Risk perceptions and responses in disaster-prone cities of the Global South

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Abstract

This research investigates how people's perceptions of disaster risk shape their responses in disaster-prone cities of the Global South. Within disaster studies, the effect of risk perceptions on people's responses remain unclear and has been labelled 'weak' within the disaster studies literature. This lack of clarity has contributed to the marginalisation of people at risk from contributing to interventions that address disaster risk. Therefore, a better understanding of how people perceive their risk and how this shapes their responses would help inform more effective and multi-scalar interventions to address disaster risk.

The research takes place in three adjacent neighbourhoods of Cochabamba city, Bolivia. Within this 'case site', the house is used as a methodological tool to investigate how people's risk perceptions shape their responses to disaster risk. In particular, the research explores how risk perceptions influence the way people design and construct self-build houses in order to reduce their risk of a disaster. The 'case site' experiences persistent, low-intensity natural hazards which are linked to disaster risk that incrementally increases over time. This marks a shift away from many studies that investigate rapid-onset, extreme hazards that quickly overwhelm people's capabilities. Additionally, the research is concerned with small-scale disasters, which again marks a shift away from the disaster studies literature which principally focuses on large-scale disasters that cause many casualties, large economic loss and affect a large geographical area.

This thesis shows that people with 'high' and 'low' risk perceptions equally design and construct their houses in order to reduce their disaster risk. This moves beyond research that has focused on understanding how people with 'high' or 'low' risk perceptions differently respond to disaster risk. Furthermore, this thesis argues that research which describes the relationship between risk perceptions and responses as 'weak' forecloses the nuances and complexity of human behaviour in disaster-prone contexts because it does not capture the subtle, yet important ways that people are integrating disaster risk reduction strategies into social, cultural and economic processes at the household level.

Declaration

I, Gemma Sou, hereby state that no portion of the work referred to in this dissertation has been submitted in support of an application for another degree or qualification of this or any other university or other institution of learning.

Copyright statement

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Dedication

To my Mum who always says "Just do your best."

To my Dad who has supported me throughout.

To Kellie and Karen because I told them I would.

List of abbreviations

AOP	Annual Operative Plan
COMIBOL	Bolivian Mining Corporation
DM	Disaster Management
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
ELFEC	Light and Electricity Company Cochabamba
GDP	Gross Domestic Product
IDM	Information Deficit Model
IFRC	International Federation of the Red Crescent Societies
INE	National Statistics Institute of Bolivia
IPCC	Intergovernmental Panel on Climate Change
KAB	Knowledge, Attitudes, Behaviour Model
LPP	Law of Popular Participation
NCRRDR	National Council of Risk Reduction and Disaster Response
NGO	Non-Governmental Organisation
PAR	Pressure and Release Model
RAP	Rational Actor Paradigm
SEMAPA	Municipal Service for Potable Water and Sewage Company
SISRADe	National System of Risk Reduction and Disaster Response
TBO	Territorial Base Organisation
UN	United Nations
UNISDR	United Nations International Strategy for Disaster Reduction
VC	Vigilance Committee

CHAPTER ONE: INTRODUCTION

1.1 Problem definition

According to the latest World Disaster Report (2014: 29), "Many disaster risk reduction organizations are divorced from the realities of life and the expectations of those at risk. People do not behave in the way that disaster managers and institutions want – or expect – them to behave." This disjuncture between the expected and actual behaviour of people at risk of disasters is the concern of this thesis. Specifically, it explores the relationship between people's perceptions of risk and their responses in disaster-prone cities of the Global South.

The relationship between risk perceptions and responses has often been labelled unclear and/or weak within the disaster studies literature (Haynes et al. 2008, Wachinger et al. 2013). There are many explanations for this, including that people do not understand disaster risk (DR) (Tobin and Montz 1997); they lack the resources to take action (Grothmann and Reusswig 2006) or because vulnerable people prioritise other 'everyday' risk such as income and security over less frequent disasters (Shepherd et al., 2013; DFID, 2005). Other research suggests that people may deny that they are at risk (Lewis, Kelman et al. 2011) or argue that people are too overwhelmed by fear to try and reduce their DR (Karanci, Aksit et al. 2005, Grothmann and Reusswig 2006, Siegrist and Gutscher 2006, Hall and Slothower 2009, Jóhannesdóttir and Gísladóttir 2010). As the relationship is still unclear, risk perceptions and the influence that they may have on people's responses have tended to be overlooked and undervalued in disaster research and policies. This has encouraged top-down disaster risk reduction (DRR) interventions that are imposed on those at risk, and discouraged the development of more holistic and multi-scalar DRR interventions, which incorporate the skills and knowledge of vulnerable groups (Wamsler 2014).

This research uses the house as a methodological tool to investigate the relationship between the risk perceptions and responses of people at risk. In particular, the research investigates how risk perceptions shape how people design and construct self-build houses in a disaster-prone context. Self-build does not necessarily mean that urban dwellers construct the entire building. Rather, what is most important is that people

decide where, how and when they want to build (Greene and Rojas 2008). The design and construction of the house is an appropriate way to explore this relationship for three principal reasons. First, many studies, across different disciplines and topics have documented the process of incremental self-build housing in cities of the Global South, and have shown that it is an important way that people acquire housing (e.g. Turner 1976, Gilbert and Ward 1985, Kellett 2005, Green 2008, Wakely and Riley 2011, Jabeen 2012, Mitlin and Satterthwaite 2013). Second, research indicates that people's DR levels are significantly shaped by the design and construction of the house (e.g. Bosher 2008, Lorch 2005). Thirdly, because vulnerable groups often use the design and construction of the house to reduce their DR (e.g. Mercer et al. 2009, Wamsler 2014).

This research explores frequent, less extreme, natural hazards that are linked to the slow-onset risk of small-scale disasters, which are also more frequent in occurrence. This is because disaster literature has often focused on less frequent extreme hazards that are linked to infrequent rapid-onset and large-scale disasters (Pelling 2010). Further, the research focuses on disasters that occur in a medium-size city, as disaster studies have been largely biased towards rural locales or large or mega cities. This is important, because previous research has suggested that medium-size cities are more likely to have weak institutional frameworks to address DR. Therefore the research provides potential to explore if and why this may be so (IFRC 2010).

Greater understanding of the relationship between risk perceptions and responses is important for developing multi-scalar DRR policies that incorporate the skills, knowledge and networks of vulnerable groups. This is particularly significant in the context of increasing disasters and DR in the Global South. The World Disasters Report (2014) reported that there were 6,525 disasters across the world between 2004 and 2013. This resulted in 1.1 million confirmed deaths and an estimated economic damage of US$1.7 billion (IFRC 2014). However, the losses stemming from a disaster go far beyond fatalities and direct economic loss. The cumulative and indirect effects of disasters include impacts on the social, human, political and physical capital of individuals or even whole societies (Carter, Little et al. 2007).

The IFRC (2014) report highlights that disasters disproportionately affect countries in the Global South and the marginalised populations within them. This is not because

developing countries experience more hazards, but because countries in the Global South and certain populations within them are more vulnerable to the impacts of hazards. In other words, they have fewer resources to allow them to prevent a disaster; reduce the impacts of a hazard; or recover from a disaster (Blaikie et al. 2004, Pelling 2010). Further to this, there is overwhelming evidence that the climate is changing. The long-term effects of climate change include weather variability, more extreme weather such as monsoons; or incremental and slow-onset changes that cause more extreme weather conditions, such as prolonged periods of rainfall (IPCC 2014, Moser et al. 2010). These changes in weather can increase the number of hazards and people's vulnerability, which increase people's risk of a disaster (Mercer 2010).

Incidences of disasters are also growing in cities of the Global South, and urbanisation represents one of the key reasons for this. More than half the world's population currently live in urban areas. By 2010, there were 2.5 billion urban dwellers in low-and middle-income nations (IFRC 2010). As urban centres become more densely populated the amount of people, infrastructure, buildings and economic activities that are exposed to hazards increases. Additionally, higher density areas may result in the creation of further hazards. For example, locating dense communities on slopes can result in landslides (Blaikie, Cannon et al. 2004, Wamsler 2014). Further, the movement of populations to cities in the Global South often results in people who are socio-economically marginalised in society being forced to live on land that is more prone to natural hazards and disasters, such as flood plains, steep slopes and riverbanks (Pelling 2003). As these groups are typically more vulnerable than other sectors of the population and they are more likely to live in hazardous areas, it makes the issue of urban disasters ever more pressing.

In disaster studies and policies there has been a tendency to focus on less frequent extreme hazards that are linked to rapid-onset and large-scale disasters that affect large numbers of people and which may result in many fatalities, injuries and large economic loss (Desinventar 2009, Pelling 2010). This focus has come at the expense of research on more frequent and less extreme natural hazards that incrementally increase people's DR over long periods of time. These hazards may only affect a small number of people and typically cause property damage and not fatalities and/or injuries. However, despite their scale and their incremental onset, these disasters can have large cumulative losses

and can lead to more significant and large-scale disasters (Bull-Kamanga, Diagne et al. 2003, Marulanda, Cardona et al. 2010).

Despite the growing number of small and large-scale disasters in cities of the Global South, there is negligible coordinated institutional support to address disasters. There is often a "lack of knowledge and financial capacity (and sometimes willingness) of urban authorities to reduce risks" (IFRC 2010: 20, Dodman, Bicknell et al. 2012). A large reason for the problem with coordinated institutional support (or a lack thereof) from urban authorities is because DR is often treated as separate from other development projects, such as infrastructure and access to basic services. Wamsler (2006) and Pelling (2003) argue that this is because DR is a relatively new field of urban development and because disasters were seen to be largely a function of infrastructure planning, and so best addressed by specialised disaster agencies that apply engineering and technological solutions. What support there has been from urban authorities has tended to overlook measures to prevent small-scale disasters and has focused more on large-scale disasters in the post disaster stage (Pelling 2010).

Following the Hyogo Framework for Action 2005-2015, attention has turned to the incorporation of preventative actions. These actions seek to avoid and reduce hazards and to reduce people's vulnerability to their impacts (UNISDR 2005). This framework is known as disaster risk management (DRM) and it expands beyond response and recovery to include disaster risk reduction, which is defined as:

> systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events (UNISDR 2009: 100-11).

Fundamentally, DRR relates to any actions that attempt to reduce both the likelihood of a disaster occurring and its negative impacts (Wamsler 2007, Baas, Ramasamy et al. 2008). This differs to response and recovery which takes place in the period after a disaster has occurred.

The impacts of hazards occur at multiple levels (Ostrom 2009 cited in Dodman and Mitlin 2013) and DRR can be carried out by multiple actors that include individual urban dwellers, households, city authorities, NGOs or the national government. Despite this, DRR has tended to marginalise the role of urban dwellers in the planning and

execution of DRR. Rather, there is emphasis on top-down interventions that are technological or which focus on the reformation of institutions and policies. Problematically, such interventions are largely imposed on populations and often rely heavily on the knowledge and skills of 'risk experts' (Torry 1978, Hewitt 1983, Blaikie, Cannon et al. 2004, Gaillard, Liamzon et al. 2007). Structural and technological solutions to disasters are indeed important. However, they often neglect the role of agency as they frame vulnerable populations as prostrate and helpless victims of a process that is external to their behaviour (Wamsler 2007, Moser, Norton et al. 2010, Moser and Stein 2011). However, more recent research shows that vulnerable groups are critical actors in shaping the success of DRR interventions (e.g. Wamsler 2007, Baumwoll 2008, Cutter, Barnes et al. 2008, Mercer, Kelman et al. 2009, Cadag and Gaillard 2012, Gaillard and Mercer 2013).

Capturing the knowledge, skills and DRR strategies of urban dwellers has the potential to contribute to more holistic and empowering DRR interventions. These interventions would ensure that the DRR strategies by different urban actors are integrated into a multi-scalar process from formal strategies to informal strategies that are present within urban neighbourhoods. Dodman and Mitlin (2013) suggest this when discussing community-based adaptation to climate change. They argue for a multi-scalar analysis of the practices, roles and capabilities of different urban actors that shape political, social and economic processes that are located above the immediate locale.

A growing body of research shows that vulnerable populations carry out many strategies to reduce DR, commonly in isolation from formal support from urban authorities (e.g. Wamsler 2007, Baumwoll 2008, Cutter, Barnes et al. 2008, Mercer, Kelman et al. 2009, Cadag and Gaillard 2012, Gaillard and Mercer 2013). Although this research is growing, technological and structural solutions that tend to overlook the role of vulnerable groups continue to influence many disaster policies. As highlighted in the opening paragraph, the tendency to overlook and undervalue people's perceptions of DR is a significant obstacle for the incorporation of vulnerable groups into DRR interventions.

A risk perception is an individual's subjective assessment of the probability of a particular event occurring and how concerned a person is with the consequences (Sjöberg, Moen et al. 2004). There has been a tendency to characterise the relationship between risk perceptions and responses as weak and unclear (Haynes et al. 2008,

Wachinger et al 2013). Studies have concluded that there is no strong correlation between people's risk perceptions and their responses and that people with high risk perceptions may in fact do nothing or behave in ways that actually increases their risk (Paton, Smith et al. 2000, Donner 2007, Miceli, Sotgiu et al. 2008).

Explanations for the weakness of this relationship are varied. One of the most influential is that that people are 'non-rational' or are unable to organise and understand information about DR and how to reduce it (IFRC 2014). This has been labelled a 'bounded rationality' whereby "behaviour is generally rational or logical but is limited by perception and prior knowledge" (Tobin and Montz 1997: 5). This thinking is underpinned by ideas such, as the Rational Actor Paradigm (RAP) the 'Knowledge, Attitudes, Behaviour' model (KAB), and the 'Information Deficit' model (IDM), which still influence disaster studies and policies (IFRC 2014). Problematically, these models all fundamentally assume people will behave in ways that minimise risks identified by outsiders when provided with sufficient risk information. They are therefore descriptive and normative models of how people decide and take action. Critiques of these models argue that humans are fundamentally viewed as:

> Hedonic calculators calmly seeking to pursue private interests. We are said to be risk-aversive, but alas, so inefficient in handling information that we are unintentional risk takers; basically we are fools (Douglas and Wildavsky 1982: 13).

This is a reductive caricature of human behaviour in disaster contexts, which assumes there is a linear relationship between 'real risk', risk perceptions and responses. These approaches do not fully capture the social, economic, political and cultural factors that shape people's risk perceptions and behaviour according to social constructivist approaches (Lupton and Tulloch 2002).

Other research which suggests people do not fully understand their risk argue that people may have 'normalisation bias', in which people who were able to cope with the effects of less severe hazards, over-estimate their ability to deal with future hazards because they expect future hazards to be the same (Weinstein 1980, Paton, Smith et al. 2000). Building on this, other research has argued that people may deny that they are at risk (Lewis, Kelman et al. 2011). Finally, some studies argue that people are unable to act because they are too overwhelmed by fear (Karanci, Aksit et al. 2005, Grothmann and Reusswig 2006, Siegrist and Gutscher 2006, Hall and Slothower 2009,

Jóhannesdóttir and Gísladóttir 2010).

Further research which explores the influence of social, economic, political and cultural factors on the relationship between risk perceptions and responses suggest that people may perceive other risks and objectives such as income or health as more important than risk of disasters (Barberi, Davis et al. 2008, Lavigne, De Coster et al. 2008). This is related to the idea of a 'risk hierarchy' whereby people are more concerned with 'everyday' risks that are linked to livelihoods, rather than the infrequent effects of natural hazards (DFID 2005, IFRC 2014, Shepherd et al. 2013). However, this idea is largely based on research that has explore less frequent extreme hazards, rather than frequent less extreme hazards that are linked to small-scale disasters, which this thesis is concerned with. Some research argues that people are discouraged from DRR strategies where they have high levels of trust in external actors such as local authorities to reduce their DR (Baan and Klijn 2004, Hung, Shaw et al. 2007). Other explanations include a lack of resources such as income, time or skills to reduce DR (Grothmann and Reusswig 2006).

In sum, the relationship between risk perceptions and responses appears weak and insignificant within the disaster literature and there has been a negligible amount of research on the relationship between risk perceptions and responses in a context of frequent less extreme hazards linked to small-scale disasters. The lack of clarity about the effects of risk perceptions is problematic because it places emphasis on the need for 'risk experts' who are implied to have the 'objective', 'scientific' and 'expert' ability to comprehend DR and reduce it (Hajer and Versteeg 2005). An excerpt from the second paragraph of the 2012 World Bank 'Knowledge note on Risk Communication in urban development' illustrates this when stating:

> local communities generally lack the tools and skills needed to conduct scientific risk assessments and fully understand the underlying risk in their localities without expert assistance (World Bank 2012: 3).

This encourages top-down and expert-led interventions that marginalise the perspectives, skills and capabilities of those most immediately affected by disasters (Felli and Castree 2012). Examples include capital intensive interventions that are imposed on vulnerable populations, or the vertical communication of risk information from 'experts' to vulnerable populations. This information predominantly relates to the

probability of harm and recommendations for reducing the probability of harm (see Mileti and Darlington 1997, Sandman and Lanard 2003, Eisenman, Cordasco et al. 2007, Shklovski, Palen et al. 2008, World Bank 2012, United Nations 2013).

1.2 Aim and contribution of the research

Exploration of how perceptions of risk shape people's responses in disaster-prone cities of the Global South is important because this relationship still remains unclear and research within disaster studies often suggests that the influence of risk perceptions on responses is weak, or that vulnerable people do not fully comprehend DR. This has encouraged top-down interventions to reduce DR in 'Southern cities' that do not incorporate the role, capabilities, resources and knowledge of vulnerable populations. This thesis suggests this is problematic as they are also the groups who are often the most severely affected by disasters. Hence, the thesis provides evidence for the need to capture the risk perceptions of vulnerable groups when planning and executing DRR interventions. Ultimately, the research contributes to a broader body of research that focuses on the ability of vulnerable populations to reduce the adverse impacts of natural hazards (e.g. Wamsler 2007, Baumwoll 2008, Sabates-Wheeler, Devereux et al. 2008, Simatele, Binns et al. 2012, Dodman and Mitlin 2013, Gaillard and Mercer 2013, Shaw 2014, Wamsler 2014).

As previously stated, this thesis uses the house as a methodological tool to explore the relationship between risk perceptions and responses. In particular, the research examines how perceptions of risk shape the way that people design and construct self-build houses. The house was chosen for several reasons. Firstly because many people in 'Southern cities' self-build their houses (see Turner 1976; Gilbert and Ward 1985; Kellett 2005; Green 2008; Wakely and Riley 2011; Jabeen 2012; Mitlin and Satterthwaite 2013). This increases the importance of this research, because it sheds light on one of the most significant processes that people engage in cities of the Global South. Secondly, building on this, previous research shows that vulnerable groups often use the design and construction features of the house to reduce DR. Thirdly, research also shows that the house can significantly shape the DR of people. The latter two points demonstrate the significance of the house for reducing DR and further justify this focus. Finally, studies on risk perceptions and responses often overlook the physical form of the house or do not give principal attention to the form of the house as a useful tool to explore this relationship. Therefore focus on how risk perceptions shape

people's construction of self-build houses represents a new approach for investigating this relationship.

The research aim is explored in the context of persistent and less extreme natural hazards that are linked to DR which is insidious and slow-onset. This marks a shift away from many studies that investigate rapid-onset extreme hazards that quickly overwhelm people's capabilities and which are associated with crises and a sense of urgency (with the exception of droughts and desertification) (Birkmann and von Teichman 2010). Further to this, the research is concerned with small-scale disasters, which again marks a shift away from disaster studies that often focus on disasters that cause "massive collective stress" (Kinston and Rosser 1974: 438); many casualties, and which affect a large geographical area (Pelling 2010). In particular, this research aims to provide new knowledge about the ways that small-scale disasters and the incrementally increasing risk with which they are associated influence risk perceptions and the responses of vulnerable urban dwellers.

The context of this research is a medium-size city, which again represents a shift away from disaster studies that often focus on rural contexts or large and mega cities. As highlighted above this allows the thesis to raise new findings of why medium-size cities typically have weak institutional capacity to address DR (IFRC 2010). Although the effects of disasters are not isolated to urban or rural locales, there are characteristics of urban centres that shape DR and its effects in distinctive ways. Examples include the density of the built environment which includes houses and infrastructure that can exacerbate DR or create new hazards, the settling of vulnerable people on cheap or free land which is often environmentally hazardous, lower levels of social capital within neighbourhoods and inefficient institutional support. As such, the research seeks to build on research of urban DR.

The research aim explores **how perceptions of risk shape the responses of people living in disaster-prone cities of the Global South.** In order to address this overarching aim, the following three research questions are examined:

1. **How are people at risk of a disaster?**
2. **How do people perceive their disaster risk?**
3. **How do people reduce their disaster risk?**

In addressing the research questions and aim this thesis contributes to knowledge in four distinct ways.

First, the research builds on literature about the relationship between risk perceptions and responses in disaster contexts. Whether people perceive DR as high or low is not what is most influential on how people design and construct the house. Rather, the thesis argues that people's awareness of DR and their understanding that the physical form of the house can potentially reduce DR is more important. This encourages people to incorporate design and construction features that they perceive as reducing DR. As such, design and construction features that people perceive reduce DR have now become 'architectural norms' that people incorporate when they self-build. This allows the research to move beyond notions of 'non-rationality' and a 'bounded rationality' (Tobin and Montz 1997) for explaining the relationship between risk perceptions and responses. Furthermore, and significantly, the research shows that risk perceptions are by no means the catalyst or the exclusive factor shaping how people design and construct the house. Rather, the thesis shows that people pursue DRR alongside the transformation and consolidation of other social and economic processes when self-building. As such, the thesis suggests that the relationship is not 'weak' or 'unclear' as many studies propose; rather the influence of risk perceptions on responses is subtle and complex because urban dwellers negotiate many objectives, values, beliefs, aspirations and risks when designing and constructing their house in disaster-prone contexts. This is directly related to the second contribution.

The *second* contribution lies in the adoption of the house as a methodological tool. The design and construction features of the house have previously been adopted to explore how vulnerable groups reduce DR in 'Southern cities' (e.g. Wamsler 2007). However, there is room for research that gives particular attention to how risk perceptions shape preventative and anticipatory responses when people self-build houses. Further to this, this research takes a more holistic approach when investigating the reasons behind people's decisions to design and construct their house in a particular way. By this, I suggest the thesis identifies and explores the influence of risk perceptions; however, the thesis also identifies the influence of other factors related to social and economic processes that also shape how people design and construct their house. A more holistic

conceptualisation of the house is also novel because disaster studies largely understand the house as a physical resource to reduce DR, whereby the design and construction features of the house are largely understood and explained through the vernacular and analytical 'tools' of disaster studies.

This allows the research to identify what houses mean to the people who live in them, in terms of social, economic and physical processes. As such, the thesis adopts a more holistic conceptualisation of the house, which helps the research to identify the multiple objectives, values and risks that people attempt to negotiate and articulate when self-building. This allows the thesis to 'pin down' how and to what extent risk perceptions shape responses. Through this approach, the thesis argues that research which describes the relationship between risk perceptions and responses as 'weak' forecloses the nuances and complexity of human behaviour in disaster-prone contexts because it does not capture the subtle yet important ways that risk perceptions shape responses.

Third, the research shows that persistent, less extreme hazards have distinct effects on how people perceive disaster risk. In particular this encourages people to give more attention to these types of hazards which shapes the temporality and timescale of risk perceptions in distinctive ways and which have consequences for how people respond. As people give significant importance to local natural hazards and their impacts, this research contradicts studies that suggest there is a 'risk hierarchy' whereby people are less concerned with natural hazards linked to disasters, and are typically more concerned with 'everyday' problems like food on their plate, paying school fees, getting water, crime, road 'accidents' and so on (Barberi 2008, Blaikie et al. 2004, IFRC 2014, Lavigne et al. 2008). In contrast, this thesis shows that because local natural hazards and their impacts are frequent (albeit principally during the rainy season) and observable, people consider them important and 'everyday' local problems.

With regards to temporality, the research shows that residents acknowledge that their risk increases incrementally with the persistence of local hazards. People understand that their future risk is not abstracted from their everyday lives; rather, people recognise that their future levels of risk are connected to the ongoing, subtle and often visually observable impacts from local hazards, such as rainfall. As such, risk perceptions are not principally bound by the present and past experiences of people as suggested by several studies (Grothmann and Reusswig 2006, Siegrist and Gutscher 2006, Ruin, Gaillard et al.

2007, Miceli, Sotgiu et al. 2008, Wachinger and Renn 2010, Wachinger, Renn et al. 2013), but also by people's ability to consider how their risk will be in the distant future. Furthermore, this long-term temporal structuring of risk perceptions is not disengaged from people's present behaviour. In contrast, people make substantial investments of their resources to reduce their current and future DR. An exploration of the design and construction of the house is critical for making this argument. As such, the thesis shows that residents' perceptions of slow-onset DR are broadly in line with the long-term temporal scale that is often used for understanding and adapting to the impacts of climate change.

