing visitor numbers and tourism businesses on the island, it became apparent, though, that the capacity of the treatment plant itself had been exceeded, as indicated by a water specialist who stated that the “wastewater is being generated far beyond the system’s capacity” (The Thaiger, 2018). It was estimated that, in 2016, around 83% of Koh Phi Phi’s wastewater was released untreated into the ocean (Gazette, 2016). A study investigating the freshwater availability on the island, undertaken by a research team from Kasetsart University, concluded that there is a severe shortage of clean fresh water on the island (ibid.). This shows that the massive expansion of tourism increased the pressure on environmental ecosystems and the island’s resources. The negative impacts from a high volume of visitors also led to the media-effective closure of Maya Bay on Koh Phi Phi Lee (Coldwell, 2018). The small, roughly 200 metres long, beach attracted around 5,000 tourists per day which led to massive overcrowding (Hess, 2019). After an initial closure of three months, Thailand’s government announced in October 2018 that the Bay continues to be prohibited to tourists until the ecosystem ‘fully recovers to a normal situation’ (Ellis-Petersen, 2018). Considering this enforced closure, it can be assumed that the maximum carrying capacity of the natural systems of visitors has been reached. The increased pressure on environmental systems and the island’s key resources to tourism, particularly freshwater, will likely reduce the resilience of the island’s tourism sectors to climate change impacts.

### 2.1 *Climate change and Koh Phi Phi*

To date, existing academic literature has emphasised assessments of vulnerability factors, mostly in regard to tsunami hazards, with limited discussions on climate change impact (Taylor, 2019; Steckley and Doberstein, 2010; Calgaro, 2010; Calgaro et al., 2009), on sustainable tourism (Dodds, 2013; Taylor, 2012; Dodds, 2010; Dodds et al., 2010), and the recovery of the island after the tsunami event of 2004 (Leopold, 2008). Thus, the literature from other island destinations investigating tourism stakeholders’ perceptions of impacts commonly associated with climate change can be of relevance for this study. An investigation from Sardinia, for example, found that the “respondents perceive climate change to be a real and actual problem capable of undermining the tourism sector and its sustainability” (Del Chiappa et al., 2018, p. 7). Another study from Barbados found that entrepreneurs considered it very likely that climate change will lead to beach changes, damage to coastal tourism facilities, and adverse effects on marine ecosystems (Belle and Bramwell, 2005). An absence of an adequate policy framework to address and a low level of awareness about climate change were identified in Malta and Mallorca (Dodds and Kelman, 2008). In the Maldives, Shakeela and Becken (2015, p. 65) concluded that “local tourism stakeholders are not immediately concerned, and adaptation measures are woefully inadequate to cope with future climate risks”. The range of investigations showed that the location and awareness of actors shape the sense of urgency to undertake action.

On Koh Phi Phi Don, five dominant landowner families appear to share the majority of wealth and power (around 80% of the land is owned by these families) (Calgaro et al., 2009). Their influence on the island’s development, and recovery after the tsunami, was highlighted both critically (Dodds, 2010) as well as positively (Calgaro et al., 2009). Calgaro et al. (2009) state that the strong ties of the families into the business networks “have created a robust support system that guides island development, promotes business expansion and improves standards of infrastructure” (Calgaro et

al., 2009, p. vii). Calgaro et al. (2009) also acknowledge, though, the risks associated with centralisation of power within a small group on the island, which can lead to exclusion of 'outsiders' or be counterproductive to innovations or resilience development if the proposed changes do not align with the interests of the business elites and their network. These discoveries are reflected by the findings of Dodds (2010, p. 258), who found that the most common barriers in regard to sustainable tourism development were: (i) lack of education; (ii) economic priority (short-term economic focus wins over long-term social and environmental concerns); (iii) lack of planning and private sector power; and (iv) lack of stakeholder involvement. These insights are very relevant for this research as they indicate that the level of risk awareness on Koh Phi Phi appeared to have been very low in 2009/2010, even after the traumatic experiences of the tsunami, that the government's capacity on the island is low, and that smaller enterprises have very little decision-making power.

### 3. Methods

Of the two Phi Phi islands, only Koh Phi Phi Don is inhabited and developed to accommodate a large number of tourists. While the totality of the islands forms the attraction of the destination, this study mainly focuses on Koh Phi Phi Don (subsequently referred to as 'Koh Phi Phi') as it is the only island with accommodation suppliers. The research followed a mixed-methods approach, using survey and in-depth interviews to collect data from a sample of accommodation owner-managers to understand their role in the businesses' decision-making processes.