The timescale of risk perceptions is also significant. Research has looked at the ways that risk perceptions increase and attenuate following a disaster (Weinstein and Nicolich 1993). However, the literature largely views risk perceptions as static, which leaves room for research that looks at the nature of risk perceptions over different timescales. Significantly, this research finds that risk perceptions are far from static. Rather they are particularly fluid, as they may increase and decrease throughout the year and even throughout a single day. This is because people understand that risk increases incrementally and that there is a 'delay effect' (Renn et al. 2011) between initial impacts of hazard and a disaster. As such, people are often more concerned and aware of DR during rainfall, which encourages people to carry out ad hoc risk reduction strategies during the rainy season and during rainfall in particular. Ultimately this indicates a more conspicuous relationship between risk perceptions and responses during the onset of persistent, less extreme natural hazards.

The *fourth* contribution is represented by new knowledge gained about urban disasters in the Global South. This research confirms many well-established trends such as the link between urbanisation, increasing density and higher levels of DR (Bolivar Vallejo 2011, Pelling 2003); the tendency of vulnerable people to settle on land that is often environmentally hazardous (Smith 1996, Blaikie, Cannon et al. 2004), and the presence of an urban 'vulnerability gap,' whereby urban authorities have weak institutional structures to address DR (IFRC 2010). However, this thesis also provides new insights of why DRR often takes place at the household level which builds on Wamsler (2014), who argues that low levels of social capital in urban neighbourhoods and weak institutions to address DR are central reasons why DRR typically takes place at the

household level. In particular this thesis shows that people largely perceive that DRR is the responsibility of the household which discourages residents from seeking help from urban authorities to address DR. There are three principal reasons that encourage people to perceive DRR as 'project' of the household.

The first reason is because residents largely understand the physical form of the house is the most important resource for reducing DR. However, residents simultaneously perceive that the design and construction of the house falls within the remit of the household. As such, DRR strategies that focus on the house are more likely to be carried out by the household and in isolation from coordinated institutional support. Secondly, 'personalisation' of DRR is also encouraged by the "lack of knowledge and financial capacity (and sometimes willingness) of urban authorities to reduce risks", which is known as the 'vulnerability gap', and which is most evident in medium-size cities such as Cochabamba (IFRC 2010: 20). This 'gap' is illustrated in 'official governmental approaches' such as a resettlement programme and a 'risk map' which frame local disasters as natural and beyond human control. The thesis argues that these governmental 'interventions' imply that the impacts of local hazards are the result of household error for not 'removing themselves' from a hazardous area. Ultimately, this places the onus of responsibility onto the shoulders of residents and further constructs perceptions that the household must take responsibility to reduce DR. Thirdly, the research finds that the scale of disasters also encourages households to adopt more 'individualistic' approaches towards DRR. Previous research shows that large-scale disasters are sometimes associated with higher levels of social capital in the post-disaster period, and that this can facilitate more collaborative DRR strategies (e.g. Nakagawa and Shaw 2004). However, this research finds that small-scale disasters, which are geographically spread and sporadic over time, do not catalyse collaborative strategies and further encourage the perception that DRR is the household's 'project'.

In this way this thesis provides another reason why there is a 'vulnerability gap' in 'Southern cities'. Previous research has argued that the vulnerability gap is because disasters have been seen as rural phenomena and the responsibility of specialist disaster agencies (IFRC 2010, Pelling 2010, Wamsler 2006); however, this research shows that a lack of pressure from urban dwellers is also influential in hindering the development of the skills, knowledge and willingness to address DR within urban authorities.

1.3 Geographical focus: Cochabamba city, Bolivia

The geographical focus of this research is Cochabamba city in Bolivia. The research site is composed of three adjacent urban neighbourhoods that are located on a hill in Cochabamba city. The target group of this research is the population that live within these three neighbourhoods. There is an approximate population of 7,553 according to the 2001 census (INE 2001).[1]

Bolivia is a Presidential Representative Democratic Republic, and Evo Morales, who was elected in 2005, is the current President. It is a landlocked country, located in South America and bordered by Peru, Chile, Argentina, Brazil and Paraguay (see figure 1). The per capita income is US$1,460 (INE 2012) and it is one of the least developed countries in South America, with a 45% poverty headcount ratio at the national poverty line (World Bank 2013). However, there have been many recent improvements as the poverty headcount was 60% in 2006. Life expectancy has also increased from 61 years to 67 years between 1994 and 2012 (World Bank 2013). The annual GDP (Gross domestic Product) is US$36 Billion, which indicates a 6.5% growth rate in 2013 (World Bank 2013).

Bolivia was chosen for this research for several reasons. Firstly, 37% of the Bolivian population is at risk of a disaster. Between 1980 and 2010 there were a reported sixty-one disasters that affected over six million people and caused an estimated US$3 billion in damage (EM-DAT 2014) Further, there has been scant progress in the implementation of the Hyogo Framework for Action in Bolivia, and so there has been highly insufficient coordination and action toward DRR at the institutional level (VIDECI 2013). As such, urban disasters are not sufficiently addressed or given attention by Bolivian governmental institutions, and so many urban dwellers are left to tackle their DR in isolation from coordinated and institutional support (VIDECI 2013).

Bolivian state housing policies have been ineffective in reaching the poor. Therefore inhabitants of Bolivian cities and many other cities in the Global South, often self-build their houses (O'Hare and Rivas 2005, Greene and Rojas 2008, Nathan 2008,

[1] The last Bolivian census was in 2012; however there were significant political and administrative problems with the results which encouraged widespread protests in Bolivia. Therefore all of the results have not yet been released, which includes data at the neighbourhood level across the research site.

Bredenoord and van Lindert 2010). Research also argues that self-build housing has proliferated in urban areas following rural to urban migration in Bolivia (Bredenoord and van Lindert 2010). The presence of self-build housing is critical to this research because it is the means to explore the relationship between risk perceptions and DRR responses.

Figure 1 Bolivia situated within South America

Source: opendemocracy.net

Figure 2 The nine departments of Bolivia

Source: worldatlas.com

Bolivia is divided into nine departments (see figure 2), and there are three principal geographic regions: the altiplano (or highlands) in the west, the lowlands in the east and the Yungas and central valleys. The weather in the highlands does not change dramatically, and it is a cold weather region. However, the weather can be hot during the winter days (May to September) but can drop below freezing at night. The eastern lowlands include all of Bolivia north and east of the Andes. This forms part of the Amazon rainforest, plus the Chaco grasslands to the south-east. The eastern lowland region is sparsely populated; however, its economic importance has grown rapidly since the 1960s principally because of agribusiness and the exploitation of hydrocarbons (oil and gas) (Klein 2011). The Yungas and central valleys are between the high Andes mountains to the west and the upper Amazon basin to the east (Klein 2011). This is where the research site is located; this region is generally hot and humid and does not change much during the year. However, during the wet season (December to March) levels of rainfall can increase to an average 163mm per month (World Bank 2014).

The national population is 10,027,254, which indicates a fourfold increase since 1950 (INE 2012). For the first half of the twentieth century, the population of Bolivia remained largely rural as 86% of Bolivians lived in rural areas and only 14% lived in cities of approximately 5,000 inhabitants (de Pabon and Garcia 1988). From 1900 to 1950 the population of the Highlands gradually declined as people steadily moved to mining centres for employment. However, it was from the 1950s onwards that urbanisation began to take place. This was because the majority of people were tied to the land before significant land reforms in 1953 (Kohl and Farthing 2006). Under Spanish rule, the 'hacienda system' was established. Through this system land was originally owned by single landowners called 'hacendados' (see Appendix 3 for a glossary of foreign terms) who subdivided the land and rented areas to people so that they could engage in agricultural activities. The tenure and labour relations were similar to a feudal system (Mendelberg 1985).

Following the national Bolivian revolution of 1952, there was significant land reform as peasants pressured the government for land to be redistributed. Subsequently, the Bolivian government passed the Bolivian Land Reform in 1953. This redistributed large landholdings to the mass of peasants ('campesinos') in a bid to transform the economic, political and social relations between tenants and landlords (Kohl 1978, Whitehead and Gray-Molina 2003). Later, in the 1960s, the government began dividing the land and distributing portions to the 'campesinos' through a process known as 'dotacion de colonizacion', which designated the land for agricultural purposes (Klein 2011). Each family was given a 'minuta de compraventa', which signifies that the family had bought the house, however they did not have legal land tenure ('derechos reales') (Kohl 1978, Whitehead and Gray-Molina 2003). This practice, whereby people may buy a house and 'inherit' a 'minuta de compraventa' but not necessarily legal land tenure, continues to today. Interestingly, in Bolivia the 'minuta de compraventa' entitles households to the same governmental services as households registered in 'derechos reales'. This is significant for this research as literature suggests that access to basic governmental facilities such as services and institutional support with DRR can heavily shape people's levels of DR.

Later, in 1986 during the structural adjustments of the 1980s, the state-owned multi-mineral mining company, Corporación Minera de Bolivia (COMIBOL) was

decentralised into five semi-autonomous mining enterprises. The dismantling and privatisation of many industries and resources resulted in surging unemployment rates within the mining industry, which forced many to look for jobs elsewhere, with the majority of people deciding to move to cities (Klein 2011). Many people arrived from these mining towns migrated to the research site. This is discussed further in 3.3. As a result of this influx of people, many 'campesinos' decided to sell their land to the large number of migrants moving to cities (Klein 2011).

A further influence on the population flow to cities was the Bolivian government's National Economic Corridor policies in the 1990s which sought to geographically diversify the productive activities of the country by developing other regions and seeking growth in cities other than La Paz, with particular focus on Cochabamba and Santa Cruz (Del Carmen Ledo 2002). As a result of these developments, Bolivia is now an urbanised country, with 67 % of people now living in urban areas (INE 2012).

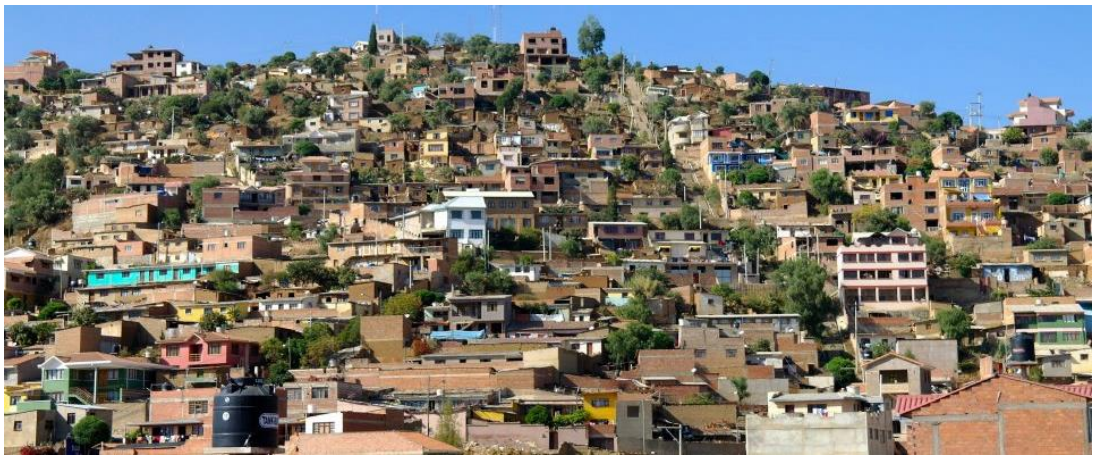
Locating the research site within the department of Cochabamba

This research specifically focuses on the population living within three adjacent urban neighbourhoods, Amposta, Simancas and Vinateros. They are located in a densely populated hill in Cochabamba city, named 'Cerro Lourdes' (see image 1 and figure 3). There have been many small-scale landslides across the Cerro, and residents self-build their houses, which are both factors that must be present in order to address the research aim. This hill is located within District 6 of the Cercado province, which is located within the department of Cochabamba.

One of the principal reasons Cochabamba city was chosen was because it is a medium size city. Research and policies on urban disasters have belatedly developed because rural areas were disproportionately affected by disasters; however this is changing with the increasing risk and incidence of urban disasters (IFRC 2010). In addition, research on urban disasters has tended to focus on the largest urban centres and not the many medium-size urban centres in the Global South (Pelling 2003). According to the United Nations Department of Economic and Social Affairs, Population Division (2014) a medium-size city has a population between 1 million and 5 million inhabitants: Cochabamba has a population of 1.5 million residents . Research also suggests that there is typically poor institutional infrastructure to address DR within urban authorities in medium-size cities; therefore residents are more likely to carry out their own

strategies to reduce risk (Wamsler 2014). This is reflected in Cochabamba city as there is a weak institutional and legal framework to address disaster related issues, and so many urban dwellers carry out DRR in isolation from external support (Bolivar Vallejo, 2011).

Image 1 Cerro Lourdes



Source: Author

Figure 3 Location of Cerro Lourdes in Cochabamba city

Source: Google Maps

The department of Cochabamba is located in the very centre of Bolivia and is divided into sixteen provinces (see figure 4), forty-seven municipalities and 146 districts (Olivera 2004). According to the 2012 national census there are 1.7 million residents living in the department and Cochabamba city is the department capital (INE 2012). Over the last three decades the department has become increasingly populated because of rural to urban migration that was particularly catalysed by structural adjustment (Landaeta 2004). In 2012 Cochabamba city had a population of 1.05 million inhabitants, which represents

62% of the population of the department (INE 2012). This population growth expanded the city in the north and south, through an unplanned settlement process. This has seen the number of 'low-income' settlements noticeably increase; however, density levels have remained low due to the sprawl of the city (Bolivar Vallejo, 2011).

Figure 4 The provinces of Cochabamba department and the Cercado province within it

Source: Valle Hermoso Municipal House

Figure 5 District 6 situated within the sixteen Districts of the Cercado Province

Source: opendemocracy.net

The highly urbanised Cercado province is located within Cochabamba department (see figure 4). This province is governed and administrated by the Municipality of the same name. The Cercado is composed of fourteen rural and urban Districts as well as the capital city of the department, Cochabamba city (see figure 5). Of the 1.7 million people living in the department of Cochabamba, the Cercado is inhabited by 630,587 people (37% of the department population). This population total indicates a 22% increase between 2001 and 2012, which is equal to the relative growth of the total Bolivian population during the same period (INE 2012).

Previously, public administration by the Cercado municipality was particularly focused in urban Districts and planning instruments were formulated to regulate and control the

urban development and expansion of the city.[2] Despite the General Plan designating the boundaries for urban and agricultural land use, conventions for land management were only instituted for urban areas (Landaeta 2004). As a consequence, and despite the municipality designating rural land to be used for agricultural purposes, rural land in the Cercado province became vulnerable to changes in land use via the unplanned expansion of settlements. This saw settlements become more urban in nature and decreasingly used for agricultural purposes, particularly in District 6 where the research site is located (Honorable Municipalidad de Cochabamaba 1997 cited in Landaeta 2004, Bolivar Vallejo 2011).

Each municipality is divided into Municipal Houses and the Communa Valle Hermoso is the Municipal House that administrates and manages District 6[3]. District 6 is comprised of twenty-six neighbourhoods and 62,341 residents live within its 89km^2 territory (INE 2012) (see figure 5 for the location of District 6 within the Cercado province). Each neighbourhood has an average of 2,398 residents, which makes it the most populous and second most densely populated (698 residents per km^2) District within the Cercado province (INE 2001). Originally, the priority of the Valle Hermoso Municipal House was the introduction of basic services. This has been largely achieved and District 6 now has these services in most neighbourhoods, including the research site (Sanchez[4], CEDIB 2006)

The population of District 6 is composed by 42% of people who arrived from outside of the District (INE 2012). This is 4% more than the average of the Cercado province and places the District first in terms of the number of migrants that constitute the population (Butron and Veizaga 2003). More than half of the population identify themselves as Quechua and 15% as Aymara. This reflects 22% and 8% more than the average of the Cercado province (INE 2001). The characteristics of the research site are given further attention in Chapter Three when outlining the context of the research.

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[2] These planning instruments pertain to the Regulatory Plan (1961); General Plan (June 1981) and the Regulatory Framework (December 1991) of Bolivia.

[3] Communa Valle Hermoso Municipal House administrates and manages sixty neighbourhoods and 98,147 residents. These are located in District 7 which contains twelve neighbourhoods, District fourteen which has twenty-two neighbourhoods and the twenty-four neighbourhoods located in District 6 (INE 2001).

[4] 'Sanchez' was one of the interviewees. A list of interviewees can be found in Appendix 1. Where this thesis uses interview data to support results the pseudonym of the respondent will be referenced e.g. (Daniela), (Felix, Fabiola). This is distinguishable from references in the literature because there is no date.

1.4 Methodology

This research adopts a social constructivist approach which applies mixed methods for collecting and analysing qualitative and quantitative data. The research uses semi-structured interviews, participatory tools and a quantitative survey. Given the interest in the risk perceptions and responses of people living within disaster-prone contexts, the majority of interviews were carried out with residents. This data substantially informs all three research questions that explore residents' levels of DR, risk perceptions and their responses. Participatory tools were used for residents to draw their current and 'ideal' house. Participatory drawings provide an alternative source of information about the intentions of residents when designing and constructing their house, which ultimately helps the research to answer how important reduction of DR is for residents when self-building their house.

Although the research adopts a social constructivist approach, which is philosophically grounded in the idea that there is no 'objective' and 'true reality', a 'naturalist' model to analyse risk is applied to help measure DR. These models are commonly framed as 'objective' measurements of DR and are widely used in DR studies as a standardised way of measuring 'real' risk across space and time. Although the thesis acknowledges that all models are inherently subjective, the adoption of a 'naturalist' model allows this research to juxtapose people's 'real' DR (according to dominant thinking in disaster studies) against their risk perceptions. This allows the thesis to uncover why perceived risk may not reflect 'real risk'. Accordingly a large set of quantitative data from a survey of 382 households was gathered to help measure the vulnerability levels of residents through the quantification of factors such as income levels, sources of income and household composition. This quantitative data also informs the profile of the research site, which is detailed in Chapter Three.

1.5 Structure of the thesis

This thesis is divided into seven chapters. *Chapter One* introduced the problem definition, research aims, research questions, contribution of the thesis, the choice of research site and methodology. Following this, in *Chapter Two,* there is a review of theoretical and empirical debates about disasters, DR, perceptions of DR, and DRR. This chapter aims to establish the most appropriate theoretical framework for investigating and analysing the research aim and questions and to identify research gaps and contradictions.

The chapter begins with a discussion of DR, which involves discussion of hazard exposure, characteristics of hazards and the vulnerability of a socio-ecological system. This is followed by a discussion of how a disaster is conceptualised, based upon scale, frequency, speed of onset, and location. In the second part of Chapter Two, the theoretical development and conceptualisations of vulnerability are explored. This is followed by a discussion of the particular components of vulnerability, with particular emphasis on how the design and construction features of the house shape vulnerability. Next, approaches to understanding risk perceptions are explored, which can be broadly categorised as realist or social constructivist approaches. There is also a review of previous research which has explored the factors that shape risk perceptions, and the relationship between risk perceptions and responses. Finally, there is a review of DRR with particular focus on research that investigates the agency of urban dwellers to reduce DR. Given the importance of the house to this thesis, there is particular emphasis on the ways that urban dwellers may reduce their DR through the design and construction of self-build houses.

Chapter Three outlines the methodology and the context of the research. The research adopts a social constructivist approach with a single case study framework that applies mixed methods. The chapter discusses why this approach is appropriate in light of the research aim, conceptual framework, and the research context. The chapter ends by discussing problems with the research strategy and data collection process; namely positionality, language, emotions, and representation.

Chapter Four discusses the findings of research question 1: *How are people at risk of a disaster?* The particular characteristics such as frequency and intensity of natural hazards are identified and their impacts on residents are discussed. Exposure to hazards is also discussed and disaggregated between and within households through an agency-oriented approach. Following this, and according to the conceptual understanding of vulnerability this thesis adopts, an agency-oriented approach is applied to measure people's levels and access to physical, social, human, political and economic capital within and across households. Ultimately, this chapter reveals heterogeneous DR within and across households and shows that residents are effectively left to tackle DR in isolation from coordinated and institutional support because of the urban 'vulnerability

gap'. Finally and significantly for this research, findings show that design and construction features of houses heavily determine residents' DR.

Chapter Five addresses how people perceive DR. It first shows that residents are aware of risk and they perceive disasters as a likely outcome of living in Cerro Lourdes. Further, the chapter reveals that residents overwhelmingly understand disasters as the result of exposure to a hazard and their physical vulnerability – the design and construction features of their house. This shows how residents perceive the locus of control for DRR as internal to human behaviour and that the physical form of the house is the most significant resource for DRR. Next the chapter discusses the factors that shape risk perceptions and reveals a pattern of heterogeneity. Consistent with many studies, people with more severe experience with hazards tend to have higher risk perceptions. Additionally, risk information provided by urban authorities is influential; however, horizontal communication via informal personal networks is more influential because of the frequency and proximity of residents to this information, and the levels of trust within personal networks. Next, perceived personal vulnerability is explored, and the chapter shows that design and construction features of the house significantly shape residents' perceptions of risk. Despite this, many residents perceive that certain design and construction features of the house do not altogether eliminate DR, but only delay damaging impacts and make the house "last longer" against local hazards. This is directly linked to another finding which shows that residents consider their immediate (or 'everyday') risk and future scenarios about how their DR may play out in light of the design and construction of the house. The chapter ends by showing that risk perceptions are particularly fluid and not static over time as many studies suggest. This is demonstrated by the tendency of residents' awareness and concern with DR to increase during rainfall and the rainy season and attenuate during the dry season.

Chapter Six focuses on the actions that residents carry out to reduce risk. It begins by discussing why many people live in an area they perceive as prone to disasters. The chapter discusses the ad hoc DRR strategies that people carry out during rainfall when risk perceptions are typically higher. However, the chapter principally focuses on the many residents who increasingly reconstruct, plan to reconstruct or aspire to reconstruct the house in ways they perceive reduce DR. The chapter argues that it is not whether people perceive DR as high or low that is most influential; rather it is

awareness of DR and understanding that the house can be built to reduce DR that encourages people to incorporate risk reducing features when self-building. Furthermore, through a holistic conceptualisation of the function of the house and exploration of the factors that shape how people design and construct their house, the chapter reveals that risk perceptions play an important role in shaping how people design and construct their house; however, risk perceptions are neither the catalyst for reconstruction nor the principal influence because people associate the house with multiple social functions that include and are located beyond issues of DR.

Chapter Seven brings the arguments together and responds directly to the research aim: how do perceptions of risk shape the responses of people living in disaster prone cities of the Global South? The objective of this chapter is not to make generalisations about risk perceptions and responses in disaster-prone 'Southern cities', but to discuss how the findings discussed in Chapters Four, Five and Six challenge, confirm or extend wider debates that are reviewed in Chapter Two, and to synthesise the implications of this for the problem definition discussed in 1.1, policy implications and future research.

CHAPTER TWO: TRACING THE RESPONSES OF URBAN DWELLERS TO DISASTER RISK

The chapter will review the literatures relevant to disaster risk (DR), disaster risk reduction (DRR) and risk perceptions. The chapter will explore how the relationship between people's perceptions of risk and their responses have been explored and understood. Particular attention will be given to cities of the Global South and the role of the house within these literatures. In exploring these literatures, the chapter will identify research questions for addressing the research aim, the most appropriate conceptual framework for answering the research questions and some of the gaps and contradictions in the literature which require further investigation.

The first section of the chapter explores DR and the particular characteristics of disasters. This opening section will highlight the unique characteristics of slow-onset risk of small-scale disasters in urban contexts, and show the importance of research on such disasters given their increasing frequency. The second section of the chapter will consider how and why urban dwellers are differently affected by natural hazards through a review of the theoretical and empirical components of vulnerability. This will identify the most appropriate approach for conceptualising and measuring vulnerability within and across households. This section will then explore the factors that shape vulnerability at the household and the intra-household level. This will enable the research to capture how urban dwellers are differently affected by natural hazards, and differently able to reduce DR within and across households. The discussion of vulnerability will also pay particular attention to the role that the house plays in shaping the DR of urban dwellers.

The third section of the chapter begins by looking at the theoretical approaches to exploring risk perceptions, which can be broadly categorised as 'realist' and 'social constructivist' approaches. This section reveals the need for an approach that looks beyond the properties of 'real' risk when explaining how risk perceptions are formed. Following this, how the relationship between risk perceptions and responses has been researched is given attention. Furthermore, this section also shows that studies have often overlooked the house as a methodological tool for exploring this relationship. This section also shows that social, economic and political processes have been largely overlooked when exploring the influence of risk perceptions on responses because

many studies have explored this relationship almost exclusively according to the vernacular and analytical tools of disaster studies. The chapter shows that this narrow analytical focus is one of the main reasons why the influence of risk perceptions on responses has often been labelled 'weak'.

The final section will begin by exploring the different approaches to disaster risk reduction, which will show that urban dwellers have an important role to play in the process of DRR. This requires a review of the recent and growing body of research which focuses on the agency of urban dwellers to address DR. This section is also important because it highlights the need for research and policies to engage with urban dwellers, of the kind this research offers. The section is also vital for laying out the varied and multiple ways that urban dwellers reduce their DR according to the literature, and sketches the ways in which self-build houses are used to reduce DR. It will also explore the literatures on self-build houses in 'Southern cities', located outside the broader disaster literature. It identifies the diverse motivations which shape the ways in which people design and construct their houses; demonstrating the importance of adopting a more holistic conceptualisation of the house. The section will conclude that this research has the potential to identify if, and to what extent, risk perceptions shape housing construction.

The chapter ultimately concludes that there is a need to demystify the relationship between risk perceptions and the responses of people living in 'Southern cities' and suggests that a focus on self-build housing represents a novel and appropriate approach for doing this. The chapter also highlights the unique characteristics of slow-onset risk of small-scale disasters and explains why this is a unique context to explore the influence of risk perceptions; as much of the literature focuses exclusively on rapid onset large-scale disasters. The chapter will situate this research in the broader literature and the findings of this chapter will inform the development of research questions and a conceptual framework.

2.1 Disasters

Within the field of disaster studies, the widely accepted definition of a disaster states:

> A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts,

> which exceeds the ability of the affected community or society to cope using its own resources (UNISDR 2009: 9).

This definition has encouraged research on a particular type of disaster: those that are infrequent, large in scale and with a rapid speed of onset (Pelling 2010). These types of disasters are undeniably worthy of attention, demonstrated by their impact on 100, 000 people; with 29, 163 deaths and an economic cost of $US119 million in 2013, globally (IFRC 2014). However, other kinds of disasters have been largely overlooked. Recently researchers began to recognise the need to explore urban disasters (Pelling 2003, Wamsler 2006) and frequent, less extreme, natural hazards that are linked to small-scale disasters (Bull-Kamanga, Diagne et al. 2003, Desinventar 2014). This thesis aims to build on this smaller body of research by investigating persistent, less extreme natural hazards that incrementally increase the risk of small-scale disasters in urban contexts.

Different understandings of disaster risk

The term risk was initially used in relation to natural hazards (Renn, Burns et al. 1992). The UNISDR (2009: 17) defines a hazard as:

> a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Hazards may be natural such as earthquakes and climatic events; they may be biological such as nuclear technology, or they may be human-induced such as crime or terrorism (Smith 2013). This research focuses on natural hazards, which can be characterised by their location, intensity, frequency and probability. A focus on natural hazards is particularly important in the current context of climate change which is linked to weather extremes such as monsoons, weather variability and incremental and slow-onset changes that cause more extreme weather such as prolonged periods of rainfall (IPCC 2014, Moser, Norton et al. 2010). Therefore, natural hazards are set to become more intense and frequent given the effects of climate change, which can exacerbate DR and which highlights the importance of understanding and exploring the effects of natural hazards (O'Brien, O'Keefe et al. 2006).

The rise of rationalist scientific thinking has seen the lens through which disasters are viewed change from an understanding of them as malign 'acts of God' to knowable and predicable events (Chester 2005, Steinberg 2006). Within disaster studies, this

progression helped to develop the concept of 'DR', which indicates the likelihood of a hazard occurring and its likely impact on a socio-ecological system (Cardona 2003, Blaikie, Cannon et al. 2004). A socio-ecological system "reflects the idea that human action and social structures are integral to nature and hence any distinction between social and natural systems is arbitrary" (Adger 2006: 263). It is based on the idea that humans must be seen as a part of, not apart from, the environment, because delineating between social and ecological systems is artificial (Berkes and Folke 1998).

Naturalist (sometimes referred to as scientific) models are the most commonly used approaches for analysing DR. In ontological terms, DR is argued to be an objective and 'real' thing as it is a "physically given attribute" of a socio-ecological system that can be used to calculate the 'actual' likelihood of impacts and the expected outcomes (Bradbury 1989: 381). There are two broad types of scientific models of DR. Those that frame disasters as natural phenomena, and those that frame disasters as caused by humans.

Disasters have been conceptualised as a function of the hazard and the risk, and some have emphasised the likelihood, duration, frequency and severity of the hazard(s) when measuring DR (e.g. Browder 1989, Palm and Hodgson 1992, Bohle, Downing et al. 1994, Cassel-Gintz, Lüdeke et al. 1997, Adger 1999, Yohe and Toth 2000, Leichenko and O'Brien 2002). However, this interpretation has been accused of biological reductionism, as Tobin and Montz (1997: 8) illustrate;

> The traditional view of natural disasters has ascribed all or almost all responsibility for them to the processes of the geophysical world. The approach has meant that the root cause of large-scale death and destruction has been attributed to the extremes of nature rather than encompassing the human world. Frequently, disaster victims have been viewed as unfortunates who could do little but react to physical processes. The physical world, then, has been seen as an external force, separate from human forces.

Biophysical approaches are criticised for framing disasters as phenomena that are beyond human control and for placing limited emphasis on how agency and economic and political processes shape DR (Whittow 1979, Watts and Bohle 1993, Hewitt 1995, Adger 1996, Blaikie, Cannon et al. 2004). As such, these approaches implicitly frame people living in disaster-prone areas as passive victims that have negligible control over DR (Bankhoff, Frerks et al. 2004).

Hewitt (1983) pioneered the shift away from biophysical approaches by highlighting that the damage inflicted does not always correspond to the intensity of the hazard, but instead corresponds to the socio-economic conditions of the area. These societal conditions influence the likelihood of hazards resulting in severe impacts. These economic losses, social effects, fatalities and injuries are termed 'vulnerability';

> Whereas hazards perspective tends to explain risk and disaster in terms of external agency and their impact, vulnerability looks to the internal state of a society and what governs that (Hewitt 1997: 28).

Vulnerability is seen as the link between the onset of a hazard and a resultant disaster. It helps to explain why disasters disproportionately affect people in the Global South and the socio-economically marginalised groups within society (O'Keefe, Westgate et al. 1976, Twigg 2004, Sperling and Szekely 2005). Highlighting this, Hooke (1999: 283) comments:

> To the extent that most natural disasters are indeed social in origin, it also follows, as experts agree, that their burden falls disproportionately on those already most economically disadvantaged, both on an international level…and domestically. The poor within each society are forced to live in substandard structures on more dangerous land, and have fewer resources to lessen their own risk and vulnerability.

The literature on vulnerability is more fully explored in section 2.2. For now, it is important to continue to clarify what a disaster is by thinking about scale and frequency.

Scale and frequency of disasters

Official registers only include events where one of the following criteria is met: 10 or more people are killed; 100 or more are affected; damage is sufficient for international agencies to be called in; or a state of emergency is declared (IFRC 2010)[5]. As such, there is an emphasis on hazards that are typically rare in occurrence and which cause "massive collective stress" to people across a large geographical area (Kinston and Rosser 1974: 438, Desinventar 2009, Pelling 2010). These disasters are linked to less frequent extreme hazards that directly threaten human life and property through severe physical trauma on a scale sufficient to manifest upon whole communities, cities, districts or even countries (Smith 1996).

[5] Recent examples include the 2013 Typhoon Haiyan in the Philippines and the South East Asian Tsunami in 2005.

Other researchers argue that the current criteria for registering disasters steers attention away from frequent (or 'persistent') less extreme natural hazards that may only affect an individual household or a small number of people (Bull-Kamanga, Diagne et al. 2003, Desinventar 2009). Research indicates that these hazards can deplete and negatively impact the human, social, physical, natural, economic and political capital of people (Bull-Kamanga, Diagne et al. 2003, Desinventar 2014). See Table 1 for an explanation of these capitals. Some researchers also argue that small-scale disasters have large cumulative impacts because of their frequency (Bull-Kamanga, Diagne et al. 2003, Desinventar 2014). Maralunda et al. (2010) also argue that these types of disasters reveal where vulnerability is growing; where hazards are becoming exacerbated; or where new ones are occurring, which has instrumental value for preventing larger scale disasters.

Table 1 Types of capital

Type of capital	Explanation
Physical	The house, equipment, infrastructure and other productive resources
Economic	Financial resources available to people.
Social	Rules, norms, obligations, reciprocity and trust embedded in social relations, social structures, and societies' institutional arrangements.
Human	Education, health and the nutrition of individuals.
Political	Legitimate rights and power and the illicit operation of power of people
Natural	Environmentally provided resources such as soil, atmosphere, forests, minerals and water.

Source: Bebbington 1999, Moser, Norton et al. 2010

Research that investigates persistent, less extreme hazards tends to focus on traditional development hazards, such as inadequate provision of water and sanitation services. Wamsler (2006: 155) commented that this is because:

> Development people focus more on life, health or livelihood threatening everyday hazards, while disaster people look at life threatening situations of occasional large-scale disasters.

Disaster studies has tended to overlook frequent less extreme natural hazards that are linked to small-scale disasters (Bull-Kamanga, Diagne et al. 2003).[6]

The conventional definition of a disaster (see UNISDR 2009: 9) does not acknowledge 'small-scale' effects from less extreme and persistent hazards. However, this research

[6] Some attention is given to urban natural hazards such as floods, but the predominant focus is on stresses such as rising prices or falling incomes or losses in livelihoods, which are not considered disasters (Bull-Kamanga 2003).

argues that 'small-scale' impacts may still be labelled disasters for two principal reasons. Firstly, DR which is symptomatic of the interaction between a hazard and a vulnerable socio-ecological system is not isolated to the 'community' or 'society' scale as it can occur on multiple scales including the household. Secondly, reflecting the conventional definition of a disaster by the UNISDR (2009: 9), frequent, less extreme natural hazards have the potential to cause a "serious disruption of the functioning" of a socio-ecological system[7]. Furthermore, like large-scale disasters, persistent, less extreme natural hazards have the potential to cause "material, economic or environmental losses and impacts, which exceeds the ability of the affected [socio-ecological system] to cope using its own resources" (UNISDR 2009: 9). Therefore, the adverse effects of natural hazards on the 'small scale' may still be labelled 'a disaster' because the theoretical components of risk that may lead to a disaster are consistent across scales and because the impacts of less extreme and extreme hazards are identifiable by their effects on people's material, economic or environmental losses (Bull-Kamanga, Diagne et al. 2003, Marulanda, Cardona et al. 2010).

In an attempt to steer attention towards small-scale disasters, Desinventar (2014) proposes the use of the term 'event' instead of 'disaster'. An event considers all losses stemming from the impacts of natural, technological or anthropogenic phenomena (Desinventar 2009). However, this research argues that 'event' implies that a disaster occurs in a vacuum, isolated from any process that leads to it such as DR, or any process following it, such as recovery and reconstruction. Therefore, 'small-scale disaster' is argued as appropriate for this research. Discussion now turns to the onset of a disaster.

Onset of a disaster

Disasters are also categorised by the period from when a hazard first impacts upon a socio-ecological system to when a disaster occurs. The length of this period is the speed of onset. Disasters can be categorised as either rapid-onset or slow-onset (McFarlane and Norris 2006). Rapid-onset disasters are commonly associated with hazards that arrive within minutes or hours, for example, cyclones and flash floods, and, in the case of earthquakes, with no warning (Blaikie, Cannon et al. 2004, Siegele 2012). Rapid-onset disasters are often considered uncertain future events because the location, severity and

[7] 'Socio-ecological system replaces '*community or society'* which is found in the UNISDR (2009: 9) definition of a disaster.

impacts are difficult to correctly predict (Van Wassenhove 2006). They are also often large-scale disasters as they quickly overwhelm people's capabilities and can cause extreme disruption (Bosher 2008).

In contrast, this research is concerned with slow-onset disasters; risk that incrementally escalates over time. As such, this research will shed light on the particular ways that people perceive their risk of a disaster in a context of incrementally increasing risk. This has been largely overlooked because of a bias towards rapid-onset disasters. Slow-onset disasters are associated with a period of latent incremental change that may occur over many years; through an increased intensity; and/or frequency of less extreme repetitive impacts from hazards (Siegele 2012). Renn, Klinke et al. (2011) label this the 'delay effect'; where there is a dormant period between initial events and actual damage. Drought and desertification are examples of hazards that are associated with slow-onset disasters such as famines.

This type of DR is likely to be exacerbated by climate change which is linked to incremental and slow-onset changes that can cause more extreme weather conditions, such as prolonged periods of rainfall (IPCC 2014, Moser et al. 2010). In the context of climate change it is increasingly important to understand DR which accumulates over long periods of time (Mercer 2010)[8]. The time dependent characteristic of slow-onset disasters means that the impacts of hazards can typically be monitored and there is a warning period where people may take actions to reduce the likelihood of a disaster occurring, or reduce the severity of its impacts (Blaikie et al. 2004). However, other research argues that the insidious characteristic of slow-onset DR can be difficult to detect because it is not visually salient which can make it difficult for people to prepare for (Siegele 2012).

Seasonality and weather patterns are also important indicators of the onset of a disaster. For example, food prices and the amount of agricultural work available have strong seasonal dimensions which can exacerbate or contribute to the onset of famines (Blaikie et al. 2004). These characteristics may help people to predict the onset of a hazard, and

[8] To read about the debate about the need to merge climate change adaptation and DRR, see Birkmann and von Teichman (2010), Field (2012), Gero et al. (2011), Mercer (2010), Sperling and Szekely (2005), Thomalla and Downing (2006), Wamsler (2014) and World Bank (2003).

avert a disaster. For example, pastoralists and farmers have developed ways to reduce the negative consequences of droughts (Sabates-Wheeler, Devereux et al. 2008). However, weather patterns are becoming increasingly difficult to predict because of climate change, and, as such, seasonality is becoming less useful as a predictor for the onset of hazards (IPCC 2014).

Rural and urban disasters

Disasters were originally considered rural phenomena because rural areas experienced the greatest impact from disasters in terms of deaths, injuries and impoverishment (IFRC 2010). This encouraged a bias in disaster research, whereby the related concepts and tools were developed to focus on rural contexts (Pelling 1997, Blaikie, Cannon et al. 2004). However, because of the increasing vulnerability of urban populations and number of urban disasters, research is increasingly focusing on cities in the Global South (IFRC 2010). Disasters in rural and urban areas are not mutually exclusive. Rural and urban locales share many interdependencies that shape the effects of disasters (Tacoli 1998). For example, disasters in rural areas often disrupt the supply of goods to urban locales. Equally, disasters in urban areas may disrupt goods suppliers and services that are used in rural areas (IFRC 2010). Migration between the two may also affect DR. For example, migrants may build vernacular architecture that is custom to rural contexts, and which has the potential to increase or decrease the vulnerability of a household in urban neighbourhoods (Del Real and Gyger 2013). However, Wamsler (2014) suggests that it is important to consider the distinctiveness of urban areas and how this affects urban disasters and DR, which will now be discussed.

Pelling (2003: vii) argues that, "urbanisation looks set to be one of the most forceful drivers for and contexts of social change that will prefigure DR in the medium and long term." An urban disaster typically affects more people because of the high concentration of people living in dense environments that incorporate infrastructure; buildings; services; and political and economic centres (Wamsler 2014)[9]. However, high-income nations with a high concentration of people, buildings and industries are not generally associated with a higher number of disasters. The critical element is the ability

[9] The physical features of cities and the presence of political and economic centres do not always create vulnerability as they are also keys factors that can decrease vulnerability. Additionally, the socio-economic conditions of cities can also facilitate people to accumulate capital that is necessary for DRR.

of the city to accommodate large populations without intensifying vulnerabilities. This is problematic in the Global South because more affordable (or sometimes free) land, which appeals to lower-income groups, is often more hazardous (Smith 1996, Blaikie, Cannon et al. 2004). Therefore, people with lower levels of economic, human, physical, social and political capital often end up living on land that is exposed to more hazards, increasing their DR (Pelling 2010). Recent research by Bolivar Vallejo (2011) demonstrates these processes, in particular, how urbanisation in the Cercado province has resulted in vulnerable groups living in hazardous areas of the city.

Cities may also indirectly create new hazards. Cities typically have high levels of emission, linked to climate change, which are associated with the climatic hazards that shape DR (Sanchez-Rodriguez, Seto et al. 2005, United Nations 2007). However, Dodman (2009) argues that the per capita emissions from cities may be lower than the average for their countries. Urban areas can also intensify existing hazards. For example, high population density, inefficient heat emission and larger transport industries can intensify the urban heat island effect (Tan, Zheng et al. 2010).

The built environment, which refers to the micro-scale of a city; the buildings, streets, infrastructure and the people who engage with them, also affect vulnerability in distinct ways (Moffatt and Kohler 2008 referenced in Jabeen 2012). A dense built environment, common in urban neighbourhoods, is said to facilitate the spread of damage from one house to another, which can increase the scale of disasters (Wamsler 2006). Some research finds that high densities and space restrictions can affect how people design and build their houses, which may increase vulnerabilities (Bosher 2008, Lorch 2005). For example, a lack of available land may restrict people building deep foundations which can reduce the impact of landslides.

Research has also identified the urban 'vulnerability gap', whereby urban authorities in low- and middle-income countries have weak institutions which lack the knowledge, willingness or financial capacity to reduce DR (IFRC 2010, Wamsler 2014). Some research has argued that this 'gap' is more acute in medium-size cities, which is exacerbated by a perception within urban authorities that disasters are a rural problem and/or the responsibility of specialised disaster agencies, which was highlighted in 1.1

(IFRC 2010, Pelling 2010, Wamsler 2006). Wamlser (2006) also argues that this 'gap' is one of the reasons why DRR is increasingly carried out as the household level.

This section has theoretically and empirically grounded DR, and the particular type of disasters of concern in this research, in the wider disaster studies literature. Discussion will now review the literature concerned with vulnerability, which represents a constitute component of DR.

2.2 Vulnerability

The vulnerability literature is extremely extensive and it is not possible, or vital, to review all of it here. Rather, what is important is to focus on literature which explores the significance and characteristics of vulnerability in disaster contexts (see Cannon 1994, Cardona 2003, Pelling 2003, Bankhoff, Frerks et al. 2004, Blaikie, Cannon et al. 2004, Perry and Quarantelli 2005, Kelman 2011, Wamsler 2014). Vulnerability is an essentially contested concept; however, this research argues that Blaikie et al's (2004: 11) definition is particularly useful. Accordingly, vulnerability represents "the characteristics of a person or group and their situation influencing their capacity to anticipate, cope with, resist and recover from the impact of a hazard". Although not explicit in this quote, this conceptualisation argues that risk of a disaster can be entirely eradicated through vulnerability reduction and it emphasises the ability of a socio-ecological system to transform in order to increase its ability to avoid or reduce the impacts of hazards (Kelman 2011). As such, vulnerability is directly related to a socio-ecological system's ability to reduce DR, which is discussed in section 2.4.

There are other related terms, such as sensitivity, resilience and adaptive capacity that are often understood as loose synonyms for vulnerability. However, this research adopts vulnerability for several reasons. Sensitivity is the degree to which a system is modified or affected by disturbance (Gallopín 2006). As such, this term largely frames a socio-ecological system as passive to the impacts of hazards and does not place emphasis on the ability of the affected system to take actions to reduce impacts. From a disaster perspective, resilience refers to "the ability to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner" (UNISDR 2009: 24). Resilience has received criticism for being inherently conservative as it largely focuses on the ability of a system to 'cope' with a shock and maintain the status quo, which overlooks the ability of a system to transform (Adger 2000). Resilience, as well as

sensitivity has also been criticised for implying there is a permanent condition of insecurity that requires interventions to reduce DR. This can be contrasted to vulnerability which suggests it is possible to eradicate DR through appropriate actions (ibid).

Finally, adaptive capacity is the inherent ability of a system to evolve or undertake actions to avoid loss and/or speed recovery from a hazard (Moser and Stein 2011). This term is most often used in the climate change literature. Adaptive capacity is particularly useful for this research as it places emphasis on the transformation of a socio-ecological system to increasingly evolve beyond the impacts of hazards rather than simply 'bounce back' to the status quo. Nevertheless, 'vulnerability' is appropriate for this research as it encapsulates the ability of a system to actively resist and recover from hazards in a way that does not maintain risk of a disaster as the status quo. This contrasts to 'resilience' and 'sensitivity' which largely imply that a socio-ecological system merely 'bounces back' to its former vulnerable state and that risk of a disaster is a constant condition (Adger 2000). Furthermore, vulnerability has been used extensively within the disaster studies literature which helps to situate this research within the wider body of scholarship.

There have been distinct theoretical developments in the analysis of vulnerability in disaster contexts resulting in three principal approaches for analysing vulnerability in disaster studies: structural, integrative and agency-oriented. This research argues the latter is appropriate for addressing the research aim and most accurately reflects the influence of humans on vulnerability.

Approaches to vulnerability analysis

Structural approaches to vulnerability analysis began in the 1980s. These approaches argue that vulnerability, whether to poverty, food insecurity or natural hazards, is a function of the broader economic and political processes of society that a household, for example, is situated in (Hewitt 1983, Pelling and Uitto 2001, Blaikie, Cannon et al. 2004, Gaillard, Liamzon et al. 2007). It is necessary to explore how the broader economic and political processes constrain and enable people to reduce vulnerability and carry out their lives and livelihoods when faced with hazards. This may include investigation of: ideology; international interests; institutions or groups, and their relations to each other; laws; class structure; political systems; market relations; political

regulations; and environment/ecology across the local and global scale (Dow 1992, Hewitt 1995). Accordingly, structural approaches avoid biological reductionism.

Structural approaches link disasters to underdevelopment theory, revealing that marginalisation increases the vulnerability of people and shapes exposure to hazards (Susman, O'Keefe et al. 1983, Pelling and Uitto 2001). These approaches are highly influential in explaining why disasters disproportionately affect lower-income countries and the marginalised populations within them (Pelling and Uitto 2001). Despite this, structural approaches under-emphasise the role of agency. Marglin (1990: 8) defends this by stating: "preferences, one way or another reveal little or nothing. Much more important than the choices people make are the constraints under which they choose." However, others argue that this frames people as passive victims with negligible control over their risk. This is not appropriate for this research which explores the strategies that urban dwellers carry out to reduce DR (Adger 2006, Moser et al. 2010). Furthermore, Adger (2006) commented that structural approaches often overlook vulnerability at the individual level and often homogenise the vulnerability of whole groups and communities.

Structural approaches also disregard biophysical elements as "conjectural factors" (Watts and Bohle 1993: 62 cited in McLaughlin and Dietz 2008). However, hazards have different characteristics such as frequency, severity and speed of onset that affect the degree of harm that a socio-ecological system experiences (Cannon 2008). Integrative approaches such as the Pressure and Release model (PAR) attempt to reconcile biophysical and structural approaches (Blaikie, Cannon et al. 2004). These models conceptualise risk as the result of the intersection between social, economic and political processes and the characteristics of the hazard (Blaikie, Cannon et al. 2004, Luers 2005, Füssel 2007). Nevertheless, the role of agency still receives negligible attention (Adger 2006). In contrast, agency-oriented approaches to measure vulnerability move beyond an exclusive focus on structures and the biophysical elements of vulnerability. They are equipped to identify and explain how people have agency in reducing vulnerability, which is particularly useful for this research.

As noted above, purely structural analyses of society began receiving criticism in the 1980s because they were said to neglect the influence of agency in the social world

(Scott 1998). These critiques stem from Giddens' (1979) seminal work on the theory of structuration which does not give primacy to structure or agency. This created a shift among development researchers and policy makers towards agency-oriented approaches, which this research adopts. These approaches argue that human agency has significant influence over the social world. As with structural approaches, agency-oriented approaches capture the heterogeneity of vulnerability within a society, or locality, and that for human populations, it can differ greatly because of the effects of social structures such as class, gender, disability, immigration status (whether 'legal' or 'illegal'), ethnicity and social status (Blaikie et al. 2004). These approaches are based on the idea that wider economic and political processes differently affect these diverse social structures. Accordingly, the human actor is the principal unit of analysis; allowing disaggregation of vulnerability within and across socio-ecological systems such as households (Douglas and Wildavsky 1982 cited in McLaughlin and Dietz 2008). However, contextual policies, processes and institutions at the meso and macro level are also analysed in order to gauge the effects of political and economic processes on different human agents (Scoones 1998, Moser, Norton et al. 2010).

These agency-oriented approaches argue that humans are not equally able to access resources and opportunities to reduce their vulnerability; nor are they equally exposed to the hazards because social groups have different social roles; ultimately differently shaping how economic and political processes interact with them. One example is gender; many studies have shown that women are more vulnerable to weather related events than men (e.g. Bradshaw 2003, Fordham 2004). Differential impacts include the number of deaths; physical injuries and well-being in the post-disaster period. The disproportionate impact on women has been explained as the result of their social roles in the domestic sphere (Nelson, Meadows et al. 2002). Fordham (2003) has argued that high levels of illiteracy, minimum work opportunities outside of the home and limited mobility contribute to women's higher vulnerability levels. This is particularly pertinent to his case where social norms determine that Bolivian women are largely responsible for the domestic work. Women and children tend to spend more time around the house and so are more likely to be affected by natural hazards.

The acknowledgement of agency means that people are framed as having the potential to apply their knowledge, resources and abilities to affect their vulnerability. Alas, the

effect of agency on vulnerability may be positive or negative; what is important to stress here is that agency-oriented approaches allow research to show how and why human agents are not external to DR, but in fact shape their vulnerability. These approaches also allow this research to uncover the heterogeneity of vulnerability within, and across, different socio-ecological systems; whether countries; cities; or, most importantly for this research, households. The particular ways that different social groups are affected by political and economic processes and how this shapes their vulnerability levels are explored in full in the following sections about the components of vulnerability.

Consistent with the definition of vulnerability by Blaikie et al. (2004: 11), Wamsler (2014) breaks vulnerability down into two sets of conditions. First, those that influence how much damage is inflicted on a socio-ecological system by a hazard. This is shaped by location-specific conditions, such as, the condition of the built environment, population density and the condition of the environment (Wamsler 2014). The second set of factors influence the ability of a socio-ecological system to recover from the impacts of a hazard. The conditions for recovery pertain to all urban actors, including the population affected, and institutions that are within or exogenous to the locale, such as community churches, NGOs, local government, national government or specialist disaster agencies (Cardona 2003).