There was a total of 120 accommodation businesses on Koh Phi Phi during the time the data collection took place, respectively. The quantitative data collection on the island was undertaken during the touristic off-season between June and July 2018. The targeted sample size for the survey was based on being able to detect meaning in the data set (Howell, 2013), which allows an estimate of the characteristics of the total population (inferential analysis). A total of 81 valid surveys were conducted with accommodation owner-managers on Koh Phi Phi. Every accommodation business on the island was visited, using boats where needed, and asked whether the owner-manager was available and willing to participate in completing the questionnaire. At those accommodations where the owner-managers were not present, the researcher requested an audience for the subsequent days or left the questionnaire at the premises.

For the quantitative survey of this study, the self-completion questionnaire was chosen as a suitable method to collect the data. The questionnaire comprised of 20 questions, including 12 close-ended questions in order to gain quantifiable information. In addition, three open-ended (e.g. distance in metre to the shoreline) and five five-point Likert scale questions were included in the survey. However, mostly solely closed questions were used in order to ease the flow of the questionnaire and allow a standardised analysis. The standardised analysis based on descriptive statistics, using frequencies and the non-parametric test Kendall's tau, which proved to be more accurate than Spearman's Rho to determine correlations, particularly for smaller data sets (Howell, 2013, 1997). Both Thai and English versions of the questionnaire were available and given answers back-translated.

To complement the survey findings and allow a deeper understanding of perceptions of sampled accommodation suppliers, 12 in-depth interviews with accommodation owner-managers were conducted in parallel to and after the survey was undertaken. The majority of the interviews were recorded and transcribed and lasted between eight and 60 minutes – depending on the availability of the respondents. Some interviews, however, were only documented through note-taking due to a refusal of the respondent to be audiotaped. The majority of the interviews were conducted in English, while an interpreter was also present in case respondents preferred speaking Thai or had difficulties understanding/expressing specific aspects. The guiding questions and themes for the in-depth interviews were mainly based on open questions and themes, as they "allow a free-response so that people answer using their own words" (Long, 2007, p. 59).

During the mixed method data analysis, the findings from the survey and in-depth interview were consolidated. Wherever possible, and adequate, the consolidation of findings from both methods was prioritized, without undermining, or neglecting, the discoveries through one method. Some results, however, might be dominated by findings from the survey results, while others might be dominated by insights gained through the in-depth interviews.

### 3.1 *Characteristics of respondents*

Of the conducted survey responses, the majority of the respondents were Thai (96.3%) and obtained a higher level of education, with a bachelor's degree upwards (62.0%). Furthermore, more than half (50.6%) of the sampled businesses were very small and had only one to ten employees. The sample, however, also included four very large businesses with more than 200 employees. The majority of the businesses (65.2%) have operated for more than five years in the same location. Of these, 25.1% operated for more than fifteen years in the same location and, thus, were probably present when the tsunami affected the island in 2004. A high number of businesses are located within close proximity of the shoreline, with 17.9% being only up to ten metres away, 44.9% being within 50 metres distance of the shoreline. This reflects the demand pattern of many tourists to reside close to the coastline during their holidays, as well as the development trajectory of Koh Phi Phi. Of the 12 in-depth interviewees, the majority were male (seven vs. five) and Thai nationals (ten vs. two). During the data analysis each respondent received a continuous abbreviation (P1, P2, P3, etc.), which is used in this study.

## 4. Findings

### 4.1 *Observed climate change impacts and adaptation action of accommodation suppliers*

The findings from Koh Phi Phi show that the majority of the businesses on Koh Phi Phi were negatively affected by impacts commonly associated with climate change. The respondents of the survey as well as in the in-depth interviews were questioned about their previous experiences with hazards commonly associated with climate change and about their perceptions about the phenomenon of climate change. The survey respondents indicated that they were most severely impacted by storm and wind damages, with 30.0% ranking it as a 'Strong impact' and 55% of 'Some impact' (see Table 1). This was followed by the impact of reduction of the island's natural beauty (84.8% of consolidated negative impacts), loss of biodiversity (71.3% of consolidated negative impacts), freshwater shortage (62.6% of consolidated negative impacts), and coral bleaching (57.5% of consolidated negative impacts). Utilising a correlation analysis, based on Kendall's tau-b, the data reveals that there is a significant correlation (at a significance level at 0.001, 2-tailed) between the variables of 'reduction of natural beauty and 'loss of biodiversity (correlation coefficient of .712), and 'storms and strong winds and 'changing weather seasons' (correlation coefficient of .477). Both these correlations appear to be logical as many observed impacts can influence the severity of another impact, e.g. changing weather seasons can lead to more storms.