Although these two stages are temporally distinct, they are also closely interconnected because they are both fundamentally determined by the resources and abilities of a socio-ecological system. Many studies have set about measuring these resources and ability of socio-ecological systems through a focus on their physical, social, political, human and economic capital. The literature which explores how these five different types of capital shape vulnerability will now be explored. Attention is given to literature pertinent to 'Southern cities', and that which focuses on the household level, along with how design and construction features of the house shape vulnerability.

Components of vulnerability: The importance of the house

A stated above, the vulnerability of a socio-ecological can be analysed by adopting an agency-oriented approach to explore the physical, social, political, human and economic capital of a socio-ecological system. Physical capital includes the design and construction of the built environment. Large-scale and capital intensive projects such as

dams can significantly reduce people's physical vulnerability (Bosher 2008). Other research also highlights how inappropriate housing solutions and poorly constructed houses are one of the main sources of DR (Bosher 2008, Lorch 2005, Nathan 2008, Wamsler 2014). Pertinent to this research, houses can also be built in ways that reduce the impacts of hazards. As highlighted in 1.1, many people in the Global South self-build houses so there is significant potential for people to shape their vulnerability levels (Lorch 2005, Bosher 2008).

Self-build housing is where people decide where, how and when they want to build. It does not necessarily mean that household members always physically construct the house as construction workers may be employed (Greene and Amarillo 2008). Self-build houses in 'Southern cities' are often circumscribed by building codes and regulations; the reduction of physical vulnerability to natural hazards is a typical objective of these regulations (Greene and Rojas 2008, Ofori 2008). Despite this, research suggests that many people do not comply for reasons including poor enforcement and/or the increased cost that compliance incurs (Arimah and Adeagbo 2000, Green 2008).

Many studies show that house-ownership heavily determines investment in the house, as tenants are typically unable or unwilling to invest in a house they do not own (Turner 1976, Gilbert 2008, Lemanski 2011). Therefore, house-owners have higher levels of political capital, which increases their capacity to invest in the construction of the house in ways that may reduce their physical vulnerability to hazards. Gilbert (2008) argues that landlords are also less likely to adhere to building codes, which can increase the physical vulnerability of tenants. Security of land tenure is another form of political capital, which some researchers suggest precedes housing consolidation and upgrade (Abrams 1966, Turner 1976). However, this is contradicted by research which argues that the installation of services is more influential because it indicates de facto official government acceptance of the continued existence of a community (Strassmann 1984, Gilbert and Ward 1985, Varley 1987, Boonyabancha 2005).

Houses also provide access to basic services, such as sanitation, water and electricity, which can reduce the impact of hazards on people's lives (Hardoy and Pandiella 2009). However, this is dependent on the quality of infrastructure. For example, during floods, households with latrines are typically more vulnerable to water borne diseases than people living in houses connected to a sewage line (UN-Habitat 2003). These services

are not exclusively dependent on the household but are heavily determined by institutional context. Research on climate change adaptation in cities of the Global South indicates that there is often inadequate institutional capacity which can lead to poor infrastructure and services within urban neighbourhoods. This may subsequently exacerbate the vulnerability of people living within these areas (Dodman, Bicknell et al. 2012).

Building on this, other research argues that the condition of infrastructure and the quality of access to basic services is heavily bound to political and legal recognition of communities by the state (Moser, Norton et al. 2010). Neighbourhoods that are formally recognised by the State are more likely to receive urban planning improvements such as the installation of drainage canals which can address flooding, for example (Moser et al. 2010, Wamsler 2006). Despite this, research by Wamsler (2006) shows that urban planning by city authorities is often inadequate in reducing DR, and may even increase the DR of urban dwellers. She adopts the term 'mainstreaming' to signify the need for DRR to be integrated into the wider development projects of urban authorities, and for DRR to become an integral part of urban planning practice in general.

State recognition of urban neighbourhoods also represents another form of political capital which can heavily shape vulnerability at the household level. Literature suggests neighbourhoods which are recognised by the state are more likely to receive support from urban authorities to address DR (Blaikie, Cannon et al. 2004, ADPC 2006). However, Pelling (2010) suggests that urban authorities often overlook preventative measures for combatting small-scale disasters, and focus on large-scale disasters in the post-disaster stage (Pelling 2010). Furthermore, disasters are often viewed within urban authorities as biophysical phenomena and a function of infrastructure planning that are best addressed by specialised disaster agencies that apply engineering and technological solutions (Pelling 2011, Wamsler 2006). The literature suggests that weak institutional support to address DR is often a problem in 'Southern cities', and is one of the reasons why DRR often takes place at the household level. As highlighted in 2.1, research suggests that this is symptomatic of the urban 'vulnerability gap' (Wamsler 2006), whereby there is a "lack of knowledge and financial capacity (and sometimes willingness) of urban authorities to reduce risks" (IFRC 2010: 20).

Moving on from political capital, research suggests that human capital which represents education, health and the nutrition of individuals is also linked to vulnerability (Bebbington 1999). Health determines people's capacity to work, and skills and education determine the returns from labour (Moser 2006). Other research suggests that higher education levels are linked to better understanding and awareness of risk and access to risk reduction measures (Lutz 2010, Wamsler 2011, Striessnig, Lutz et al. 2013). Education is also linked to higher paid occupations which can be invested in the construction of the house for example (Bosher 2008, Wamsler 2011). Higher levels of economic capital can also aid in the recovery and reconstruction phase of a disaster (Cannon 1994, Adger 1999, Adger 2006). However, access to income earning opportunities is not always equal between and within households as social structures based on gender, ethnicity, age and disability can significantly shape access to labour markets and alternative sources of income (Moser 1998).

Structural racism can also result in the social exclusion of certain groups accessing collective and individual goods such as health, education and work. This is particularly important in Bolivia, as some research shows that indigenous groups, such as the Quechuas, Aymaras, Guarani, Chiquitano and Mojeno, are often excluded and marginalised from higher income earning activities (typically professional occupations) (Molina and Albó 2006). This is explained as the result of structural racism whereby indigenous groups are socially excluded from higher levels of education and from accessing professional, and typically higher paid, occupations (Kelley 1988, Psacharopoulos 1993, Patrinos and Psacharopoulos 1996). However, recent research indicates that this has significantly changed since Evo Morales was elected as President in 2005. Morales has made many administrative reforms to address structural racism, which have been linked to the fall in poverty levels of indigenous people from 2001 to 2012 (Canessa 2012).

These reforms include the 2012 'Ley de bienes y inmuebles' ('Real Estate Law'), which makes it significantly easier for indigenous groups to secure their land tenure. Prior to this law, indigenous groups were often discriminated against in this process and it took many years to secure legal land tenure; deterring many from applying. However, legal land tenure is necessary if Bolivians are to access goods such as bank loans or opening up a bank account (Crabtree and Chaplin 2013). As such, the indirect effects of lacking

land tenure were substantial on indigenous groups. Despite these improvements, the Defensoria del Pueblo, which acts as the Ombudsman of Bolivia, indicates that indigenous people remain the most discriminated against and segregated groups (Defensoria del Pueblo 2014). This has been used to explain why the number of people who self-identify as indigenous has declined by 18% since 2001 (INE 2012).

Social safety programmes, such as transfers in cash or kind, represent another source of income. They aim to prevent people who are vulnerable to shocks, such as disasters, falling below certain poverty levels (Barrientos 2011). Recent research shows that they can reduce vulnerability depending on how they are targeted and invested in by people (Clay 2011). Morales also made use of conditional cash transfers in Bolivia to address structural racism against indigenous groups and to improve poverty levels in general. These include the Renta Dignidad (Dignity Pension), which is a cash transfer for people over 60 years old (Gonzales 2011), and the Bono Escolar Juancito Pinto ('School Bond'), which is a cash benefit given to guardians of school children aged six to twelve (Sugiyama 2011). The latter focuses on increasing school enrolment and completion among lower income groups, which includes many indigenous people. One of the principal aims is to encourage long-term positive changes to the human and economic capitals of people.

The stability of economic capital is also crucial. For example, research shows that people who rely on the number of days that they work are vulnerable because they may lose earnings if they have to invest time in the recovery phase (Jabeen, Johnson et al. 2010). Further, households that rely on the house as a productive asset and set up small house-based businesses such as shops, may be more economically vulnerable than people who work beyond the house because a disaster can eradicate their only source of income (Dankelman 2010, Jabeen, Johnson et al. 2010). Therefore, research suggests that households with multiple and diverse sources of income are generally less vulnerable (Cannon 1994).

Household composition further complicates access to and use of income. Agarwal (1997) argues that household members do not always act democratically and collectively. The investment of economic capital is tightly bound up with intra-household dynamics and relationships. For example, in households where only men earn an income, or

where women earn significantly less, men often control the purse strings and women are often marginalised from decisions (Agarwal 1997). Therefore, the ways that economic capital is spent may be heavily dictated by particular members of a household, which, for this research, may heavily shape how a house is designed and constructed. Household composition also shapes the resources and skills that are immediately available to a household and which can be applied to reduce vulnerability (Morrow 1999). For example, households with more healthy adults are often less vulnerable than households with more elderly members as their labour and skills may be more effective for vulnerability reducing activities such as housing construction (Moser et al. 2010).

Research also indicates that social and cultural norms may shape vulnerability. For example, countries, including Bolivia, have social norms which dictate women take responsibility for domestic duties. This increases the amount of time that women are exposed to natural hazards and their potential impacts (Wamsler 2006). Additionally, women typically engage less in income earning activities because of these norms; increasing their economic vulnerability and reducing their household bargaining power to influence how income is spent, whether on risk reduction or not (Velasquez, Bonapace et al. 2012). This is also true of older and disabled people, as research suggests that they are also likely to spend more time at home (ibid). However, other studies show that this can be circumvented by using the house as an income earning asset, by building a shop in the house or renting out rooms (Moser 1998, Moser 2010, Velasquez, Bonapace et al. 2012). Nevertheless, and as highlighted above, exclusive or heavy dependence on the house for income earning activities may exacerbate household vulnerability (Cannon 1994).

Studies also argue that social capital which is broadly defined by Gilchrist (2009: 4) as "a collective asset made up of social networks based on shared norms, trust and mutuality" significantly affects vulnerability. Woolcock suggests that there are three types of social capital. "Bonding social capital, which is based on enduring relationships with strong mutual commitments", "bridging" social capital that encompasses relationships between people that have overlapping interests (Woolcock 2001: 6), and "linking" social capital which relates to the trust across authority. Research suggests that social capital increases the likelihood that households will receive support to reduce risk and to recover after a disaster (Pelling 1998, Adger 2003, Pelling and High 2005).

Nakagawa and Shaw (2004) found that disasters potentially increase social capital among inhabitants of affected neighbourhoods; manifesting as a greater willingness to work together to prevent future disasters. However, their study was based on the 2004 Asian Tsunami, so findings may not translate to the context of small-scale disasters where there is not a "massive collective stress" (Kinston and Rosser 1974: 438). Furthermore, Wamsler (2014) argues that high levels of social capital are less common in urban neighbourhoods compared to rural neighbourhoods; so efforts to reduce vulnerability are more common at the household level, which means that they are often less effective.

In sum, vulnerability is a complex and multi-faceted concept. There are many interrelated components that are located on multiple scales and which are not static over time. The sum of these components dictates the extent of damage a hazard has on a socio-ecological system, and its ability to respond and recover. Critical to this research, this review reveals that the house significantly shapes the vulnerability of urban dwellers. The design and construction features of the house dictate physical vulnerability which heavily shapes the impact of hazards. However, the ability to accumulate and maintain political, social, human and economic capital that can reduce vulnerability is also heavily bound by the design and construction features of the house.

Although naturalist models are applied to measure 'real' vulnerability, and subsequently 'real' risk of disasters via sophisticated and technical models, people's perceptions of DR do not always mirror the results of these models (Haynes et al. 2008). This poses problems for policies, which assume there is a cause and effect relationship between 'real' risk, risk perceptions and responses; that people will automatically reduce their risk when they have the ability. The following section reviews research of how perceptions of risk are formed, and how risk perceptions shape the responses of people living in disaster prone areas.

2.3 Risk perceptions

A risk perception is a person's assessment of the probability of a particular event occurring and how concerned a person is with the consequences (Sjöberg, Moen et al. 2004). It is constituted by an individual's understanding of and ability to cope with

signals about dangers, vulnerabilities and uncertainties (Jasanoff 1998). The way a person interprets these signals is determined by many elements, and the theoretical approach adopted determines what factors are deemed the most influential when a person interprets these signals (Katz and Lazarsfeld 1970).

Perceptions of risk are conceptually distinct from the 'objective' concept of 'real' risk that risk experts claim can be measured using naturalist risk models (see section 2.1) (Bradbury 1989, Jasanoff 1998). However, this ontological distinction is inaccurate as Pidgeon et al. (1992: 90) commented that all estimates "involve a range of judgements determining the parameters of the issue." 'Real' and 'perceived' risk inescapably encompass human interpretation to a greater or lesser degree (Slovic 1982). Despite this, the present research acknowledges the usefulness of standardised ('naturalist') models that can be used to analyse DR across space and time. Exploration of 'real' risk and people's risk perceptions across the research site also provides an opportunity to question how and why the two may, or may not, reflect one another. This will be useful in explaining how and why people respond in certain ways when living in disaster prone contexts.

Understanding risk perceptions

There are two principal approaches for studying risk perceptions - realist approaches and constructivist approaches. Realist approaches aim "to bring perception as close as possible to the objective risk of an activity or an event" (Wachinger and Renn 2010: 8). They assume there is an objective and 'real' risk that people can recognise and understand perfectly. Studies and policies which apply realist approaches argue that people use cognitive processes to simplify and understand the nature of 'real' risk (Fischhoff, Slovic et al. 1978, Slovic 1982, Slovic 2000). In this way, human beings are said to calculate their risk based on the nature of the 'real' risk, and in isolation from other broader social and cultural factors that may influence their perceptions of DR (Johnson and Tversky 1983). As such, there is an assumed direct causal relationship between people receiving information about DR and their risk perceptions (Bradbury 1989, Hewitt 1995, Sjöberg, Moen et al. 2004, Wachinger, Renn et al. 2013).

Due to the assumed causal relationship, realist approaches have encouraged top-down interventions that focus on the communication of risk information to vulnerable groups

because it is expected that people will automatically attempt to reduce risk when exposed to this information (e.g. Mileti and Darlington 1997, Sandman and Lanard 2003, Eisenman, Cordasco et al. 2007, Shklovski, Palen et al. 2008, World Bank 2012, United Nations 2013). However, perceptions of risk regularly do not mirror 'real' risk. Social constructivist approaches, which this research adopts, are useful for explaining why this is the case (Haynes et al. 2008).

Social constructivist approaches to risk perceptions are based on the idea that a risk perception is a socially constructed phenomenon that is not governed by the cognitive ability of a person to understand the properties of 'real' risk (Jasanoff 1998, Douglas 2013). Accordingly, risk perceptions may be constructed by a wide variety of factors, such as; scientific or technical definitions; personal experiences; social norms; emotion; imagery; trust; values; and worldviews (O'Connor, Bord et al. 1999, Slovic 2000, Leiserowitz 2006, Weber 2010). It is clear that risk perception is deeply related to a person's understanding of the world based on their own (socially constructed) reality (Hopkins 2013). Through a social constructivist lens Pidgeon et al. (1992: 8) provide a succinct definition of a risk perceptions as "people's beliefs, attitudes, judgements and feelings, as well as the wider cultural and social dispositions they adopt towards hazards and their benefits." Therefore, cultural, psychological, institutional and social processes along with technical assessments may decrease or increase a person's perception of risk (Renn, Burns et al. 1992). This approach has been used to help explain how and why the risk perceptions of vulnerable people may differ from their 'real' risk. Reflecting this Renn, Burns et al. (1992: 137) state:

> The social experience of risk is not confined to the technical definition of risk, i.e., the product of probability and magnitude. What human beings perceive as threats to their well-being is influenced by their values, attitudes, social influences, and cultural identities.

Sunstein (2006: 195) states that "the availability heuristic ensures that some risks stand out as particularly salient, whatever their actual magnitude." Put differently, social learning circumscribes what is understood as dangerous and how much risk a person will tolerate (Dake 1992, Rohrmann 1994, Hardin and Higgins 1996, Rippl 2002). Therefore, risk perceptions are tightly bound up with the characteristics of a person, such as gender, age or disability because these characteristics affect how an individual experiences the social world and their role within it (Douglas 2013).

According to this approach, analysis of risk perceptions must, therefore, look beyond the physical properties of a disaster to the multiple factors in any given social context. Subsequently, social constructivist approaches do not label people as 'non-rational' or unable to comprehend 'real' risk when perceptions do not 'match up'; a fundamental problem that was discussed in the problem definition (1.1). As such, a social constructivist approach is appropriate for this research which explores how risk perceptions are formed, and to what degree they influence human behaviour. The next section reviews the particular factors that construct risk perceptions according to social constructivist approaches.

Factors shaping risk perceptions

As highlighted above, research has found that many variables such as profession, perceived personal vulnerability, proximity to a hazard, and size of a community may shape risk perceptions (Wachinger and Renn 2010). Research has also looked at the effects of age and education on risk perceptions (Grothmann and Reusswig 2006, Siegrist and Gutscher 2006, Ruin, Gaillard et al. 2007, Miceli, Sotgiu et al. 2008). Some research has found that, on average, women are more concerned about disasters than men (Savage 1993, Flynn, Slovic et al. 1994, Bassett, Jenkins - Smith et al. 1996, Miceli, Sotgiu et al. 2008). Building on this, research on gender and development has found that women's social roles and locations in the domestic environment often make them the first to notice subtle and slow changes in the everyday environment. This makes them more likely to respond to these changes (Momsen 2010: 117 quoted in Jabeen 2012). However, other research has not found any noteworthy difference in significance across age, gender and education when previous experience with hazards is controlled for (Grothmann and Reusswig 2006, Siegrist and Gutscher 2006, Ruin, Gaillard et al. 2007, Miceli, Sotgiu et al. 2008, Wachinger and Renn 2010, Wachinger, Renn et al. 2013).

Looking to the influence of the house, studies have explored how the design and construction features of the house shape people's risk perceptions of hazards, such as crime (Foster and Giles-Corti 2006), though this is more common in the Global North. However, the influence of the house on the risk perceptions of disasters associated with natural hazards is often overlooked. Okazaki et al. (2008) compared

the risk perceptions of people living in earthquake prone urban areas in Indonesia, Nepal, Pakistan and Turkey; they argue that the design and construction features of a person's house determines the nature of people's risk perceptions (Okazaki, Ilki et al. 2008). In particular, people associate certain design and construction features, such as brick and reinforced concrete, with lower risk. This means that have lower risk perceptions, which is also reflected in research by Green (2008). Research has largely focused on the effects of direct and indirect experience, arguing that these are the most significant predictors for the nature of risk perceptions (Grothmann and Reusswig 2006, Siegrist and Gutscher 2006, Ruin, Gaillard et al. 2007, Miceli, Sotgiu et al. 2008, Wachinger and Renn 2010, Wachinger, Renn et al. 2013).

Direct experience encompasses damage, to property or person, and witnessing the impact of a hazard with one's own eyes. It is said to provide vivid and rapid recall of information; greater personal involvement; and lower levels of uncertainty (Weinstein 1989). Furthermore, research suggests that people who experience more severe impacts perceive hazards to be more life threatening, and typically display greater dread (Finucane, Alhakami et al. 2000, Felgentreff 2003, Ruin, Gaillard et al. 2007). However, concern with risk is most acute in the period after initial impact, and is said to diminish over time (Weinstein and Nicolich 1993). In contrast, Krasovskaia, Gottschalk et al. (2001) argue that people who suffer minor or no damage, typically perceive risk to be lower. Some researchers argue that this is due to the 'normalisation bias', whereby people who cope with less severe hazards over-estimate their ability to deal with future hazards because they expect them to be the same (Weinstein 1980, Paton, Smith et al. 2000). Others argue it is because people are unable to imagine how a hazard might affect them (Peacock, Brody et al. 2005, Grothmann and Reusswig 2006, Siegrist and Gutscher 2006).

Other research suggests that indirect experience fills the 'gap' left by people's lack of direct experience (Dunwoody and Peters 1992, Breakwell 2007). Individuals may form perceptions based on secondary sources of information provided through informal social networks, opinion leaders, the media, personal networks or public agencies (Covello and Mumpower 1985, Breakwell 2007). However, the particular interpretation of risk that these sources disseminate is not necessarily determined by 'real' risk. Often factors such as the social norms and institutional conduct that they

are subject to are most influential in determining their risk perception (Renn, Klinke et al. 2011). The influence of this information on others' risk perceptions is said to be determined by trust, which is "of considerable importance when dealing with unfamiliar, infrequent and complex environmental hazards" (Paton 2008: 4). In other words, people are more likely to take note of information from a source that they trust. Therefore, research suggests that it is the quality of relationships between people, communities, civic agencies, media or governmental authorities that most heavily influence the nature of people's risk perceptions and responses, not the content of the information per se (Siegrist and Cvetkovich 2000, Paton 2008).

Research which explores horizontal risk communication suggests that personal networks are important mechanisms for people to learn about the nature of risk, its potential consequences and strategies to reduce DR (Montgomery and Casterline 1996, Kim and Bearman 1997, Kohler, Behrman et al. 2007). Despite this, more research has focused on the vertical communication of mono-logic information and often overlooked the transfer of risk information among friends, family, neighbours and their attendant social and cultural institutions such as churches and community groups. One of the main reasons for this is because of the continued influence of the Rational Actor Paradigm (RAP) the 'Knowledge, Attitudes, Behaviour' model (KAB), and the 'Information Deficit' model (IDM), within disaster studies and policy responses (IFRC 2014). As previously highlighted, they all assume a direct cause and effect relationship between risk information, risk perceptions and responses.

Studies which explore top-down communication of risk information have given particular attention to the role of the media (Breakwell 2007). However, the media is often biased towards large-scale and dramatic disasters and overlooks "low key" or "tame" small-scale disasters with which this research is concerned (Ram 1995: 173). Krimsky and Golding (1992) argue that media coverage can intensify or attenuate an individual's concern with DR. However, other research indicates that the media typically reconfirms existing perceptions and has negligible influence if a person has direct experience of hazards (Dunwoody and Peters 1992, Siegrist and Gutscher 2006, Breakwell 2007). Interestingly, Llasat-Botija, Llasat et al. (2007) propose that the media has greater impact on the perceptions of people living outside of the affected area

because media coverage is their only source of information about the given area (Llasat-Botija, Llasat et al. 2007).

Local authorities are another source of risk information because they often produce building codes that aim to encourage people to construct houses that reduce people's vulnerability to local natural hazards (see section 2.2). Therefore, these building codes and regulations implicitly suggest that people have a degree of control over their DR. Pertinent to this research which explores the design and construction of the house, Motoyoshi (2006) suggests that these codes encourage people to reduce their DR through investment in housing. However, as discussed in 2.2, people often dismiss building codes because of a perceived increase in the cost of construction (Arimah and Adeagbo 2000, Green 2008).

Local authorities may also carry out risk zoning, which can provide an easily understandable indicator of people's 'real' risk when translated into a 'risk map'. Crozier and Glade (2006) argue that risk perceptions typically positively 'correlate' with these maps, as people living in low-risk zones tend to de-emphasise DR whereas people in high-risk zones see hazards as more probable; experiencing greater concern with potential impacts and indicating a high level of trust in urban authorities (Crozier and Glade 2006, Siegrist and Gutscher 2006). Despite this, some studies suggest that zoning may promote learned helplessness, or fatalism, whereby people living in high risk zones perceive risk as natural and therefore uncontrollable (Blaikie, Cannon et al. 2004). This can encourage inaction because people perceive DR as determined by forces beyond their control (Weiner 1985, Peterson, Maier et al. 1993, McClure and Williams 1996, Lindell and Perry 2000).

Other research has highlighted how the characteristics of hazards are also critical to the construction of risk perceptions. People living in areas that are more frequently affected by hazards are said to perceive that they are at a higher risk of disasters than people in less affected areas (Brilly, Polic et al. 2005). Vedwan and Rhoades (2001) also argue that people are more likely to take note of the impact of hazards that are more visually salient over prolonged periods. Related to this, Sterman (2008) notes that people find it difficult to understand that risk accumulates when the incremental impacts of hazards are not visible, which makes it difficult to make prognoses about when a disaster will

occur. This is particularly interesting for the present research which explores disasters with a period of latent incremental change that may occur over many years or through an increased intensity and/or frequency of repetitive events (Siegele 2012) (see section 2.1).

Although research has made great strides in understanding how risk perceptions are formed, the link between an individual's risk perception and their responses in disaster-prone contexts is still less clear. Studies have also concluded that the relationship appears to be weak, as Haynes, Barclay et al. (2008: 259) commented:

> It is now understood that there is not necessarily a direct link between awareness, perceived risk and desired (by risk managers) preparations or behavioural responses.

The next section explores literature concerning the relationship between risk perceptions and responses in disaster contexts.