A range of interview respondents indicated that there were alterations of weather seasons in recent years (P1, P3, P6, P8, P12). Some respondents stated that they observed changes towards a longer dry season and a reduced number of rainy days during the rainy season (P3, P7). P8 describes the weather as "all over the place" with "the wind [being] really strong" and "when it's hot, it's [being] really hot" (P8). Two other interviewees, however, describe that they have not observed an overall change with a pattern shift in seasons, but the only variability in the weather seasons (P2, P5). P5, however, only resides for two years on Koh Phi Phi and was prior only infrequently on the island/in Thailand for 8-9 years, and P2 has lived on Koh Phi Phi only for six years. Thus, both respondents potentially have a limited time frame of reference, when compared to respondents like P1, who was born on the island, and P6, who has been living on the island for 15 years.

**Table 1.** Observed negative impacts on accommodation businesses on Koh Phi Phi (N=80) during the last 3 years (N=81)

	Strong impact		Some impact		No impact		Do not know	
	#	%	#	%	#	%	#	%
Coastal erosion (e. g. beach washed away)	3	3.8	28	35.0	29	36.3	20	25.0
Storm or winds damaged enterprise/premises	24	30.0	44	55.0	6	7.4	6	7.4
Long period of hot temperatures	7	8.8	25	31.3	41	51.2	7	8.8
Coral bleaching	16	20.0	30	37.5	23	28.7	11	13.8
Freshwater shortage	19	23.8	31	38.8	22	27.5	8	10.0
Flood (extreme rain events)	11	13.8	27	33.8	37	46.3	5	6.3
Reduction of natural beauty (attraction of island)	24	30.4	43	54.4	7	8.9	5	6.3
Loss of biodiversity	17	21.3	40	50.0	16	20.0	7	8.8
Changing weather seasons (e.g. hot/rainy season)	15	18.8	47	58.8	11	13.8	7	8.8
Sea level rise	6	7.5	21	26.3	36	45.0	17	21.3

P1, further, described more erratic rainfall events, with a reduced number of rainy days during the rainy season, which in some years led to “the private company... experiencing [a] shortage of water”. Another respondent reconfirms this by stating “the amount of water from the rain, it’s getting lesser and lesser. The rainy season started later than before...” (P3). Some hotels already imported freshwater from the mainland (P1, P3), which leads to higher operational costs. Other interviewees did not face strong negative impacts from water shortage as they operate their own wells, even though one admitted that “the water [is] a little bit salt[y]” during the end of the dry season (P9). Another observed impact is the increase of stronger wind events. A range of interviewees (P5) described wind damages at their businesses with trees falling under heavy gusts (P1), roofs flying away (P2, P4, P6), or chairs, tables, and doors breaking (P7).

In regard to coastal erosion, one interviewee said that he observed variability of the width of beaches (P11). Two other respondents have observed that the beach is “getting less” (P2) and a beach loss of 16m during the last ten years (P10). The latter has a business that is located on the outer beach (on the other side of the island than the main village). Due to the extensive beach loss, he considers relocating his resort further inland as he owns 70 hectares of land around his business (P10).

A range of interviewees made a reference to the 2004 tsunami during the interview (P1, P3, P5, P7-P9). One respondent (P1) recounted how years before the tsunami a false alarm was caused by a professor, leading people to be more unresponsive during the actual tsunami. The interviewee, further, described how during the reconstruction phase people did not consider future risks but planned their businesses in the same location and used the same materials that led to the tremendous damage. As the respondent summed up: “they supposed to learn but they never learn” (P1). Considerations about risks related to tsunamis played a role for one business owner-manager (P3) to obtain insurance coverage, whereas another one also considers getting insurance partly linked to memories of the tsunami (P8). The hotel of P8 survived the tsunami and was used as a temporary hospital in the aftermath of the event.