Risk perceptions and responses

Reviewing the literature concerning the relationship between risk perceptions and responses shows a bias towards contexts of extreme, infrequent hazards linked to large-scale disasters, as opposed to frequent, less extreme hazards linked to small-scale disasters, which this research explores (e.g. Takao, Motoyoshi et al. 2004, Motoyoshi 2006, Miceli, Sotgiu et al. 2008, Heitz, Spaeter et al. 2009, Gierlach, Belsher et al. 2010, Jóhannesdóttir and Gísladóttir 2010, Wachinger and Renn 2010). Furthermore, research has given more attention to how risk perceptions influence responses during and after the impacts of hazards with a tendency to overlook how risk perceptions shape anticipatory and preventive measures, which this researched is concerned with (Chester, Duncan et al. 2007).

Studies that explore this relationship tend to investigate the influence of risk perceptions on any number of responses that people may carry out; without the specific focus on how people self-build their houses. The small number of studies that have conclude that there may be a clear difference in risk perceptions among people, but that there is often a minor difference in the ways that people design and construct the house to reduce risk (Green 2008). This is said to be because a disaster creates an awareness of the need to address DR among people who are involved in housing construction, such as Builders, masons and house-owners. The present research builds on this work,

however, rather than a focus on a context of large-scale and rapid onset disasters, which characterise these studies, the present study focuses on the incrementally increasing risk of small-scale disasters.

Literature also suggests that house design and construction features, such as building a house on stilts or using more durable materials, associated with lower vulnerability to natural hazards, are largely discussed through the vernacular of DRR. Therefore, it is explicitly or implicitly suggested that these design and construction features have been incorporated wholly, or largely, because of people's perceptions of risk and their desire to reduce this risk. A major reason for this is a tendency to conceptualise the house as a physical resource to reduce DR, whilst overlooking other literatures which more holistically conceptualise the function of the house. According to these alternative literatures, people who self-build in 'Southern cities' often choose certain design and construction techniques to transform and facilitate social, economic and cultural processes, which may or may not be related to DRR (Gough and Kellett 2001, Kellett 2005, Klaufus 2012). Through a more holistic conceptualisation of the house, housing features that are typically explained as risk-reducing in disaster studies may have an altogether different function, meaning and explanation according to this other body of literature.

Adoption of a more holistic conceptualisation of the house has direct implications for identifying how, and to what extent, risk perceptions, and the pursuit of risk reduction, shapes how people design and construct their house. This literature is fully explored in 2.4; however, at this juncture it is important to recognise that analysis of the relationship between risk perceptions and responses would benefit from exploration of the DRR *and* non-DRR dimensions that influence how people design and construct their houses. This would allow research a more nuanced exploration of the house which is able to pin down to what extent a person's perception of risk shapes housing construction within a conceptual framework where the house also has a role to play in the transformation and consolidation of social, economic or cultural process.

Wachinger and Renn (2010) reviewed fifty-nine studies that looked at the relationship between risk perceptions and concluded that the link is still unclear. Some research suggests that a low risk perception lulls people into a false sense of security (Weinstein

1980, Harris 1996, Johnston, Lai et al. 1999). As such, some argue that individuals with low risk perceptions are less likely to respond to warnings and undertake preparedness measures (Crozier and Glade 2006, Hung, Shaw et al. 2007, Ruin, Gaillard et al. 2007). In line with this thinking, studies have also shown that higher risk perceptions catalyse risk-reducing or protective action (Mileti and Sorensen 1987, Plapp and Werner 2006, Siegrist and Gutscher 2006, Miceli, Sotgiu et al. 2008, Heitz, Spaeter et al. 2009).

In contrast to this research, other studies argue there is often a 'paradox' because individuals with high-risk perceptions regularly do not act to reduce their risk. As highlighted in 1.1, there are several explanations, including fear which is said to overwhelm people's ability to act or can induce passivity and fatalism (Karanci, Aksit et al. 2005, Grothmann and Reusswig 2006, Siegrist and Gutscher 2006, Hall and Slothower 2009, Jóhannesdóttir and Gísladóttir 2010). In contrast, denial may protect an individual from the unpleasantness of fear in which they simply refuse to believe in such a reality (Lewis, Kelman et al. 2011). Further and as highlighted in 2.3, people may have 'normalisation bias', or what is sometimes called 'the illusion of invulnerability', whereby people believe they are less likely to be harmed by hazards than other people, or they underestimate the impacts of hazards, even if they believe that they will experience a negative event (Weinstein 1980, Paton, Smith et al. 2000).

Therefore, these studies largely argue that people do not act to reduce risk because they have a 'bounded rationality' whereby "behaviour is generally rational or logical but is limited by perception and prior knowledge" (Tobin and Montz 1997: 5), which makes them "unintentional risk takers" (Douglas and Wildavsky 1982: 13). As these studies are essentially based on a realist approach to analyse risk perceptions, they often conclude the solution is to educate people about their risk through the dissemination of risk information (e.g. Mileti and Darlington 1997, Sandman and Lanard 2003, Eisenman, Cordasco et al. 2007, Shklovski, Palen et al. 2008, World Bank 2012, United Nations 2013). However, as 2.3 discussed, people use many mechanisms other than risk information to gauge their DR and so risk perceptions may not reflect the risk information or encourage the expected behaviour by disaster managers (Haynes, Barclay et al. 2008). The RAP, KAB and IDM models, which form the foundations of these studies, suggest that people will change their behaviour simply if they receive information have been shown to be inadequate in most aspects of human behaviour,

especially in regard to environmental problems and most notably in relation to climate change (Kollmuss and Agyeman 2002, van der Linden 2014 cited in IFRC 2014). The IFRC (2014: 72-73) report argues:

> It cannot be assumed that information or even education guarantees that people will face up to the risks that confront them…Culture, psychology and emotion intervene as filters that alter the way information is used to change attitudes and behaviour. Any new knowledge inevitably has to interact with already-significant attitudes and emotions, rather than providing the means to change attitudes. This means that it does not always produce the intended behavioural outcome.

Other research argues that social, economic or political factors may also influence human behaviour and help explain why people do not always engage in risk-reducing behaviour, even when they have high risk perceptions (Lupton 1999; Douglas 1992). Research which explores how social economic and political processes shape behaviour in disaster contexts does not explain behaviour as 'non-rational', or as the result of a bounded rationality, when people do not attempt to reduce risk or prioritise risk reduction. For example, Burton et al. (1993:65) argue that people often have alternative objectives and so do no prioritise DRR;

> In many instances they [vulnerable people] would have goals quite different than maximizing the expected utility. The bounds on rational choice is dealing with natural hazards, as with all human decisions, are numerous.

Other studies argue that risk-reducing behaviour may be discouraged when there are high levels of trust in external actors, such as local authorities, to reduce impacts and to facilitate response and recovery from disasters (Baan and Klijn 2004, Hung, Shaw et al. 2007). However, as 2.2 showed, coordinated institutional support is often underdeveloped in 'Southern cities'. Others state that the gap between risk perceptions is often because people are unaware of appropriate risk reducing action (Siegrist and Gutscher 2006). However, this appears to be contradicted by the many recent studies that focus on the bottom-up strategies carried out within disaster prone communities (see section 2.4). Further, some studies argue that even when people want to reduce risk they may lack the resources, such as time, skills and economic capital to reduce risk, which is strongly related to their vulnerability levels (Grothmann and Reusswig 2006).

In contrast some studies argue that there may be other risks which people perceive as more important than a disaster, such as income and security (Barberi, Davis et al. 2008,

Lavigne, De Coster et al. 2008). This relates to what the World Disaster Report (2014: 67) labelled the 'risk hierarchy', whereby people generally give:

> A very low priority to the serious hazards that disaster risk reduction agencies try to deal with. They apply much higher significance to problems of everyday life and issues that they have to confront for normal survival, most of which are linked to their livelihoods.

Instead of being interested in floods or earthquakes, research indicates that people typically mention immediate and everyday problems like food on their plate, paying school fees, getting water, crime, road 'accidents' and so on (Blaikie et al. 2004, IFRC 2014). However, this thesis is directly concerned with frequent natural hazards that are linked to slow-onset risk of small-scale disasters. Therefore, this thesis provides an opportunity to explore whether the frequency of hazards will increase people's concern with natural hazards and encourage more actions to address DR. It also gives the opportunity to explore how people respond to slow-onset risk, which may show that people take anticipatory action in order to address problems in the distant future, rather than actions to address everyday problems, which has encouraged the idea that vulnerable people in the Global South live on a 'day to day' basis.

Finally, other studies argue that people may choose to remain in a risky area as they perceive living conditions to be worse in other areas (Heijmans 2001). The IFRC (2014: 67) labels these "risk cultures" which enable people to live with danger because they perceive there are benefits. Research on the idea of 'risk cultures' has predominantly focused on benefits to people's livelihood activities such a closeness to income earning opportunities (e.g. Blaikie et al., 2004; Shepherd et al., 2013; DFID, 2005). However, this thesis argues that the term 'risk culture' places over emphasis on 'risk' as the defining trait of a social context and, subsequently, diverts attention away from the many and diverse factors that may encourage, or force, people to live in risky areas. In contrast, Starr (1969) uses the term 'voluntariness' to describe a society that seems to accept risks when they are associated with benefits, and the ability to control risk to some degree. Although this has the same fundamental meaning as 'risk culture', this thesis argues that the difference in terminology ensures that emphasis is on the dimensions that may make living with risk attractive to people. This is important because it implicitly conceptualises social contexts more holistically than simply an area where risk exists. Nevertheless, this can overlook the factors that force people to live with risk such as low levels of economic capital for example.

Research which explains 'voluntariness' using social constructivist epistemology, views people's voluntariness to live in risky areas as deeply conditioned by their freedom of action and ability to reduce risk. This is largely shaped by their social categorisation (age, gender and disability) and how these different social groups are shaped by wider economic and political processes (Jasanoff 1998). People may not consciously acknowledge these influences on their behaviour, examples include the impacts of advertising on drinking or smoking (Douglas 1986). Therefore, voluntariness is a socially constructed element of risky activity, not an intrinsic property of certain kinds of risk. Accordingly, risk reduction policy ought to focus on empowering people to make more proactive decisions about risk, rather than focusing on risk communication (Jasanoff 1998).

In sum any research which explores the relationship between risk perceptions and responses must consider processes located beyond the properties of 'real' risk. To do otherwise is to reduce human behaviour to nothing more than a caricature. Although the links between risk perceptions and responses are unclear, there is increasing research in to the many strategies that vulnerable populations carry out to reduce DR in the Global South. The next section reviews this literature, with particular attention on the role of urban dwellers and self-build houses.

2.4 Disaster risk reduction

Within disaster studies, theoretical and empirical developments have resulted in a transition from Disaster Management (DM), which focuses on reactive response and recovery, towards a more preventative approach known as disaster risk management (DRM) (Sabates-Wheeler, Devereux et al. 2008). This was partly due to the Hyogo Framework for Action 2005-2015 (UNSIDR 2005) which called for disaster risk reduction (DRR), which is defined as:

> systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events (UNISDR 2009: 100-11).

Wamsler (2014) suggests that DRR requires four distinct stages: i. Hazard reduction and avoidance; ii. Vulnerability reduction; iii. Preparedness for response, and iv. Preparedness for recovery (see Table 2). The stages of DRR are deeply interconnected

(Etkin 1999, Wamsler 2014). For example, household income diversification can fund the reconstruction of the house which may reduce physical vulnerability; however, income diversification may also aid in the ability of a household to respond and recover.

In a context of persistent, less extreme hazards linked to incrementally increasing DR, this approach brings DRR more in line with the longer term and anticipatory perspective of the climate change community (Thomalla and Downing 2006).

Table 2 The four stages of disaster risk reduction

Stage of DRR	Activity
Hazard reduction and avoidance	reduce or avoid current and future hazard exposure
Vulnerability reduction	reduce current and future potential impacts from hazards
Preparedness for response	create mechanisms and structures to respond to potential hazards/disasters
Preparedness for recovery	create mechanisms and structures to recover to potential hazards/disasters

Source: Wamsler (2014)

The next section reviews research on DRR with an emphasis on tracing the role of urban dwellers and self-build housing in this process.

Types of disaster risk reduction

The four stages of DRR can be carried out by a variety of urban actors such as transnational, governmental, non-governmental institutions, community groups, communities, households or even individuals. Further, there are three broad approaches to DRR: technological, structural and agency led solutions. These particular approaches to DRR are highly determined by how a disaster and vulnerability are conceptualised.

Technological, or biophysical, solutions, as they are otherwise known, are underpinned by the belief that disasters are a biophysical process (Hewitt 1983). This, according to Hewitt (1995: 117), allows other research disciplines, and the State, to avoid treating disasters as "failures of a research paradigm or policies and organization…[or the] conduct of everyday life." Focus is often on 'modern' and capital-intensive DRR solutions which require infrastructure-based solutions, and aim to reduce exposure to a hazard and/or alter the severity of the hazard **(**Blaikie et al. 1994, Dodman and Mitlin 2013, Smith 1996). Examples include the construction of large dams to prevent

flooding or the building of retaining walls to prevent landslides. Less direct physical interventions that are often carried out by urban authorities pertain to the establishment of building codes and regulations (see 2.2) (Arimah and Adeagbo 2000, Green 2008, Ofori 2008).

Non-physical solutions often emphasise hazard avoidance by prohibiting development, or imposing resettlement programmes away from disaster-prone areas (Chan 1995, Sou 2009, Felli and Castree 2012). These are often ineffective, as people often prefer closer proximity to income earning activities and better access to basic services in urban centres (Cutter 1993, Sou 2009). This draws on Starr's (1969) concept of 'voluntariness' to live with risk if it is associated with benefits and an ability to control risk to some extent (Jasanoff 1998). Although resettlement programmes are often adopted by urban authorities in 'Southern cities', the literature significantly critiques resettlement programmes because they imply that 'escaping' the area is the only viable solution (Blaikie, Cannon et al. 2004, Felli and Castree 2012). Felli and Castree (2012) argue that this frames DRR as the responsibility of individuals and absolves authorities from having to intervene to address DR.

Others argue that biophysical solutions are often based on instrumental rational and technocratic techniques which are deeply depoliticizing because they often overlook the social determinants of DR (Hewitt 1997, Centeno 2010). Furthermore, solutions are often presented as objective, scientifically rigorous and expert led, which can marginalise vulnerable groups from engaging in debate about social and political questions concerning DR (Hajer and Versteeg 2005, Felli and Castree 2012). Finally, by focusing on the role of technology and 'science', these solutions largely overlook the agency of vulnerable populations to reduce risk, and the potential role of other urban actors (Hewitt 1995, Prowse and Scott 2008).

In contrast, structural approaches to DRR are underpinned by the idea that a disaster is the consequence of certain populations being politically and economically marginalised, which often results in them living in hazardous environments and with lower ability to reduce DR (Susman, O'Keefe et al. 1983, Pelling and Uitto 2001). As such, solutions focus on changes to political, and overwhelmingly, economic factors to reduce DR. For example, approaches may focus on facilitating economic growth through market mechanisms to increase the income of vulnerable people, which would, according to

this approach, facilitate people moving out of risky areas or investing more effectively in DRR (e.g. Sen 1982). However, critics suggest that structural approaches are reductive because they under-emphasise the role of human agency, contextual specificity and local knowledge of DRR (Dow 1992, Adger 2006). By overlooking human agency and local context, these solutions often obscure how social structures greatly shape how people are differently affected by political and economic processes, and that the ability to reduce vulnerability differs between and within households (Moser 1998, Moser 2006) (also see 2.2). Therefore, structural reforms may positively reduce some people's vulnerability, but may increase the vulnerability of others.

Within disaster studies (and climate change adaptation research), it is increasingly argued that policies must take account of the multiple spaces, scales and actors that contribute to the reduction of hazard impact (Dodman and Mitlin 2013, Wamsler 2014). This has encouraged researchers to apply agency-oriented approaches to DRR, which acknowledge that humans have the ability to reduce DR (Cannon 2008) and attempt to capture contextual specificity in disaster contexts (Scott 1998). This has encouraged research to explore community-based participatory approaches for DRR and climate change adaptation alike, as well as influencing policy (see Wamsler 2007, Baumwoll 2008, Sabates-Wheeler, Devereux et al. 2008, Simatele, Binns et al. 2012, Dodman and Mitlin 2013, Gaillard and Mercer 2013, Shaw 2014, Wamsler 2014). Accordingly, initiatives are embedded in the existing knowledge of local communities and are based on the participation of community members. This research often explores more inductive and socially-oriented community-based approaches that may be facilitated by NGOs (e.g. Allen 2006, Van Aalst, Cannon et al. 2008, Nguyen, Prabhakar et al. 2009).

Community-based participatory approaches have received significant criticisms, however. When discussing development studies more broadly, Cooke and Kothari (2001), argue that participation is often imposed upon the 'poor' so that organisations may achieve their goals, doing little to empower people. Others argue that emphasis on the participation of vulnerable populations obscures the structural determinants of people's vulnerability and the adverse power relations within and beyond households (Mohan and Stokke 2000, Mohan 2002). Additionally, when researching climate change adaptation in 'Southern cities', Dodman and Mitlin (2013) comment that there has been relatively little done to build up links with political institutions beyond the

neighbourhood level. In this context, participatory approaches may be seen as shifting "responsibility for the consequences of...projects away from the agencies and the development workers onto the participating people" (Henkel, Stirrat et al. 2001: 183 referenced in Dodman and Mitlin 2013).

Despite these criticisms, the impacts of hazards occur at multiple levels (Ostrom 2009 referenced in Dodman and Mitlin 2013), and DRR may be carried out at any of these levels. Capturing the DRR strategies of urban dwellers has the potential to develop more holistic and empowering interventions which ensure that community level strategies are supported by urban actors in a multi-scalar process from formal strategies to informal strategies that are present at the community level. Dodman and Mitlin (2013) suggest this when discussing adaptation to climate change. They argue for a multi-scalar analysis of the practices, roles and capabilities of different urban actors which shape political and economic processes that are located above the immediate locale. Doing so would help develop methods for transferring power to local communities, and building up links with political structures and actors above the locale (ibid).

Despite increasing research on community-based approaches to DRR, effective coordination, or willingness, of whole communities to act together is not always possible, so strategies are often carried out at the household level (Wamsler 2007, Wamsler 2014). The next section explores the particular strategies that urban dwellers carry out with particular emphasis on research that has explored the role of self-build houses.

Disaster risk reduction by city dwellers

The DRR strategies of city dwellers in the Global South are increasingly researched and people often pursue diverse DRR measures (see Table 3). Many can be carried out by neighbourhoods such as establishing local committees for risk reduction or asking for assistance from local authorities. However, as highlighted above, coordination of collaborative efforts is not always possible and so many strategies are located at the household level. As previously highlighted in this chapter, Wamsler (2014) argues that low levels of social capital in urban neighbourhoods and the 'vulnerability gap' are principal reasons why DRR is largely carried out as a household 'project'.

Strategies at the household level are often called 'coping strategies' within the disaster

studies literature (Wamsler 2006)[10]. However, as with the term 'resilience' reviewed in 2.2, the word 'coping' implies that actions constitute 'survival'; there is no transformative improvement in the condition and situation of a household. Furthermore, this thesis does not find it useful to adopt a different term such as 'coping strategy' to distinguish household level strategies from the strategies of urban authorities, or the State for example, because their actions all seek to address the same process - DR. Therefore 'DRR' (DRR) is used throughout and the particular actor that carries out the DRR strategy is specified where necessary.

Table 3 outlines some of the household level DRR strategies that have been identified in recent disaster studies research (e.g. Velasquez et al. 2012, Wamsler 2007, 2014. Strategies that focus on hazard avoidance and reduction (stage i. of DRR) predominantly focus on measures that reduce physical vulnerability through the design and construction of the house. However, others focus on avoiding exposure to hazards. This may be through permanent migration or avoiding building on hazard prone areas. Vulnerability reduction (stage ii. of DRR) strategies can usefully be categorised by their focus on reducing physical, human, economic, social or political vulnerability (see 2.2 for a discussion of these types of vulnerability). Preparedness for response (stage iii. of DRR) makes people ready for potential emergencies; whereby people temporarily adapt behaviour to reduce the impact of hazards. For example, storing up food for emergencies or buying buckets to gather rainwater that may leak through the roof of the house. Short-term solutions may include temporary movements to areas that are less exposed to hazards. Finally, there is preparedness for recovery (stage iv. of DRR). Examples include taking out insurance or accumulating savings to invest in the recovery phase. Other examples are more social and include increasing one's personal network to facilitate reconstruction of the house or borrowing money.

The ability to carry out DRR strategies typically differs within and across households because of the unequal access to physical, human, economic, social or political capital which was discussed in 2.2. However, despite research uncovering the diversity of DRR at the household level, the disaster studies literature indicates that urban dwellers often focus on the design and construction of the house, which is observable in Table 3. This

[10] Other terms with similar definitions include: private adaptation, adaptive response, adaptive behaviour, adaptive practice, autonomous adaptation (see Wamsler 2014 for a review of these terms).

is not surprising as 2.2 revealed that the physical form of the house can significantly influence how much a hazard affects a household, and its ability to respond and recover. Research which explores the design and construction of self-build houses is now reviewed.

Table 3 Disaster risk reduction strategies carried out by urban dwellers

1. Hazard Reduction and Avoidance – Hazard Specific	
Hazard	**Examples**
Precipitation, flood and sea level rise	-Construct dams and embankments; Sandbags to cover doorways.
Landslides and erosion	-Construct retaining walls; Put plastic sheets on slopes.
Heat and cold waves	-Paint walls and roofs white to reduce heat.
Multi hazard measures	-Avoid extending houses into hazard prone areas; Permanently migrate.
2. Vulnerability Reduction – Hazard Specific	
Hazard	**Examples**
Precipitation, flood and sea level rise	-Construct/improve drainage systems; Change the inclination of roofing to redirect rainwater; Construct higher storage facilities; Build houses on stilts; Construct floating houses; Replace mud walls with more durable materials; Clean waste from slopes.
Landslides and erosion	-Construct deeper foundations; Put plastic sheets on slopes; Dig water channels or waterways to discharge rainwater; Increase the inclination of roofing; Replace unstable earth; Change the location of latrines and wash-places; Fill in old latrines with cement;
Heat and cold waves	-Construct houses with openings for ventilation; Paint walls/roof white to reduce heat; Install shutters to increase shading; Use reflective curtains or blinds.
Vulnerability reduction – Non hazard specific	
Increasing household income/security	-Diversify and household and/or individual income; Take jobs outside risk areas.
Accessing information and assistance	-Ask for assistance to reduce vulnerability from faith based organisations etc.; Campaign for legal tenure; Seek risk information and related measures.
Creating reciprocal family networks	-Create reciprocal and dependent relationships such as mutual support.
Creating social cohesions	-Know and interact well with other members of the community.
Creation of organisational structures	-Establish local committees for risk reduction; Campaign for the inclusion of risk reduction into the agenda of the local community committee.
Psychological/emotional support mechanisms	-Rely on external and vertical risk reduction assistance; Rely on the support of family members; Downplay or accepting existing risk.
Physical multi hazard strategies	-Change rooms so that more vulnerable people occupy the rooms least at risk; House improvements that increase well-being and prevent illness.
Preparedness for response	
Creating social cohesions	Create emergency community groups; move to refuges; store up emergency food/savings.

Information and early warning structures	Search for relevant information; contact risk organisations; monitor weather patterns.
Prepare for evacuation	Arrange emergency shelter; move to a safer place; store up emergency food/savings.
Physical measures	Construct emergency shelter; construct safe outdoor places; build emergency facilities.
4. Preparedness for recovery	
Economic diversification	Take on an extra job; work longer hours to increase income; work outside the house.
Assets and investments	Use construction materials that are easy to replace; stock up saleable assets; house-ownership.
Insurance	Pay into a formal or community savings scheme; take on a job with an insurance scheme.
Creating social cohesions	Create social networks for borrowing money, receiving remittances, obtaining food etc.
Create linkages with institutions to help in assistance	Maintain good contact with NGOs or urban authorities; secure land tenure; take part in community emergency committee.

Source: Author's elaboration adapted from Wamsler (2014)

Design and construction features of the house

Studies have shown that populations in 'Southern cities' often incrementally build their houses, frequently on hazardous land and with insecure land tenure (e.g. Turner 1976, Gilbert and Ward 1985, Kellett 2005, Green 2008, Wakely and Riley 2011, Jabeen 2012, Mitlin and Satterthwaite 2013). Therefore, it is not altogether surprising that the literature shows that people often incorporate DRR into the form of the house. DRR strategies that focus on the design and construction of the house may focus on direct physical measures, such as the use of more durable materials or building the house on stilts to avoid flooding (see Table 3). However, design and construction features also heavily determine non-physical DRR measures. Examples include moving to a safer part of the house during the onset of hazards or using the house as a productive asset to increase income that can facilitate recovery or reinvestment in the house to reduce physical vulnerability. However, the latter strategy may jeopardise disaster recovery where people rely primarily on the house for income (see 2.2) (Cannon 1994).

This body of research in disaster studies typically conceptualises the house as a physical resource to reduce DR, whether directly through construction or indirectly by using the house as a productive asset. However, in doing this, the literature has often overlooked non-DRR factors which also influence how people design and construct their houses. For example, these 'non-DRR' dimensions may relate to the transformation of social or economic processes. Therefore, this thesis suggests that it would be useful to consider how non-DRR factors influence the way that people design and construct the house (Baono and Hunter 2012, Wilford 2008). This would provide an augmented understanding of self-build houses, which links the social, economic and physical needs of people; aiding this research in identifying the influence of non-DRR factors on housing construction. This would ultimately help the thesis to identify how and to what extent people's risk perceptions and the pursuit of DRR shape the way they self-build their houses.

Kellett (2005) argues that studies on self-build houses in 'Southern cities' implicitly assume that the house essentially responds to the basic material need for shelter and economic security. This is challenged by research that applies the analytical lens of materiality to the factors that shape how people design and construct self-build houses (Kellett and Napier 1995). Accordingly, the analytical focus is on the social driving

forces of the material world and concern with the "notion that humans engage with the things of the world as conscious agents and are themselves shaped by those experiences" (DeMarrais et al 2004: 2). The effect on people may be conscious or unconscious, which suggests that material things may not be appropriated with a specific intention (Fahlander 2008). Application of the analytical lens of materiality has shown that people often pursue the consolidation and transformation of economic and social relations and cultural identity when self-building houses in cities of the Global South (Kellett 2005).

There are many studies that demonstrate the various social functions of the house which people negotiate and articulate when building. For example, some studies highlight how people often build shops, workshops or nurseries in order to use the house as a productive asset to increase income (Gough and Kellett 2001). This, obviously, has overlap with disaster research which identifies this behaviour as a measure to reduce economic vulnerability through the use of the house as a productive asset (see 2.2). Other studies discuss the use of certain construction materials, such as brick and ceramic, which are associated with domestic efficiency as they are easier to clean (Blunt 2005). However, through the vernacular of disaster studies, brick is understood as a durable material for reducing physical vulnerability (Bosher 2008). Other researchers, Klaufus (2000, 2006, 2012) in particular, use the term 'conspicuous consumption' to describe houses that are constructed to increase the public social standing and individuality of inhabitants. Elaborately decorated facades and an originally shaped house are central to this argument.

This literature applies a more anthropocentric understanding of houses, which shifts discussion "away from superficial interpretations of visual images towards analysis of underlying processes" that allow one to "study aspects of the complex interrelationships between dwellers and their dwelling places" (Hernández, Millington et al. 2005: 23). As such, this literature provides evidence that the transformation and facilitation of social, cultural and economic processes influence how people design and construct the house. As highlighted above, consideration of these non-DRR influences on housing construction is particularly useful for this research because it allows this research to identify how and to what extent people's risk perceptions and the pursuit of DRR shape the way they self-build their houses.

Other research also indicates that people's intentions when designing and constructing the features of the house can differ significantly between household members because of different knowledge, perceptions and social roles (Shrestha 2000). For example, the cooking area is often used differently by men and women because of differing social roles. Consequently, men and women may design kitchens differently because they have dissimilar priorities (Shrestha 2000). However, and as highlighted in 2.2, women are often responsible for domestic duties, which can precipitate lower levels of household bargaining power (Agarwal 1997); reducing the ability of women to influence the way that the house is designed and the construction features that are incorporated.

Research also finds that reconstructions to the house may be effective for a single household, but may transfer risk onto other households (Etkin 1999). For example, the installation of rain gutters on roofs may discharge water onto adjacent houses. Etkin (1999) also suggests that some strategies may transfer risk into the future as people take short-term solutions. For example drenching roofs to reduce indoor temperatures, may put strain on future water supplies. Therefore, reconstructions to the house should be effective in the short and long-term, and ensure that they do not transfer risk onto others (Kelman 2011).

CONCLUSIONS

This chapter reviewed the literatures relevant to disaster risk, disaster risk reduction and risk perceptions. Attention was given to literatures pertinent to cities of the Global South and which draw on the role of self-build housing. There was also emphasis on problematising the unique characteristics of slow-onset DR, linked to persistent less extreme hazards. The chapter highlighted that the relationship between people's perceptions of risk and their responses remains unclear. The chapter has also shown that a focus on self-build housing in a context of persistent, less extreme hazards linked to slow-onset DR presents an appropriate and novel approach for exploring this relationship. In sum, the chapter has identified three research questions for addressing the research aim, the most appropriate conceptual framework for answering the research questions, as well as highlighting some of the gaps and contradictions in the literature which require further investigation.

The chapter began by noting that the disaster literature has largely focused on extreme rapid onset hazards linked to large-scale disasters. However, frequent, less extreme natural hazards linked to incrementally increasing risks of small-scale disasters, and which have large cumulative impacts, are largely overlooked. The chapter also highlighted the need for research which focuses on DR in urban settings given the increasing frequency of urban disasters, as well as the unique characteristics of urban DR and disasters. The chapter also showed how disasters are now largely conceptualised as caused by humans because of the theoretical shift to vulnerability. Vulnerability indicates the susceptibility of a socio-ecological system to a hazard, and its ability to respond and recover. It suggests a more transformative approach to vulnerability reduction which does not merely return a socio-ecological system to its former vulnerable state following a disaster. Furthermore, and pertinent to this research, theoretical and empirical developments in disaster studies have shown that urban dwellers are not external to vulnerability, but largely influence vulnerability levels. In addition, these agency-oriented approaches are able to capture the different ways that social groups are affected by broader political and economic processes which, subsequently, shapes their different levels of vulnerability within and across households. Reviewed literature also showed that vulnerability can be measured by exploring the access and levels of physical, political, economic, human and social capital of a socio-ecological system, which this research also finds useful for disaggregating vulnerability within and across households.

The literature on risk perceptions revealed that people's perceptions of risk do not necessarily reflect their 'real risk'. Problematically, because this area of research and policy has been heavily influenced by realist approaches for understanding risk perceptions, there is a tendency to conclude that people are either 'non-rational' or have misunderstood 'real' risk if their 'perceived' risk does not 'match up' or when they do not attempt to reduce DR when exposed to risk information. This helped the chapter to highlight the appropriateness of an approach which recognises that risk perceptions are socially constructed. Accordingly, risk perceptions can only be understood by looking beyond the characteristics of 'real risk' and to an exploration of many factors which may shape perceptions, such as previous experience, risk information, trust in these sources, worldviews, people's membership in social or cultural groups or people's social roles (Douglas 1995, Jasanoff 1998). However, the influence of the physical form of the house on risk perceptions has received negligible attention and very few studies

focus on self-build housing as a means to explore this relationship, despite studies which show how many urban dwellers self-build in ways they perceive reduce DR.

Next the chapter discussed literature on the different approaches to address DR. This highlighted the importance of disaster risk reduction (DRR), which takes an anticipatory approach to tackle DR rather than the reactive Disaster management approach. The chapter suggested the appropriateness of agency-oriented approaches to explore DRR because they are able to capture the ability of vulnerable groups to reduce DR and are able to disaggregate the ability of people to reduce DR within and across households. This is important for potentially revealing the heterogeneous ability of urban dwellers to reduce DR, rather than drawing averages for whole populations. Chapter Two ended by suggesting that disaster studies largely discuss design and construction features of the house through the vernacular of DRR, whereby the house may reduce physical vulnerability or be employed to accumulate social, economic, political or human capital which can be used to reduce risk. Therefore the chapter suggested the usefulness of a more holistic conceptualisation of the house which would allow this thesis to identify and understand the many different reasons and motivations which influence how people design and construct the house. These motivations may relate to the transformation and consolidation of social and economic relations according to literature outside of disaster studies which has applied the analytical lens of materiality. This will allow this research to make a more nuanced exploration of factors that shape how people design and construct self-build houses, which will help the thesis to identify how and to what extent risk perceptions shape the process of self-build housing.

The research gaps identified in Chapter Two, and the adopted conceptual understandings of a disaster, disaster risk, vulnerability, perceptions of disaster risk, and disaster risk reduction have informed the following three research questions:

1. **How are people at risk of a disaster?**
2. **How do people perceive their disaster risk?**
3. **How do people reduce disaster risk?**

These questions will allow the thesis to address the research aim: **How do perceptions of risk shape the responses of people living in disaster-prone cities of the Global South?**

Now that the research gaps, research questions and conceptual framework have been identified, the next Chapter discusses the methodology for gathering the data needed to address the research aim.

CHAPTER THREE: METHODOLOGY AND CONTEXT

The aim of this chapter is to lay out the appropriate methodology and methods needed to address the three research questions and overarching aim. 'Method' refers to actual data collection and analysis, whereas 'methodology' refers to views about the nature of reality (ontology), and the knowledge (epistemology), that informs the selection of methods (Sayer 2011). The chapter explores the context of the research site and why this particular site is appropriate but does not examine factors such as household composition, age of the population, land tenure status, education levels, access to basic services, housing conditions, access to labour markets and other sources of income because they are presented in Chapter Four within the discussion on vulnerability. Discussion begins with the philosophical basis of this research - its ontological and epistemological positioning.

Reflexivity in the social sciences has received considerable documentation (Chambers 1995, Smithson 2000). However, Perlesz and Lindsay (2003) argue that the theories of the social world and knowledge that a researcher subscribes to are commonly not discussed. This can obscure the rationale for data collection and how it is interpreted. Philosophically, all research is based on assumptions of how the world is perceived (the ontology), and how we can best come to understand it (the epistemology) (Bryman 2012). Therefore, there may be multiple methodologies or choices of structuring any research.

Perlesz and Lindsay (2003) propose a continuum of research where there is positivism at one end and constructivism at the other. Positivist researchers subscribe to realist ontology and therefore seek understanding of an independent, external reality and propose that research can be carried out objectively and measured by gathering facts that provide the basis for laws (Bryman 2012). This approach is mostly associated with the natural sciences and essentialism. However, realist ontology overlooks the way a researcher constructs interpretations of the findings and assumes that findings reveal a knowable and independent reality (Burningham and Cooper 1999). At the other end of the 'scale' is social constructivism which is concerned with interpretation of the local and which is appropriate for this research.

Social constructivists argue that categories, which people use to help them understand the world, do not have "*built-in essences*", but are constructed "*in and through interaction*" of social actors (Bryman 2012: 22). As such, social constructivist researchers emphasise the involvement of people and how they construct reality, and so it tries to make sense of what it is to be human, as opposed to scientific knowledge. As such, it is essentially an anti-realist, relativist stance that is less interested - if at all - in the cognitive processes that accompany knowledge (Hammersley 1992). Despite this, social constructivism can view society as existing both as objective and subjective reality (Berger and Luckmann 1991). For example, the idea that DR exists as an independent reality is compatible with the social constructivist view. However, the naming of DR and what constitutes DR, is arguably a different matter and has the potential to be socially constructed because language predates concepts and provides a means of structuring the way the world is experienced. This is not the same as claiming that DR has no independent existence beyond language.

As social constructivism suggests that our experience of the world is shaped by the processes and practices which we use to signify or represent the world, methods must collect data about how people experience the world and interpret this experience (Hastings 1999). This ultimately allows a researcher to uncover how an individual constructs reality and how and why this shapes behaviour. This is achieved by focusing investigation on the experiences and language of people and the social practices they engage in. This allows this research to examine how and why (if at all) DR becomes defined as a problem by people and why they develop particular strategies to confront this risk. Furthermore, people may not identify all of the reasons for certain actions that they take. Therefore, focus will be given to revealing the underlying reasons or tacit knowledge for certain perceptions of risk and people's responses. This obviously sits well with the approach adopted to explore risk perceptions which looks beyond the physical properties of 'real' risk and to the many other factors such as worldviews, trust and experience, for example. Researchers adopting a realist epistemology believe that 'lay' public's understandings are unscientific and too subjective. However, a social constructivist approach allows this research to argue that even if respondents' knowledge, risk perceptions and responses are founded on a 'false' reality they must be included because they ultimately shape how people understand and mediate the world (Sayer 2011).

Social constructivism has been criticised for over emphasising the role of human agency and experiences over wider institutional and structural dimensions that curb an individual's capacity to influence change and the social world (Burningham and Cooper 1999). However, as discussed in Chapter Two this thesis accepts that agency and structures mediate human action because humans may be differently affected by political and economic processes based on social structures such as gender and age; however, humans are also able to shape these wider processes too.

Despite the adoption of a social constructivist approach to explore the relationship between risk perceptions and responses, a 'naturalist' risk model, which ascribes to a realist interpretation of the world is used to measure people's 'real' DR. 'Naturalist' risk models allow standardisation and comparison across space and time and will allow this research to explore if and how an individual's perceptions of risk reflects their 'real' risk. Nevertheless, this research acknowledges that these approaches to risk analysis are shaped by subjective interpretation and so only reveal one interpretation of reality.

Based on the epistemological and ontological standpoint of this research and the data needed to address the research questions, a mixed method approach with a case study framework is adopted.

3.1 Case study framework

A 'case' is a "specific, bounded and functioning system" that contains patterns of behaviour (Stake 1995: 237). Case studies allow an:

> empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin 2014: 23).

A single case study framework was chosen because it will allow this research to investigate questions of 'How?' or 'Why?' in relation to an existing pattern of events such as housing construction, even where I have no control over these events (*ibid*). It is also appropriate for a social constructivist epistemology which emphasises the need to gather 'thick description' data. 'Thick description' data explains human behaviour and the wider context which can help explain this behaviour. In addition, using multiple cases would require greater time and resources, which would jeopardise the 'thickness' of data needed to address the research aim.

Nevertheless, single case study research receives substantial epistemological criticisms. They are often critiqued for lacking generalisability as single case study research has restricted external validity (Miles 1979). Building on this critique, Campbell and Stanley (1966: 6-7 cited in Bent 2006) did not hold back when commenting:

> [S]uch studies have such a total absence of control as to be of almost no scientific value . . . Any appearance of absolute knowledge, or intrinsic knowledge about singular isolated objects, is found to be illusory upon analysis . . . It seems well-nigh unethical at the present time to allow, as theses or dissertations in education, case studies of this nature.

It is acknowledged that the case used for this research cannot be used to generalise findings to all disaster-prone contexts in the Global South. However, the case is suitable for working through the chosen research questions, which provide opportunity to discuss how the findings challenge, confirm or extend wider debates that were reviewed in Chapter Two, and to synthesise the implications of this for the problem definition, policy implications and future research. More specifically however, this case provides the opportunity to reconceptualise the relationship between perceptions of risk and responses, which still remains unclear. The case site also has particular characteristics which make it a unique setting to explore the nature of risk perceptions and people's responses. Briefly, these relate to its location in a medium-size city and the insidious and slow-onset nature of DR. Of course there are several other characteristics of this site which make it appropriate for working through the research questions – these are outlined below.

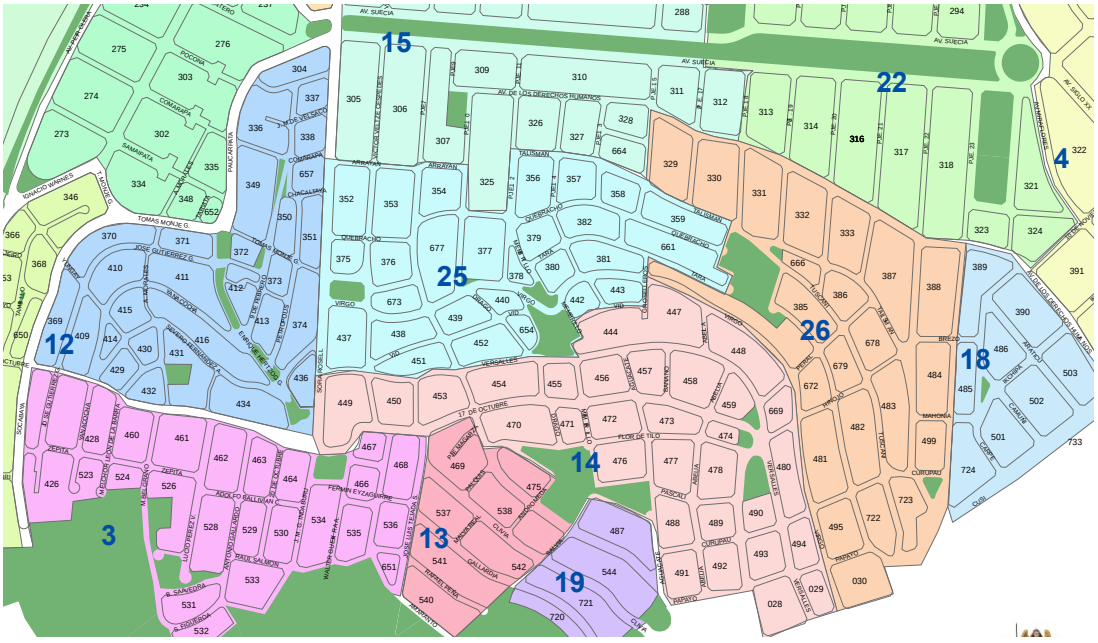
3.2 The research site: Neighbourhoods Amposta, Simancas and Vinateros

The case site, or 'research site' hereon in, is composed of three adjacent urban neighbourhoods. They are, Amposta, Simancas and Vinateros (Numbers 14, 26 and 12 on figure 6 respectively). They are located in a densely populated hill in Cochabamba city, called 'Cerro Lourdes' (see image 1 and figure 6). The hill is located 4km to the south of the old city centre and 2km from La Cancha market, which is one of the largest outdoor markets in South America.

This research site was selected for several reasons. *Firstly*, it experiences persistent, less extreme natural hazards that are linked to frequent and small-scale disasters. *Secondly*, it is categorised as urbanised. More specifically, the site is located in a medium-size city which previous literature suggests are more susceptible to the 'vulnerability gap'

whereby there are weak institutional frameworks to address DR. This raises opportunity to explore if this is so and why this may be. This is directly related to the *third* reason, and which reflects research in Cochabamba by Bolivar Vallejo (2011), the neighbourhoods receive negligible external and coordinated support from urban authorities with DRR. Therefore, residents commonly carry out DRR strategies at the household level, which is critical for addressing the research aim which focuses on the DRR strategies of residents. *Fourthly*, most house-owners self-build their house, which reflects patterns across cities of the Global South (Wakely and Riley 2011). This is critical as the research uses the house as a methodological tool to explore how risk perceptions shape how people design and construct their houses. *Fifthly*, the neighbourhoods are legally and politically recognised by the State which allows investigation of how formal State recognition affects residents' risk perceptions and responses. This refers to the possible effects of risk information and DRR interventions of urban authorities. *Finally*, the case site was practically accessible through public transport, and was socially accessible based on local gatekeeper's and residents' willingness to speak to me.

Figure 6 The Research Site: Neighbourhoods Amposta (14), Simancas (26) and Vinateros (12) located within District 6



Source: Valle Hermoso Municipal House (2009)

Amposta, Simancas and Vinateros are politically and administratively distinct. However, they have many commonalities that justify the decision to compose the research site from multiple adjacent neighbourhoods. These reasons broadly relate to the

characteristics of the population, the nature of local hazards and disasters, the history and settlement process and the development of the three neighbourhoods. A summary of these commonalities can be found in Table 4[11].

Table 4 Characteristics of the three neighbourhoods that compose the research site

CHARACTERISTIC OF NEIGHBOURHOOD	NEIGHBOURHOOD		
	SIMANCAS	AMPOSTA	VINATEROS
Persistent, less extreme natural hazards	Yes	Yes	Yes
Small-scale disasters	Yes	Yes	Yes
Year of political and legal recognition by the state	1999	1999	1999
Year people began to settle	1954	1954	1955
Population size	2241	2435	2877
Predominant place of origin before arriving to the research site	Oruro or La Paz department in Bolivia, and the Cercado Province in Cochabamba	Oruro or La Paz department in Bolivia, and the Cercado Province in Cochabamba	Oruro or La Paz department in Bolivia, and the Cercado Province in Cochabamba
% of houses with formal land tenure	50	51	52
% of house-owners	91	81	84
% of houses with access to basic services	100	100	100
Average monthly household income	2440 Bolivianos (US$353)	2580 Bolivianos (US$373)	2710 Bolivianos (US$392)
Average number of members per household	4	5	5
% of people that identify with a denomination of Christianity	93	89	96

Source: Survey and INE (2001)

The settlement and development history of Cerro Lourdes reflects similar stories across Bolivia. People began to settle on the Cerro around 1954, consistent with the effects of the 1953 land reforms which encouraged Bolivians to migrate to cities (see section 1.3 for further discussion of the 1953 land reform). Arrivals to Cochabamba city bought plots from the 'campesinos' who were able to sell land in the Cerro because of the effects of the 1953 land reform (Echavarri-Valdez, Aponte-Gonzalez, Jaime, Klein 2011). People continued to migrate to Cerro Lourdes throughout the 50s, 60s and 70s; however, migration significantly increased during the 1980s because of structural adjustment when the privatisation of many industries and resources resulted in surging unemployment rates, particularly in the mining industry. This forced many to look for jobs elsewhere, particularly in cities such as Cochabamba. This migratory pattern is observable in Table 5, which shows when the population that settled in Cerro Lourdes

[11] The collection of survey data is explained in Section 3.4.

(were not born there) arrived. For example, 6.1% of settling residents arrived between 1966 and 1977, whereas 19.5% arrived between 1978 and 1989.

Table 5 Year that settlers arrived to Cerro Lourdes

Year of settlement	% of population who settled in Cerro Lourdes
1954 – 1965	2.2
1966 – 1977	14.2
1978 – 1989	25.7
1990 – 2001	22.2
2001 - 2012	35.7
Total	**100**

Source: Survey

The large proportion of people arriving to the Cerro from departments where mining was important is in line with the mass out-migration of people following the closing down of mines discussed in 1.3 (Whitehead and Gray-Molina 2003, Klein 2011). The flow of people from these areas is even identifiable in the names of some neighbourhoods. For example, 'Villa Potosi' (number 19 on figure 6) was named after the many people who arrived from mining towns in Potosi. The rate of in-migration to Cerro Lourdes continued steadily throughout the 1990s and 2000s, and by 2001 the official combined population of the three neighbourhoods was 7,553 (INE 2001). Simancas has 2241 residents; Amposta has 2435 and Vinateros has slightly more with 2877.

Across the research site, 58% of people were born in the department of Cochabamba and 42% were born outside of the department (see Table 6) (survey). Most arrived from Oruro department (19%), La Paz department (11%) and Potosi department (7%) (survey). This reflects the 2001 census which found that most residents of Cerro Lourdes who arrived from outside of Cochabamba department migrated from Oruro, La Paz and Potosi departments (INE 2001).

The Cerro became increasingly densely populated and on August 23rd, 1999, the municipality of Cochabamba province decided to formalise and expand the urban area of the city to include Cerro Lourdes. This brought the legal and political recognition of Cerro Lourdes as a Territorial Base Organisation (TBOs). Consequently, Cerro Lourdes began receiving formal municipal support, which has resulted in significant improvements to the neighbourhoods, particularly in relation to infrastructure, access

to basic services and the ability to begin formalising property titles with the state (Paulo-Jaime, Gemita, Echavarri-Valdez)[12].

Table 6 Origin of residents

Place of birth	% of the population
Cerro	29
Cercado Province	11
Oruro Dept.	19
Other province of Cochabamba	18
La Paz Dept.	11
Potosi Dept.	7
Santa Cruz Dept.	2.5
Sucre Dept.	0.5
Trinidad Dept.	0.3
Tarija Dept.	0.3
Another country (Argentina or Peru)	1
Total	**100**

Source: Survey

In 2004 Cerro Lourdes was legally and politically divided into multiple neighbourhoods, in order to provide more efficient administration and development of the neighbourhoods (President of Vinateros, Echavarri-Valdez). All of the neighbourhoods were given formal State recognition as TBOs so all follow the same, political, legal and administrative procedures. Each neighbourhood elects a municipal vigilance committee (VC) that is headed by a community President. The VC oversees the annual expenditure and budget which is provided by the Valle Hermoso Municipal House. Each month there is a mandatory neighbourhood meeting that is led by the Vigilance Committee. These meetings act as spaces for neighbourhood residents to participate in grassroots politics (Lalander and Altman 2003, Landaeta 2004).[13]

The outcome of meetings culminates in the production of the Annual Operative Plan (AOP), which outlines the development projects for the neighbourhood. This is submitted to the Valle Hermoso Municipal House for approval and fiscal resources. It is the responsibility of neighbourhood residents to carry out the work, predominantly through cooperatives. Professionals of the municipal house sometimes, but not always, supervise the projects by assisting with technical dimensions regarding infrastructure. Since becoming TBOs, the neighbourhoods have seen dramatic improvements in

[12] The status of land tenure and residents' access to basic services are discussed in more detail in Chapter Four when discussing residents' levels of vulnerability.

[13] Neighbourhood members that do not attend meetings are fined 10 Bolivianos (US$1.40), which calculates as less than 1% of the average monthly income of a resident.

relation to access to basic services, transport links and urban planning infrastructure, such as roads and surface drains. These are fully explored in Chapter Four when discussing residents' vulnerability and exposure to local natural hazards.

The population of the research site has an average age of 24, which is one year above the National average (INE 2012). 31% of people are below 20 years, 62.8% are aged 21 to 40, and only 6.2% are 41 years or more (survey) (see Table 7). 52% of the population are males and 48% are females (survey). The neighbourhoods also share a large proportion of the population identifying as indigenous with more than half of the population in each neighbourhood self-identifying as Quechua and 15% as Aymara (Molina and Albó 2006).