The respondents were asked to agree or disagree with statements related to the future of their business. Of the sampled accommodation owner-managers, 24.0% ‘Strongly Agree’ and 42.7% ‘Agree’ with the statement that climate change is a long-term (more than five years) threat to their



business. When asked how they perceive the threat to their business over the next five years, more than 50% indicated that they think climate change poses a threat to their business, with 14.7% indicating that they 'Strongly Agree' and 44.0% that they 'Agree' with the statement. This goes in line with the indication by a range of interviewees that there is high awareness among the accommodation owner-managers about climate change issues (e.g. P1-P6). It appears, though, that the risk is not immediate enough, as despite a perceived high awareness only two respondents consider climate change a big risk factor (P1, P7) to their businesses. Other respondents stated that they consider increasing pressure from the government (P2, P6), no tourists (P9), and environmental degradation (P4) as posing the biggest risk to their operations. P4 relates potential inactivity to address climate change issues to the greed of the people (P4). The existing knowledge about the phenomenon of climate change among accommodation suppliers' stems from news coverage of the topic (P3, P5, P6), as well as through government educational programs from the local disaster centre (which was established after the tsunami) (P1, P6).

The investigation, further, assessed in which way the accommodation owner-managers already implemented (knowingly or not) or consider implementing adaptation action and what their motivational factors to invest into such measures were. Most of the sampled businesses already invest (consciously or not) in climate change adaptation measures. Prominent adaptation measure implemented (presented in Table 2) are planting trees for shading (63.0%), insurance coverage (53.1%), water treatment appliances (46.9%), and staff training on emergency responses (39.5%). There are significant negative correlations (all based on Kendall's tau-b, excluding the 'do not know' answer category for calculations, 2-tailed) between the observed negative impacts of coastal erosion and investments in shoreline protection measures (correlation coefficient of 0.359,  $p < 0.01$ ), observed negative impacts from sea level rise and investments in coral rehabilitation (correlation coefficient of 0.229,  $p < 0.05$ ), and observed negative impacts from the storm and strong winds and investments in storm-proof building design (correlation coefficient of 0.237,  $p < 0.05$ ).

**Table 2.** Implemented actions to reduce the risk of being impacted by natural hazards (N=81)

	Frequency	Percentage of total
Insurance coverage	43	53.1
Flood proof-building design	12	14.8
Shoreline protection (e.g. sea wall, sandbags)	15	18.5
Storm-proof building design	19	23.5
Planting trees for shading	51	63.0
Desalination plant/facility	6	7.4
Rainwater collection	31	38.3
Water-treatment applications	38	46.9
Staff training on emergency responses	32	39.5
Use of water-saving appliances	16	19.8
Coral rehabilitation	8	9.9
Planting mangroves	4	4.9
Relocated to higher grounds/inland	4	4.9

The water supply and wastewater management appeared to be an important topic for in-depth interview respondents. On the freshwater supply side, it seems that most respondents did receive their fresh water from the local freshwater supplier (P5, P6), operate their own well (P1, P9), or do both (P2, P3). P1 described how her family operates ten different deep wells on their mountain properties and how they treat the water before usage. This is a practice which not all well owners pursue, which often leads to a salty taste of or unclear groundwater during the dry season in some



businesses (P1, P2, P9). The local water company operates another larger rainwater catchment and reservoir in the mountain, but despite the two rainwater catchments, the company has to import freshwater from Phuket to cover local demand during long dry periods (P1, P7). Regarding wastewater treatment, there is one large wastewater treatment facility on the island, which was constructed through Danish donations after the tsunami in 2004. One interviewee stated that they have septic tanks (P1), another respondent that they have one in combination with a wastewater treatment technology (P10). Two of the interview respondents, however, accused other accommodation owner-managers to release their businesses' unfiltered wastewater into the ocean (P1, P4).

In addition to the adaptation actions displayed in Table 2, the respondents were asked if they implemented other measures during the previous five years. Of these measures, googling information about climate change impacts was, with 29.4 percent of the respondents having done it, the most prominent one. This was followed by participation in (an) educational event/s on climate change (28.4 percent) and the organization of staff training on climate change impacts (21 percent). A range of interviewees stated that the local disaster center (which was established after the tsunami) frequently organizes training or informational events on disaster risk reduction (touching on climate change adaptation issues), wastewater management, and reduction of plastic waste (P1, P3, P6). P10 and P11, both located on the outer side of the island, also organized training on coral reef protection.