Table 7 Age of the population

Age group	% of population
0 – 10	10.7
11 – 20	20.4
21 – 30	37
31 - 40	18.7
41 or above	6.2
Total	**100**

Source: Survey

Within the research site, 93% of the population identify with a denomination of Christianity. Disaggregated by neighbourhood, 93%, 89% and 96% self-identify with a Christian faith in Simancas, Amposta and Vinateros respectively. 69.5% identify as Catholic and 18.6% as Evangelical Christians; other faiths, such as Adventism (5.1%), Pentecostalism and Mormonism are represented but at a much lower rate across the research site.[14] 7% have no religion (see Table 8). Although people belong to different denominations of Christianity and each denomination has its own distinctive beliefs or practices, there are common core values and practices between them, such as belief in the Bible and its contents, the holy Trinity, the person of Christ, life after death and religious Saints, praying to communicate with God, attendance at church, which is viewed as the place where faith is nurtured and where the Holy Spirit is manifest on earth (Smith 1998).

[14] Semi-structured interviews and observation of churches show that Mormons and Pentacostalists are also present across the research site; however this did not register in the survey data.

Table 8 Incidence of self-identification with a religious faith

Religion	% of population
Catholic	69.5
Evangelical Christian	18.6
Adventist	5.1
No Religion	6.8
Total	**100**

Source: Survey

The land tax system is also identical across the neighbourhoods. In accordance with the land reform act of 1953, people living in the three neighbourhoods pay an annual 'property tax' ('Impuesto a la propiedad de bienes inmuebles') to the Municipal House. The amount of tax that is paid is dependent on the cadastral value of the property, which is determined by the local Municipal House[15]. Households and neighbourhoods that are located on the peripheries of Cerro Lourdes, which are not politically recognised as TBOs and that have no formal access to services, pay less property tax[16]. Interviews and informal conversations suggest that residents of neighbourhoods that are not recognised as TBOs are willing and predominantly do pay the 'property tax' despite receiving no municipal support. I was told this is because residents understand it may result in the neighbourhood being given TBO status, and subsequently receiving external governmental support (Javier, Fabiola, Echavarri-Valdez).

All three neighbourhoods experience persistent, less extreme hazards in the form of rainfall and landslides which are linked to risk of small-scale disasters. Persistent rainfall is linked to the collapse of houses through incremental impacts on the structure of the house and the exacerbation of ground instability which can lead to a landslide. The particular nature of local natural hazards, residents' exposure to these hazards and impacts are explored in greater detail in Chapter Four. Other similarities between the neighbourhoods include population size, the number of houses registered with legal land title ('derechos reales'), the high number of house-owners, the universal formal access to basic services, the average monthly household income and the average number of household members. Again, these will be discussed in greater depth in Chapter Four when discussing vulnerability.

15 The cadastral value is largely determined by the quality of access to public services, the location of the house (e.g. proximity to the city centre, transport connections) and the condition of the house (e.g. materials used, size of the house).

16 For example, the community of Villa Rincon de Ticte, located behind Villa Potosi (number 19 on figure 6) is a new community, where people began to settle in 2010. It is not politically recognised as a TBO and people do not have any access to formal services and so they pay fewer taxes.

In sum, the neighbourhoods are very similar in terms of history, political, legal and administrative procedures, the demographics of the population, characteristics of households, the presence of natural hazards and their impacts and the shared geographical traits of the neighbourhoods such as topography. This, I argue, justifies composing the research site of the three neighbourhoods.

It is also important to consider wider DR policies and their effects on the research site to further contextualise the research and to reveal any institutional support given to residents when addressing DR. However the following discussion will not give great exploration to formal governmental interventions that have taken place across the research site as this is explored in Chapter Four when discussing vulnerability.

Formal policies to address disaster risk

Reflecting the urban 'vulnerability gap' discussed in Chapter Two, there has been ineffective development of an institutional and legal framework to address DR in urban areas of Bolivia. There has been very limited progress in the implementation of the Hyogo Framework for Action, and there has been negligible action toward disaster risk management (DRM) (VIDECI 2013). The World Bank states that Bolivian national and subnational levels do not have the government structures to implement policies or strategies (World Bank 2010).

The law for 'Risk Reduction and Response to Disasters or emergencies, 2000 (law No. 2140, 2000)' resulted in the creation of the National council of risk reduction and disaster response (NCRRDR) which is made up of the Vice-Ministry of Civil Defence (World Bank 2010). The law also created the National system of risk reduction and disaster response (SISRADe), which is composed of eleven sectoral ministries and the President of the Republic. The incorporation of these ministries aims to achieve DRM with a sectoral vision. Using Wamsler's (2006) terminology, this reflects intent to 'mainstream' DRM into the projects of different sectors such as water or sanitation. Departments and municipalities are responsible for risk reduction and response. At these subnational levels there has been some positive strengthening of programs and actions. However, coordination between the national, departmental and municipal levels remains inadequate (World Bank 2010). Limited resources, high staff turnover and lack of compliance to DRM responsibilities within organisations have also jeopardised significant progress in DRM (VIDECI 2013).

Despite creation of the NCRRDR and SISRADe, the lack of guidelines, supervision and expertise, all necessary for DRM related interventions, suggests a need for development. At the municipal levels many projects were only achieved through the assistance of NGOs following large-scale disasters (VIDECI 2013). There are also communication and coordination difficulties between subnational governmental agencies such as local Municipal Houses and the eleven national ministries which are said to 'mainstream' DRR (VIDECI 2013). As such, Municipal Houses lack the knowledge, resources and skills to address DR, and international donor organisations and NGOs remain invaluable and necessary actors when disasters occur. In this way, the situation in Bolivia clearly reflects the urban 'vulnerability gap' identified in literature.

Further, policies that exist tend to focus on reactive responses to large-scale and rapid-onset disasters, which is typical in the wider field of disaster research and policies. Examples include the 2011 landslide in La Paz (Los Tiempos 2011) and the 2014 floods in Cochabamba department (Revello 2014). Therefore, frequent small-scale disasters that are common in the research site largely occur unnoticed or are ignored; therefore residents are effectively left to reduce risk, respond and recover from small-scale disasters in almost complete isolation from coordinated and institutional support. Therefore, there is room for vast improvement to strengthen the legal and institutional framework to address issues of DR, not only in the aftermath, but importantly in the period before a disaster (World Bank 2010).

With the context of the chosen research site, conceptual framework, research questions and a social constructivist epistemology the next section discusses methods.

3.3 Mixed method approach

This research applies a mixed method approach that collects and analyses both qualitative and quantitative data (Creswell and Clark 2007). Using a variety of different and yet interconnected methods will allow this research to cross reference (triangulate) data and results from different methods, which increases the rigour of this research by combining multiple methods, measures, theories and perspectives in order to check that results are consistent (Perlesz and Lindsay 2003).

Quantitative data is the use of statistical, numerical and computational data to systematically and empirically investigate social phenomena, and to describe, test and examine cause and effect relationships. It allows this research to gather large data sets, which is useful for increasing the statistical significance of findings, which strengthens the generalizability of research to the wider population of the research site. Analysis of numerical data is also less time consuming as statistical programmes can be used to analyse data. The methodology itself is shaped by a natural science model of research (in particular positivism), and so principally has a realist conception of social reality.

Quantitative data is used to inform the descriptive profile of the research site which was discussed in 3.3. Quantitative data is also used to gather data on residents' vulnerability levels, which according to the adopted conceptualisation of vulnerability requires information about multiple factors, many of which can be presented in numerical format. Examples include household composition based on, age and gender, household and individual income, and the number of household members.

Quantitative data has received much critique however. First, this type of research is said to increase the chance that phenomena will be missed because of the focus on hypothesis testing instead of theory or hypothesis generation (Mayoux 2006). To reduce chance of this, quantitative data was collected at the end of fieldwork, and preliminary findings from qualitative data informed the design of the quantitative questionnaire so that the quantitative data was as relevant as possible. Second, quantitative data is excellent for describing phenomena such as people's vulnerability levels; however, problems arise when trying to interpret the data and pose *why* and *how* questions. This is particularly important for this research which asks how people form their perceptions of risk and why people design and construct their houses in certain ways. For these reasons, and because this research understands that language, the experiences of people and the wider context shape the social world, qualitative data is principally used to address the research aim.

Denzin and Lincoln (1994: 2) describe qualitative research as:

> Multi-method in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative research studies things in their natural settings, attempting to make sense of, or interpret phenomena, in terms that the people bring to them. Qualitative research involves the studied use and collection of a variety of empirical materials.

Qualitative research is inductive, and is able to identify how and why people respond to a particular phenomenon making it particularly useful for this research, which aims to uncover people's perceptions of DR (research question 2), and why they design and construct their houses in particular ways (research question 3). Consistent with social constructivism, qualitative research questions 'objectivity' and aims to identify the 'different accounts of 'facts', meanings and perceptions by focusing on the accounts of people (Mayoux 2006). This type of data is predominantly revealed through open-ended questions that develop and alter in order to put together the many pieces of different accounts of 'reality' (Mayoux 2006). This type of research is also appropriate for measuring risk perceptions which cannot be empirically observed, but only revealed through in-depth narratives that disclose the nature of perceptions and the underlying mechanisms that shape them.

Despite a large amount of advantages for this research, qualitative methods also receive criticism as they are commonly regarded as unscientific and laden with bias because they are seen as exploratory and too personal (Denzin & Lincoln, 1994). They are criticised for focusing too much on descriptive narratives, which can result in the unreliability and unrepresentativeness of results (Silverman 2005). Qualitative data is also criticised for being anecdotal because research is said to just describe a small number of incidences where a phenomenon is clear, whilst dismissing data that is contradictory (Silverman 2005). This research can also be criticised on these grounds; however the objective of this research is not to make generalisations about risk perceptions and responses to all disaster-prone 'Southern cities', but to discuss how the findings challenge, confirm or extend wider debates that were reviewed in Chapter Two, and to synthesise the implications of this for policy implications and future research.

3.4 Methods

It is important to consider which of the wide spectrum of research methods are most appropriate for answering the research questions. According to social constructivism, people's knowledge mediates everyday social phenomena and the underlying mechanisms that constitute a society. As such, even if people's knowledge about DR or how to reduce risk is limited and a particular perception is generated as a result, this is a finding in itself and will allow the research to explain why 'real' and perceived risk may not 'match up' for example. Methods must therefore collect this type of knowledge, which is not always empirically observable and which suggests the need for a discursive

analysis of people's knowledge and experience about DR and DRR (Coelho 2010). Therefore semi-structured interviews and participatory drawings were adopted. A quantitative household survey was adopted to measure the vulnerability of residents because it is able to gather data about vulnerability that can be categorised and measured statistically.

The choice of research methods was also influenced by the nature of the research site, access to it and availability of resources such as time (Bryman 2012). Furthermore, multiple methods allow this research to cross-check data. For example, residents consistently stated that DRR was the main reason behind the design and construction features they chose when self-building. However, 'ideal house' drawings helped to reveal that DRR is one of a multiplicity of motivational factors behind housing construction, which is significant for addressing the research aim.

It is also important to consider when to end data collection. This is known as 'saturation', and this indicates the point when all of the emerging concepts and questions have been explored and no new information is being generated (Bryman 2012). Before beginning data collection there was no number of interviews considered necessary. It was a matter of applying the methods, and continuously considering the effectiveness of the methods for gathering relevant data and reflecting on the preliminary findings being generated. This allowed me to identify when no new ideas/data were being generated from the qualitative research methods. When saturation had been reached using the qualitative research methods, the decision was made to design the questionnaire.

Data was collected over a six-month period from January 2012 until June 2012. Therefore, data was collected throughout the rainy season, which takes place from December through to March. This allowed me to observe how people respond during the onset of rainfall. I arrived in Bolivia in October 2011; however it took three months to identify the research site and to gain access via gatekeepers. My particular gatekeeper was an evangelical Christian woman who had migrated to Bolivia from the UK in the 1980s to establish nurseries across the Cerro. Through her I was introduced to the Pastor of one Evangelical church, and Mauge who directed the COMPASSION project in another Evangelical church. COMPASSION is an international faith based

organisation that aims to reduce child poverty through the teachings of the bible in Evangelical churches.

Despite my atheism, I initially volunteered with the COMPASSION projects that are run in the two churches and I attended Sunday mass from 10am until 1pm. On two occasions I also went on three day 'church retreats' to rural areas of Cochabamba with members of the church. The two churches acted as initial access points to community residents who I then carried out semi-structured interviews with. However, over time, I was able to diversify interviewees away from evangelical Christians. I carried out all data collection in Spanish, however, I was accompanied by a male interpreter (research assistant), Pablo, during interviews in case of any language-based difficulties which are discussed later. I also employed and managed four local students, whom I knew socially, to gather the quantitative survey of 382 households.

This research looks to the action of urban dwellers in their neighbourhoods and in relation to their houses in particular. Therefore it is important to outline the definitions of house, household, plot and dwelling unit. Some definitions of the *household* reference 'eating together' (Selby, Murphy et al. 2014). However, this does not acknowledge migrants who live overseas and who add to the 'collective pot'. Therefore, this research follows Varley's (1994) understanding of a household as people who save and spend money collectively. The *house* encompasses all of the physical structures and space inside of the plot. This includes the dwelling units and communal services/areas such as the kitchen, patio and toilet. A *dwelling unit* is a single unitary structure that may be used as the main living space by a household living in a plot occupied by multiple households, and where facilities such as the toilet, kitchen and patio are communal. Or a dwelling unit may represent a single room in a house that is occupied by a single household. Finally the *plot* signifies the physical boundaries of the house.

Pseudonyms have been given to all interviewees, and the names of the neighbourhoods have also been changed in order to increase the anonymity of participants.

Semi-structured interviews

Semi-structured interviews are said to be akin to informal narratives and they place great value on language as data (Gillham 2005). Seventy-one interviews were carried out with: *residents*; *neighbourhood leaders* - Presidents of each neighbourhood and important

members of two local churches; *Construction specialists* – local construction workers and architects: and, *Officials of the Valle Hermoso Municipal House* (see Appendix 1 for a summary list of semi-structured interviews). The questions asked were loosely guided by a set of pre-determined questions. However, they were more conversational, which allowed me to follow up 'leads' that interviewees raised, but still retain the purpose of the interview (Burgess 2002).

Despite the advantages of semi-structured interviews for this research, they have been criticised for several reasons, including their vulnerability to leading questions which can severely skew data and findings (Clough and Nutbrown 2012). Second, the validity of interview data is dependent on the ability of respondents to accurately articulate their perspective, which may vary significantly between respondents (Punch 2001). Interviews are also susceptible to the 'Hawthorne effect', whereby human subjects change their behaviour, often in order to give the researcher the data the 'subject' believes they want (Adair 1984). Next there is what is known as the 'Interviewer effect' whereby people respond differently depending on how they perceive the interviewer and the types of topics that are discussed (*ibid*).

In order to reduce these effects, triangulation of data from multiple methods was used to strengthen the validity of findings and I was particularly mindful of leading questions and tried to make the interviewee feel as comfortable as possible. Furthermore, all interviewees were told that the focus of the research was self-build housing, with particular interest on the design and construction techniques. This ensured that the research did not fall into the 'trap' of leading respondents to talk about disaster risk and replying that DRR is the principal influence in how they house was built. This is particularly important because this research seeks to understand to what extent risk perceptions shapes responses. Open ended questions and participatory drawings (the latter is discussed in the following section) were invaluable for ensuring this.

Sixty-eight of the seventy-one interviews were audio recorded and they lasted sixty minutes on average; however, some were longer. Interviews were particularly useful to access officials in the Municipal House, Presidents of the neighbourhoods and architects, and it was quite clear when approaching these individuals that a sense of flattery encouraged them to agree to talk (Herod 1999). All interviews with residents were carried out during the day as I was told by local contacts that it was too dangerous

to be walking in the neighbourhoods at night and Pablo was unwilling to conduct interviews at night for this very reason. All interviewed residents were known to me personally or were indicated to me through personal networks. Access was eased because I knew church leaders personally through my attendance and volunteering at the church. I approached most local construction workers whilst they worked and all agreed to be interviewed.

Residents: Household informants

Fifty-three interviews were conducted with members of forty-eight households. I interviewed two household members in five households and a single household member in the remaining forty-three households. A larger interview set of household informants (53 from 71) is because this research is concerned with the risk perceptions and responses of people who live in disaster-prone areas.

In total, I interviewed fourteen men and thirty-nine women. This imbalance is because problems arose when organising interviews with household informants. I initially wanted to interview an adult man and an adult woman from each household. However, I soon learnt that it was extremely difficult to interview men. First, because the majority of men work outside of the house during the day, in contrast to many women who take on the responsibility of domestic duties and/or work from the house. Second, on six or seven occasions during the initial period of data collection I arrived at houses intending to interview a male household member, but was greeted by a female member of the household telling me "esta tan borracho, lo siento mucho" (he is too drunk, I'm really sorry). I learnt over time through informal conversations and interviews that many men regularly consume large amounts of alcohol in the Cerro. For these reasons I decided to focus predominantly on women and interview men when possible. The implications of this for data collection and knowledge are discussed in the next section.

Six household informants (11%) were part of a household that did not own the house (Faya, Fabiola and Felix, Eliza, Luna and Juan). However, the remaining forty-seven interviewees were part of a household that owned the house. This interview sample is approximate to the proportion of house-owners and tenants across the research site, as the household survey shows that 14% of houses are not owned by the occupiers. All interviews were conducted inside the household informant's house, which allowed respondents to relax during interviews and visually illustrate their answers when

discussing the design and structure features of the house and the DRR strategies they carry out. Interviewing people inside of the house also aided people to draw their 'ideal house' and provided me with the opportunity to take photographs, which the research uses to illustrate findings.

Although fewer men were interviewed, it is still possible to draw insights about gender differences in relation to levels of DR, perceptions of DR and people's responses. However, it is acknowledged that research with a larger and more gender balanced sample would certainly increase the strength of gender based findings. Despite this, a larger sample of women raises the opportunity to thoroughly investigate the perceptions and responses of women, who are often more exposed and vulnerable to DR because of their tendency to work from home (Wamsler 2007).

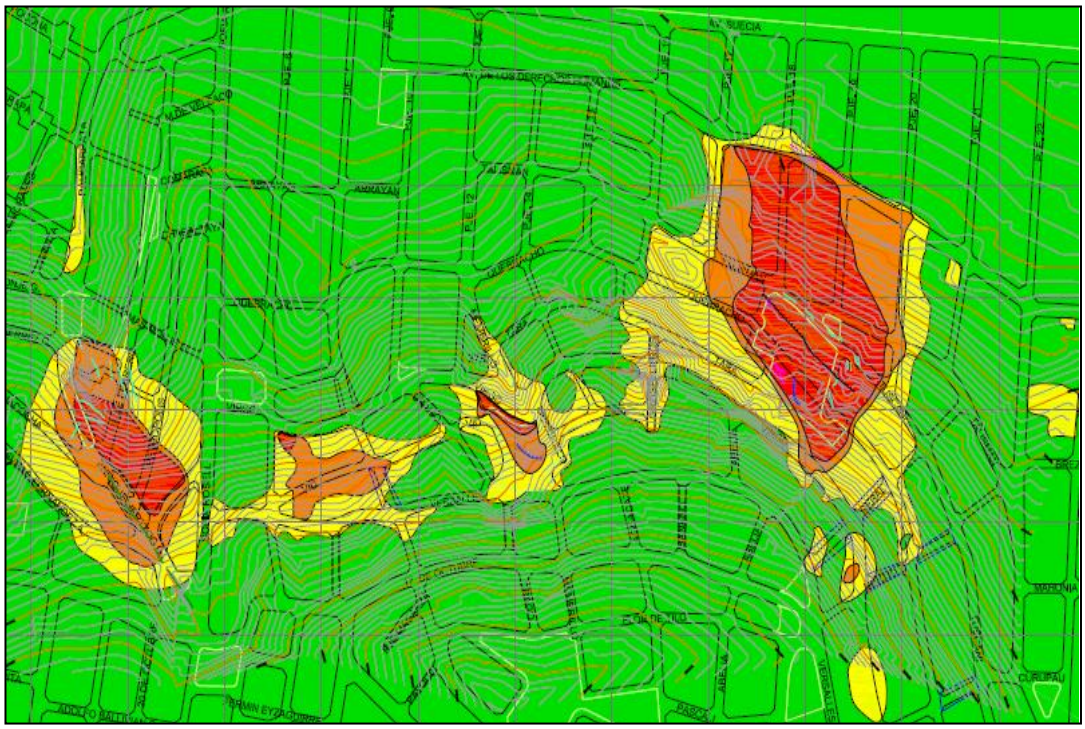
Household informants were initially sampled using a map that disaggregates the research site by levels of DR (see figure 7). Red indicates high risk; orange indicates medium risk, yellow indicates low risk and green indicates no risk. This was produced by engineers of the Valle Hermoso Municipal House following two large-scale landslides in Simancas and Vinateros, in 2008 and 2006 respectively. These two landslides affected many households - eight adjacent blocks of houses in Simancas (85 houses), and eleven adjacent blocks of houses in Vinateros. However, this scale of landslides is not indicative of the research site because small-scale landslides that affect one or two houses are far more common. Despite this, the map was a useful starting point for identifying household informants to interview, based on their levels of 'real' DR according to the 'official approach' of the Municipal House[17]. The map also provided an opportunity to investigate how 'expert-led' information about DR constructs people's perceptions of DR and their responses. Therefore, I sought an equal distribution of interviewees living within all zones of the map so that comparisons can be drawn.

Despite diversification of interviewees, nineteen of the fifty-three household informants (35%) were Evangelical Christians. This is not reflective of the percentage of the wider population as only 19% of the population is Evangelical. The effects of this on findings

[17] Section 4.2 fully discusses this map and shows that the method used to measure residents' 'real' DR is inaccurate. The map indicates where physical impacts of the landslide occurred. The map does not capture vulnerability levels, the severity of hazards, or residents' exposure to these hazards, which are necessary to measure DR levels according to the conceptualisation of DR which this research adopts.

are discussed when necessary in Chapters Four, Five and Six. In addition, I typically visited the research site six times a week, which also helped increase my contacts over time and opened up further opportunities to secure interviews. In this way, a long time spent in the research site made it increasingly easy to access interviewees.

Figure 7 Risk zone map of the research site



Source: Valle Hermoso Municipal House

Neighbourhood Presidents and church leaders

Interviews with the Presidents of neighbourhoods Amposta, Simancas and Vinateros provide further data about the relationship between the Municipal House and the research site. Presidents, as acting leaders of the TBO vigilance committee interact with the Municipal House on issues related to the Annual Operative Plan (AOP) and the general development of the neighbourhoods. The Presidents were very forthcoming when discussing the role of the Valle Hermoso Municipal House in terms of development of the neighbourhoods. They also discuss the current political and administrative system for addressing the needs of residents and the neighbourhoods, including and beyond issues of DR. They also gave historical accounts of the neighbourhoods and discussed the concerns and issues residents typically raise and prioritise during the monthly neighbourhood meetings.

I also interviewed two central figures of the two Evangelical Christian churches where I volunteered. These were the Pastor of one church, and Mauge, the director of the Compassion project in the second church. The principal reason behind these interviews was to raise alternative information about the influence of faith on people's understandings of disasters and whether faith shapes people's responses in any significant way. These two interviews were carried out during the penultimate month of data collection, when it was increasingly clear that very few residents ascribe to divine interpretations of disasters, despite 93% of residents identifying with a Christian faith.

Local construction workers and Architects

As this research focuses on the design and construction features of self-build houses, interviews were made with local construction workers and architects. I interviewed eight local construction workers who worked and lived in the research site. I also interviewed an architect who had been employed by local residents. These interviews provide additional data about the importance of DRR for residents when self-building and the local construction practices. These interviews also helped the research to understand how much control architects and construction workers have on the way that the house is designed and built. They also shed light on the content and purpose of building codes and the extent to which residents follow these rules and regulations.

Officials in the Valle Hermoso Municipal House

Representatives of the local Municipal House were 'targeted' for this research. They provide information about the relationship between the research site and the 'State', and the nature of any institutional framework to address DR. These officials also provided information about local building codes and any risk information that was available and/or disseminated to residents. This allows the research to explore the particular interpretation of a disaster that is constructed from within the Municipal House and how this information is disseminated to the public. However the ways that this 'official' information is interpreted by residents is a question that can only be answered by looking at the interviews with household informants.

Valle Hermoso Municipal House does not have a unit or department dedicated to issues of DR, whether in the period before or after a disaster. Nor was there any significant evidence to suggest DRM was being mainstreamed into other development projects of the Municipal House. Therefore I interviewed Echavarri-Valdez, a senior

engineer in the Municipal office for urban development. Officials in the Municipal House revealed that he was the most informed on the issue of disasters across the research site, and he coordinated the project that produced the 'risk map' discussed above and. Next I interviewed Aponte-Gonzalez who was the head of infrastructure, and Sanchez, the head of 'Urbanism and administrative processes'. They provided information about whether DRM had been 'mainstreamed' into urban planning practices, the historical timeline of development projects and planned future projects. They also shed light on the political and administrative 'landscape' and how this affects the neighbourhoods and residents of the research site. Finally I interviewed Shamelo, a senior housing officer. He provided information about building codes and their enforcement, how residents can apply for formal land tenure and the State-led services which formal land tenure entitles people to.