The respondents were also asked in the survey what kind of adaptation actions they consider investing in during the next five years. The most considered measures included a water treatment plant (44.4 percent), a rainwater harvesting system (37.0 percent), diversifying offered touristic services (both 25.9 percent), coral rehabilitation actions (23.5 percent), as well as insurance coverage (19.8 percent). The latter is interesting as 53.1 percent of the respondents indicated that they have insurance coverage (see Table 2), meaning that if all the respondents that indicated an interest in an insurance cover obtained it, there would be a total coverage of 72.9 percent of the sampled businesses on Koh Phi Phi.

#### *4.2 Obstacles, barriers, and incentives influencing accommodation owner-managers adaptation action*

To explore their motivation towards climate change adaptation measures, the respondents were asked for the reasons why they did not implement some of the actions that are listed in Table 2. Their most prominent reason for not taking action being that adaptation actions are considered expensive (29.6%), followed by a lack of information about expected climate change impacts on the island (28.4%), and a lack of know-how to implement the actions (22.2%). The aspect of higher cost for adaptation actions is reconfirmed by P1, who stated that "everything is really expensive on the island because it has to come this far". In another question, the survey respondents were asked for their motivation to invest in adaptation actions. The most frequently given reasons given were to increase their businesses' security against natural hazards (53.1%), to increase the attraction of the business for tourists (49.4%), to reduce investment risks (33.3%), and to secure long-term (more than 5 years) profitability (21.4%).

In regard to potential barriers for adaptation, the land right situation appears to be a major factor for some businesses influencing their investment decisions. Two accommodation owner-managers claim, for example, that the zoning plan on the island has been changed several times since after the tsunami (P4, P5) – "the zoning always changes, every year. keep changing" (P4). According to the latest version of the zoning plan, a range of accommodation businesses (such as the ones from P4, P5, and P12) are in the strict no-building zone even though their structures have been in the location for a long time (plus nine years for P4 and P5). Considering the continuous revision of the zoning plans of the island, some business owner-managers speculated off-the-record that a zoning plan is a tool used by the local government and powerful families on the island to shut down the operation of some of their business competitors, who (like P4 and P5) are located just outside of the area in which

constructions are allowed according to the latest zoning plan. However, P5 doesn't believe that they "want to remove everything outside the two areas. But it could be." P4 describes that the revision of the zoning plans has some consultation processes, whereas "who participates the meetings are the local government, not the small people. The normal people just say yes, to what the local government says."

The law enforcement and planning of development on the island appear to be weak. The local politicians are often related to the powerful families of the island, which hinders law enforcement (P1). P4 stated that "some people here say its Phi Phi country, not Thailand". Consequently, three interviewees (P1, P7, P11) doubt that there will be much support from the local government to address climate change issues: "They just talk. They always just talk" (P7)."

The survey included a question on what the accommodation owner-managers perceive as support for them to invest in risk reduction/climate change adaptation actions (see Table 7). It is apparent that the majority of the respondents perceived all of the listed potential support options as either very or somewhat helpful. The most prominent was the availability of information on localised climate change impacts (50.6% for Very helpful and 39.0% for somewhat helpful), followed by educational training on climate change for their business (88.4% consolidated findings), and strict enforcement of government regulations for all businesses on the island (81.9% consolidated findings). The data also indicate that businesses that operate not so long in that location favour strict enforcement of government regulations for all businesses on the island (Kendall's tau-b correlation coefficient of -0.206,  $p < .05$ ).

## 5. Discussion

While the majority of the sampled accommodation owner-managers were affected by impacts commonly associated with climate change and have some general knowledge about the phenomenon of climate change, it is not perceived to be a(n) big/immediate risk factor to their business. The perception about the interplay between global risks (climate change mainly being portrait as a global risk) and local variability was described in a study by Hopkins (2015, p. 961), whose findings "suggest that while the general public does not engage with the broader concept of (global) climate change, they are reacting to locally experienced changes to the climate, and often not relating this back to a larger global risk". Hopkins's (ibid.) research, consequently, identified "the importance of including non-quantifiable as well as non-climatic risks when considering the impact of climate change on a local or regional scale." In this manner, the underlying development factors are understood to shape the vulnerability of the accommodation businesses and, thus, determine the level of risk posed to them through climate change (whether perceived or actual). The results show that the predominantly observed negative impacts, which are commonly associated with climate change, included storm and wind damages, freshwater shortage, and coral bleaching. It can be argued that development patterns are likely one driver of all of these listed impacts, in particular the destruction of natural beauty and loss of biodiversity. Former studies paint a picture of the negative impacts of a largely unregulated and rapid development on Koh Phi Phi (Dodds, 2010; Gazette, 2016). The impact of unsustainable development patterns on Koh Phi Phi with improper wastewater management practices can also be identified to be the main driver of reduced freshwater availability. Consequently, it can be said that "development decisions creating and perpetuating vulnerability are the root causes of disasters [or negative impacts of climate change], not environmental phenomena which sometimes become hazardous" (Kelman et al., 2016, p. S131). This notion was supported by a range of scholars (e.g. Kelman, 2020; Blaikie et al., 1994; O'Keefe et al., 1976). The clear distinction, however, between the degree of causality of these impacts related to climate change exceeds the scope of this study.

Among the sampled accommodation owner-managers there is high awareness about the concept of climate change on the island. There might not be, however, an in-depth understanding of potential impacts. Furthermore, while there is knowledge about climate change, it might not be perceived as

immediate stress by most of the sampled businesses. It appears that the possible impacts of climate change are not very tangible to the participants. The existing lack of information on localised impact projections and access by accommodation owner-managers to capacity building on associated coping strategies creates a barrier to adaptation action.

There is a strong interconnectedness between the powerful native Thai families and the local government representatives on Koh Phi Phi. Previous literature confirmed that, on the island, there are five dominant families who share the majority of the wealth and power (Dodds, 2010; Calgaro et al., 2009). Calgaro et al. (2009, p. 39) argue that in the context of Koh Phi Phi the wider community is able to benefit from strong family networks as “the dominating families cooperate with each other, resulting in a stabilised environment; there is little tangible tension on the island”. The latter could not be reconfirmed during this research. During the in-depth interviews, a range of respondents criticised the concentration of power in the hands of the few. It can be concluded that investments in adaptation could potentially face some resistance on small islands if the dominant families are not in favour of the adaptation measures. The connectedness of the ruling elite and local government makes it difficult to determine how powerful the local government is to enforce regulations on the island, assuming that they intend to apply a strict enforcement.

The exclusion of stakeholders from decision-making processes about the development pathway, through the concentration of power in the hands of a few, can be a barrier to sustainable tourism development on Koh Phi Phi (Dodds, 2010). It can be argued that it also hinders climate change risk-informed planning. According to Johnson (2018, p. 5), “deciding on how to mitigate risks from disaster and climate change requires a collective understanding of the values that different people have and the current and future hazards in particular places.” Conversely, this means that in a setting with a strong concentration of power, like on Koh Phi Phi, the risk mitigation is highly dependent on the mindset (subjective risk perception) of the leading families. In the small island setting, these families are the actors with the highest resilience against impacts commonly associated with climate change, though established political support networks and financial resources, which potentially provides them with a sense of security and hinders their willingness to take immediate action.

## 6. Conclusion

The results from Koh Phi Phi reveal that most of the sampled accommodation suppliers were in some ways negatively affected by impacts that are associated with climate change and weather variability, including from storm and wind damages, and freshwater shortage. Despite these observed impacts and a seemingly high level of awareness about the phenomenon of climate change, it is not perceived to be a(n) big/immediate risk factor to their business. Climate change is not perceived to pose the biggest, and/or an immediate, threat to the operations of the sampled businesses.

Regardless, the findings provide evidence that most of the sampled businesses already implemented (consciously or not) climate change adaptation measures, such as insurance coverage, water treatment appliances, and staff training on emergency responses. Through a concentration of power on the island, their action is hindered, which creates a barrier to a sustainable and climate risk-informed development pathway. Moreover, a lack of access to information and participation in planning meetings can create a barrier and uninformed decision-making processes. Thus, it needs to be acknowledged that the adaptation action of individual stakeholders is dependent on the power system and regulatory framework in which they operate.

Future research could build upon these findings and widen the scope of the respondents to include other tourism businesses, public stakeholders, as well as other key tourism actors relevant to Koh Phi Phi's context to allow comparative analysis and in-depth investigation of different stakeholder perceptions of climate change adaptation as well as the dynamics among them.

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