Participatory tools: 'Ideal house' drawings

A participatory method further explored the reasons why people choose to design and construct their house in a particular way. This particular method was informed by the literature reviewed in Chapter Two which highlighted how people's intentions to facilitate and consolidate social, economic and cultural processes can also determine how houses are built. Each household informant drew a picture of their current house and their 'ideal house', which represents the house they aspire to have.[18] They verbally talked through their drawing and explained why certain design and construction features were chosen or aspired for. In this way the drawings act as social maps that uncover the many and often subtle (or hidden) ways that residents perceive and relate to the physical form of the house (Kumar 2002). Although the 'ideal houses' of interviewees were often beyond household informants' resources because of insufficient economic capital or lack of house-ownership, for example, this method still helps the research conceptualise the house and to identify the many and overlapping reasons why people reconstruct, or aspire to reconstruct, their house.

Participatory drawings of houses have been used before in disaster research in the Global South (e.g. Tanner, Garcia et al. 2009). However, this was predominantly to reveal specific risk reduction actions that people carry out through the physical form of

[18] Eleven interviewees were not able to participate as they did not feel comfortable using a pen and paper. Therefore, the drawing was not attempted, or I drew the house, whilst the interviewee dictated their ideas.

the house. In contrast, this research adopts a more holistic conceptualisation of the house in order to reveal how important risk perceptions are to the self-build process. To do this it is important to reveal other features of the house that may not be directly related to DRR, but which may shape how people design and construct the house.

Many interviewees commented on how they enjoyed the experience of drawing their 'ideal house'. This reflects the suggestion that interviews are not always engaging for interviewees and may seem rigid, whereas participatory methods are said to augment conventional research (Chambers and Blackburn 1996). Participatory tools are also said to "investigate and give voice to those groups in society who are most vulnerable and marginalised in development decision-making and implementation" (Mayoux 2006: 118). However, many have criticised the aims of participatory tools, and argue that they may do very little to empower respondents (e.g. Cooke and Kothari 2001, Mohan and Stokke 2000) (see section 2.4 for further critiques of participatory approaches). As with semi-structured interviews, participatory techniques such as drawings are also susceptible to the Hawthorne effect and rely on the ability of the interviewee to articulate their ideas (Adair 1984), which can be problematic because:

> People's own assessment of their own condition can overlook their objective condition, and can be biased as a result of limited information and social conditioning (Laderchi, Saith et al. 2003: 40).

Additionally, although the interviewee is in control of 'data generation', as the researcher I am still the person who interprets this, and so this method is still susceptible to misinterpretation (Bryman 2012). These critiques are valid and I was aware of these during data collection and analysis. However, the ability to uncover household informants' knowledge (and tacit knowledge) about how they perceive and relate to the house and their intentions when self-building, which are sometimes difficult to verbalise justifies the use of this method.

Household survey

During the last five weeks of fieldwork a quantitative household survey was carried out across 382 households, which represents a third of houses across the research site[19]. This number was chosen to increase the statistical significance and validity of the data. To view the questionnaire, see Appendix 2.

[19] The 2001 national census was used to calculate how many households represent a third of each neighbourhood.

The questionnaire was designed with two objectives in mind. *Firstly,* to create a profile of the research site with information that could be categorised and/or quantified. This includes details such as the arrival of residents to the Cerro, where they arrived from, levels of household income, religious identity, and levels of education. Many of these were discussed in 3.2. *Secondly*, survey data helps the research to answer research question 1, which explores how people are at risk of disasters. This requires data about people's vulnerability levels which are composed and shaped by many factors that can be categorised and quantified, such as household income, household composition, age of household members, sources of income and educations levels. Furthermore, because the survey gathers data within and across households, this information allows the research to disaggregate vulnerability levels within and across households, rather than draw averages for the research site. Therefore the survey does not capture the deeper and often hidden reasons of certain behaviours and residents' tacit knowledge about how they perceive and relate to the house.

The questionnaire was structured and most questions were multiple choice and closed-ended, however some questions allowed respondents to rank answers. Given time constraints of the research, three research assistants (Lidia, Maria and Alex) were employed to gather the questionnaires. All three were local University students that I knew personally. Initially, a team of six students were employed to collect the survey and two separate pilots were conducted to perfect the design of the questionnaire. However, following the pilots, three of the students did not want to carry on for reasons that included the high number of aggressive dogs in the area, the steep gradient of the Cerro and the sweltering heat[20]. In contrast to Lidia, Maria and Alex, these three students were from the North of the city, where more affluent neighbourhoods are located. Interestingly, they all agreed that they were not used to spending time in the city's Southern areas and that they did not feel safe doing so. This helps illustrate my experience with many people of North Cochabamba, who on several occasions commented or implied that the South of Cochabamba city is "dangerous" and "dirty", despite admitting they seldom go there. Despite this initial trouble, the survey was quickly completed.

[20] The pilot was conducted in Villa Cosmos (community 25 on figure 6) which is the neighbourhood adjacent to Vinateros.

First, using a map of the neighbourhoods (see figure 6), which was created by the Municipality of Cochabamba, I counted the number of blocks ('manzanas') in each of the three neighbourhoods. I then divided the number which represents a third of houses in each of the neighbourhoods by the number of manzanas in that neighbourhood. This gave an approximate number of houses that the survey needed to target in a single manzana, to ensure the survey was equally distributed across each neighbourhood[21]. This also ensured that residents living in the green, yellow, orange and red zones of the risk map (see figure 7) were questioned. I then assigned Lidia, Maria and Alex an equal number of manzanas to conduct the questionnaires. Before they conducted the questionnaires, I would walk with them to each of their assigned manzanas and indicate which houses they should 'target'. This was to ensure that the survey gathered information from residents living in architecturally diverse houses, rather than focusing on people living in houses with highly similar design and construction techniques. As Chapter Four will show, this is critical because the design and construction techniques of houses across the research site are highly diverse and I wanted to ensure that the survey data reflected this.

A single household from each targeted house was surveyed (if there were multiple households in a single house) and the research assistants were told to speak with the household head or an adult member of the household which owned the house. If the house was entirely occupied by tenants, the research assistants again spoke with the household head or an adult member. Approximately 90% of questionnaires were conducted on Sunday afternoons when most residents do not work, and when church attendees have typically arrived back in the house. Once all 382 of the questionnaires were gathered an Information Technology teacher at the local University input the raw data into SPSS (Statistical package for the social sciences), which was then analysed on my return to Manchester.

One of the main critiques of questionnaire surveys is that the researcher cannot be certain respondents are being truthful (Ackroyd and Hughes 1981). However, Lidia, Maria and Alex all lived very close by to the Cerro and so have many commonalities with the residents, which is likely to have helped respondents feel more comfortable revealing information such as household income. However, it is acknowledged that this

[21] This number is 'approximate' because I did not calculate the exact number of houses in each manzana. Therefore, more households may have been surveyed in one manazana than other manzanas.

risk can never be entirely circumvented. In addition, respondents may interpret questions in different ways which may result in data which does not actually measure the same thing (Neuman 2006). Finally, this questionnaire was designed by me, with my subjectivities. Therefore, the design is at risk of including things that I perceive as important, whereas other elements that may be important to the research aim may be missing (Bryman 2012). To try and avoid this, the survey was designed after the interview stage so that preliminary findings from the qualitative data could inform the survey design and pose the most pertinent questions.

Aside from the interviews, participatory drawings and survey, valuable data was gathered through observation. For example I observed the issues residents raised during seven monthly neighbourhood meetings, and how these meetings function. Observation during heavy rainfall also provided data of how residents behave during the onset of a hazard and how rainfall interacts with the built environment and houses in particular. I also made mental notes and when possible took notes in my research journal, whether during or after observations. I also collected media sources related to disaster events in the research sites. These were found on-line and help to illustrate the tendency of the Media to focus on large-scale disasters and to dismiss frequent small-scale disasters that are common across the research site. Maps and policy documents were also collected, which raise data about the relationship between the Municipal House and the research site. As such, this research gathered a large amount of data and in several different forms. Therefore it can be difficult to decide what is relevant and what is not. Below are some brief reflections on the analysis of data.

3.5 Analysis of data

I analysed the survey data using SPSS. As the quantitative data is predominantly needed to generate descriptive data, the task of using SPSS was not as complicated as I had initially thought and (admittedly) dreaded. After a few days becoming familiar with the programme I was soon able to quickly calculate statistics to measure many indicators of vulnerability, draw up a profile of the research site and disaggregate this data by neighbourhood.

Analysis of qualitative data was a lengthy process. Reflecting the suggestions of Jackson (2001), this consisted of reading transcripts, fieldwork notes, studying the participatory drawings and drawing out commonalities and themes from words, phrases and

sentences, and then using the conceptual framework to analyse these 'codes' in relation to one another and in light of the research aim. Analysis began during data collection when I drew up preliminary findings that helped to shape questions in future interviews and design the questionnaire. As such, the analysis process was not linear and cannot be delineated into clear and exclusive stages. It was an ongoing process and one that incrementally developed.

The interviews were transcribed in Spanish by my research assistants Maria and Lidia. When I returned to England I began a lengthy process of reading through the transcripts whilst listening to the interviews at the same time. Transcripts were read through more than once, with some being read up to three or four times in order to re-evaluate them in light of my prior assumptions and to try to identify commonalities and themes. These themes were mapped on A1 size paper, and over time the number of themes increased and it became clearer how themes overlapped and trends that tied many of the interviewees became apparent. This was particularly useful in identifying the factors that shape residents' risk perceptions and why residents construct or aspire to construct their houses in similar ways.

3.6 Problems encountered

This section discusses some of the methodological problems encountered; in particular issues of language and transcription. Positionality, which all researchers must inescapably confront and reflect on, is also discussed.

Language, representation and translation

The need to problematise language when conducting research in social sciences has been discussed by many academics (e.g. Helms, Lossau et al. 2005, Müller 2007). I conducted all interviews in Spanish, alongside Pablo who was a twenty-seven year old Bolivian student and who acted as an interpreter if any language difficulties arose. Despite living in the affluent North of Cochabamba city he was extremely comfortable spending time in the research site and had a genuine skill at talking to respondents and putting them at ease.

Of the seventy-one interviews, two interviews were conducted in Quechua because the respondents did not speak Spanish. On these two occasions, Pablo translated answers to me and I would then give him questions to translate into Quechua. Despite my use

of Spanish, which people clearly identified as a second language, there are many other elements which placed distance between respondents and I. Most obvious is my profile as a white, middle-class, and Western woman. I believe one of the starkest distinctions was my economic status. However, I believe that there was some form of identification with women, which manifested as more candid, open and emotional interviews, and a greater willingness of female residents to talk with me.

Despite my awareness that I was missing some subtleties, conducting interviews in another language and in a context that is entirely different to one that I am used to in England was very exciting. However, when listening to interviews and re-reading transcripts at my desk in England, I began to fully reflect on the fieldwork, particularly in relation to language. Several times I cringed listening to some of the interviews; not *only* because of my accent, but because there were certain moments where I had missed nuances that I could have probed further during questioning. These moments, which illustrate the constraints of my Spanish language skills brought to mind Watson's (2004) paper, 'what a dolt one is: language learning and fieldwork in geography'.

I decided to translate any quotes into English and explain any colloquialisms or terms when necessary to try and maintain the meaning of interviews (Müller 2007). Maintaining the local understandings of certain words and concepts was a priority during analysis and transcription. In order to maintain the representative authenticity of the research I e-mailed Maria and Lidia to clarify the meaning of certain terms and words to ensure that my findings were drawn from an accurate understanding of local culture and language (Smith 2010).

It is also important to reflect on the translation of words and to what extent the meanings of words are consistent when translated to academic text (Bennett and Shurmer-Smith 2001). This research comes from the ontological position that language produces the concepts we use to make sense of the world (Hastings 1999) and so it was important that people who are sensitive to local culture, language and contextual factors transcribed the interviews (Smith 2010). Doing so is important for accurately representing the 'voice' and intentions of respondents. As such, Lidia and Maria transcribed the interviews into Spanish, which ensured the local subtleties that I may not have picked up on were included. I asked for them to indicate any non-verbal incidences, such as pauses, laughing, crying or any other explicit signs of emotion.

Although I listened to the interviews when reading the transcripts, having these notes stressed the importance of identifying the nuances in people's words and their meaning. For example, one interviewee, Fabiola suffered two landslides; when asked what she disliked most about her house, she replied, whilst laughing, "That it will fall down again." Without being aware of her laughter, I may have missed the suggestion she is somewhat 'apathetic' about DR and perceives disasters as an inevitable consequence of living in the Cerro.

Despite the numerous strategies carried out to increase the authenticity and representation of research, it is acknowledged that the social constructivist position, which this research adopts, accepts that there are multiple realities and there are many different ways that information can be read. Therefore, research may offer "an interpretation of an interpretation, complicated further by the researcher's own subjectivity and positionality" (Lombard 2009: 174).

Positionality and emotions

Up until the 1970s, the 'idealist human geographer' approach, which views the researcher as an empty vessel that observes and records ideas in a neutral way was pervasive (Moser 2008). However, claims of objectivity have grown increasingly unfavourable as social scientists began recognising that they never shed their identities and represent neutral actors when conducting research (England 1994). Therefore, discussion of researcher positionality, which refers to the relationship between the researcher and the researched, and how this affects the research process is integral. A researcher's positionality may relate to dimensions such as their age, social and economic status, personal history, political persuasion, sexual identity, gender, ethnicity and education, which all may influence particular data collection methods and interpretations (England 1994).

As previously discussed, being a white foreigner is viewed locally as a characteristic of privilege. However, only during a handful of interviews did this power dynamic between respondents and I feel uncomfortable. The effect of this was diluted by my relationships with residents of the research site, my Spanish language skills and time spent in the neighbourhood, which ensured people knew who I was and why I was there. In addition, my positionality would shift depending on the situation I found myself in, demonstrating how positionality is more fluid than is often put forward

(Herod 1999). Illustrating this, I found myself accentuating my position as a neutral researcher when speaking with officials in the municipality.

I also believe my personality and respondents' personalities significantly shaped the research process and the data gathered. Specifically, through humour and a light-hearted attitude it was possible to create a more informal and relaxed interaction, which encouraged greater openness from respondents. This reflects Moser (2008) who argues that personality traits, such as shyness, paranoia, impatience and gregariousness shape the interaction between researchers and researched as much as an individual's status as a feminist, a middle class woman, or a post-structuralist. However, within social sciences there is an effective silence about how individual researchers interact and behave with research subjects who also have a spectrum of emotional abilities and social skills. As such, positionality becomes a selected version of oneself that addresses the elements that are important to academic analysis, whilst obscuring other more personal elements that may be more influential during data collection (Moser 2008).

CONCLUSIONS

This chapter explained the research methodology and contextualised the research site. The methodology was informed by the conceptual framework, the research questions and the context of the research site. In particular a social constructivist epistemology and a single case study approach are adopted and semi-structured interviews, participatory tools and a questionnaire survey are the chosen methods. This chapter concludes by summarising the appropriateness of this approach for answering the three research questions and addressing the research aim.

This research aims to critically explore the relationship between people's perceptions of DR and their responses Accordingly, research question 1 asks, 'how are people at risk of a disaster?' This requires analysis of exposure to a hazard, the characteristics of the hazard (severity and frequency) and vulnerability. Vulnerability levels within and across households will be measured using a 'naturalist' model of risk that is based on realist ontology. Although this thesis adopts a social constructivist epistemology and recognises that these risk analysis models are based on the subjectivities of those who design them, 'realist' approaches for risk analysis have become standardised in disaster studies and will allow the results to be compared across space and time. It also allows

this research to explore how and if people's 'real risk' reflect their perceived risk. As discussed in Chapter Two, measurement of vulnerability requires identification of how wider political and economic structures located at the meso and macro interact with social structures such as gender to shape people's levels of and quality of economic, social, human, physical and political capital. A large proportion of this data can be categorised and quantified, therefore a quantitative household survey principally informs the exploration of vulnerability. However, qualitative data from semi-structured interviews will supplement this data if necessary and to triangulate findings.

Research question 2 investigates how people perceive their risk of a disaster. This requires exploration of how probable people perceive a disaster and how fearful they are about a disaster. The research will also need to identify the factors which construct residents' risk perceptions. However, risk perceptions are largely impossible to empirically observe and quantify. Therefore a broadly qualitative methodology and a predominantly discursive analysis will be used. Semi-structured interviews are the most important method for gathering this data. This method is conversational in nature and will allow the research to explore residents' lived experience with hazards, the sources of risk information people are exposed to and to what extent they influence perceptions. This method must also be flexible enough to identify any factors that may shape risk perceptions, but which may not have been expected.

The third research question asks, 'how do people reduce their DR?' This question is concerned with the actions people take to reduce DR. However, there is particular attention given to how people use the design and construction features of self-build houses to address DR. In addition and most importantly for addressing the research aim, this question is critical for identifying how and to what extent risk perceptions shape residents' DRR strategies and the way they design and construct the house in particular. This requires identification of underlying mechanisms that motivate behaviour, which may not be empirically observable and which may not be related to issues of DRR. Therefore semi-structured interviews are appropriate and again a discursive analysis will help identify the motivations behind residents' behaviour which respondents may not explicitly reference. This data will be supplemented by data from a participatory method that will further reveal how and the nuanced reasons why people choose to construct their house in particular ways, which may be located outside of the 'disaster box'. Research question 3 must also consider residents' ability to reduce DR,

therefore discussion will draw on the vulnerability levels of residents which are identified when answering research question 1.

With these issues in mind and the methodology in place for answering the three research questions, the next chapter discusses findings from research question 1: How are people at risk of disasters?

CHAPTER FOUR: THE DISASTER RISK OF RESIDENTS

This goal of this chapter is to reveal the levels of disaster risk (DR) within and across households. It also aims to highlight the role of the house for DR because the research focuses on how people self-build their houses in order to explore the effects of risk perceptions on responses to DR. Previous chapters have told us that revealing residents' levels of 'real' DR will provide the opportunity to explore how and if residents' 'real' risk reflects their perceived risk. Disasters were viewed as natural phenomena that are exclusively determined by the severity of the hazard and exposure to this hazard. However, Chapter Two showed that this 'naturalist' interpretation of a disaster was debunked with the introduction of vulnerability. Accordingly, DR is determined by three components: the characteristics of a hazard such as severity and frequency, the exposure of a socio-ecological system to this hazard, and the vulnerability of this system. This chapter will explore all three factors and will identify the impacts of these local natural hazards. Socio-economic impacts are given attention; however, focus is principally on the physical impacts on the house (which obviously has indirect socio-economic impacts as Chapter Two discussed). This is because this thesis is concerned with the house as a resource for people to address DR and so this section seeks to highlight the role of the house for local DR.

This chapter is split into two main sections. The first section explores the characteristics of local natural hazards, and residents' exposure to these hazards. As discussed above, this section also identifies the particular impacts of these hazards. In the second section, vulnerability is explored, which represents "the characteristics of a person or group and their situation influencing their capacity to anticipate, cope with, resist and recover from the impact of a hazard" (Blaikie et al 2004: 11). Therefore, vulnerability determines a socio-ecological system's susceptibility to harm, and its ability to transform and reduce DR. Chapter Two also showed that vulnerability can be explored and measured through a focus on residents' access to, and use of physical, political, social, human and economic capital. Literature reviewed in Chapter Two revealed that people's access to, and levels of these capitals is heterogeneous within and across households because broader economic and political structures differently interact with and affect individuals based on the social groups they belong to, such as, age, ethnicity and gender. Therefore,

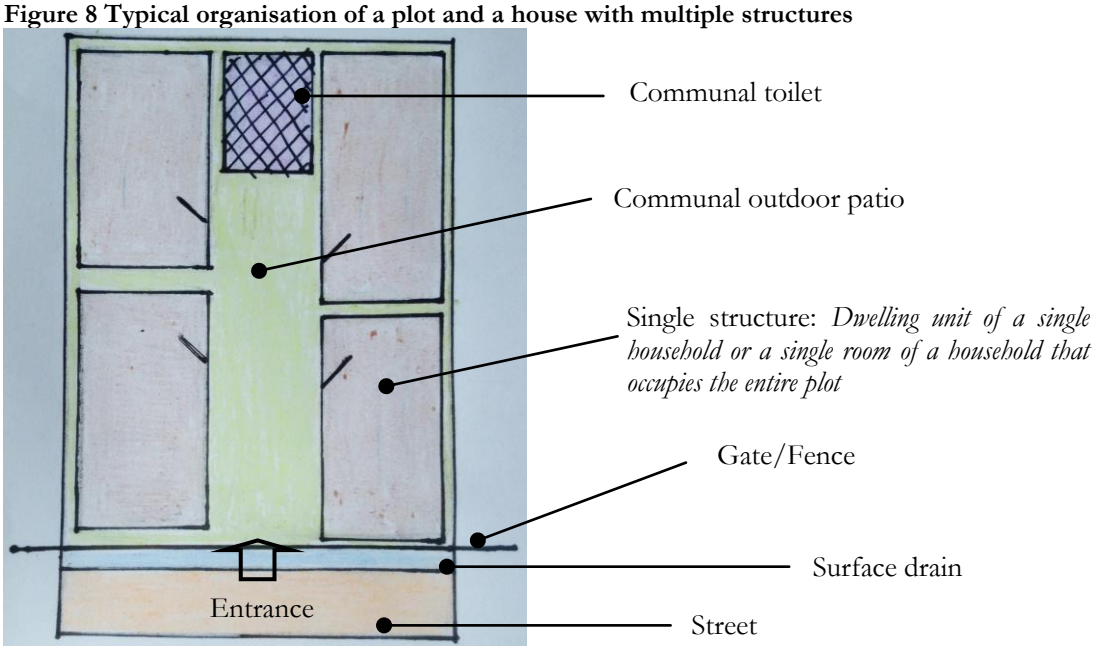
policies, institutions and processes located above the case site locale are investigated and their impacts on vulnerability levels within and across households will be sketched. This chapter also highlights the importance of the house for DR. More specifically, this chapter seeks to explore the importance of the house in terms of physical vulnerability and the ability of residents to accumulate and consolidate political, economic, human and economic capital which can reduce levels of DR. The chapter will also explore the urban 'vulnerability gap' because literature suggests that the institutional framework to address DR is typically weaker in medium-size cities such as Cochabamba, than in large or mega cities. The chapter explores this assertion by investigating how the urban authorities and the Valle Hermoso Municipal House in particular, address DR across the research site. Identifying the 'official' approaches of authorities is also important for exploring residents' risk perceptions as Chapter Two showed that 'expert-led', State support can influence people's risk perceptions and their responses which are explored in Chapter Five and Six respectively.

4.1 Exposure to natural hazards and their physical impacts

The organisation of space in the house and the social composition of households can differ greatly; this has implications for the exposure and impacts of hazards within and across households. On average, five people occupy a house, with a range of 1 to 26 people (survey)[22]. 57% of houses are occupied by a single household, and 43% of houses are occupied by multiple households (survey). Some plots are occupied by a house that is a single multi-storey unitary structure with all of the rooms, such as bedrooms, kitchen, bathroom and living area inside of this structure. One or multiple households may occupy this type of house. In other plots the house is composed of multiple single structures that are typically one storey in height and which are spread out linearly in the plot (see figure 8). These single structures may collectively represent the house of a single household. However, in 43% of cases, a plot is occupied by multiple households, and a single structure represents the dwelling unit of a single household. There are communal services such as a toilet and cooking area, and a communal patio, where activities such as socialising, cooking, eating, and storing water take place.

[22] Household compositions include migrant household members who are living away from the house, but maintain connections through social or economic remittances.

Figure 8 Typical organisation of a plot and a house with multiple structures



Source: Author's interpretation

Therefore, the physical impacts of a hazard on a house that is constructed of a large unitary structure may directly affect a single household or multiple households, depending on the social composition of the house. Alternatively, where a single structure is damaged in a house composed of multiple single structures, this may directly affect the dwelling unit of a household that shares the plot with other households, or it may affect a single structure of a house that is occupied by a single household.

Informal conversations with Cochabambinos who live outside of the research site suggest that people associate Cerro Lourdes with large-scale landslides. Before explaining the focus of my research, people would begin to tell stories about "un gran derrumbe" (a big landslip), which had destroyed many houses. People were referring to two large-scale landslides that affected eight adjacent blocks of houses in Simancas in 2008, and eleven adjacent blocks of houses in Vinateros in 2006 which were discussed briefly in 3.4[23]. According to a report from the local newspaper, Los Tiempos, a total of eighty-five houses were affected in Simancas (Amarillo 2011); however, there was no available data on the exact amount of houses that were affected in Vinateros.

[23] Although the impacts of these two landslides are not considered 'large-scale' according to the UNISDR (2009) definition of a disaster, this thesis will refer to them as 'large-scale' throughout in order to distinguish them from the 'small-scale' landslides which occur more often across the Cerro.

Although 'outsiders' of the Cerro focus their attention on these two large-scale landslides, small-scale landslides and the collapse of houses due to the impacts of rainwater on the structure of the house are far more frequent. Small-scale impacts from landslides and rainwater typically result in property damage and not fatalities or injuries. However, as identified in Chapter Two, the physical impacts of hazards have indirect and often unobservable impacts on an individual's and a household's levels of social, human and economic capital. These indirect impacts are given attention in section 4.2 when discussing vulnerability.

Landslides are linked to ground instability and rainfall which exacerbates ground instability. Although a landslide occurs rapidly, ground instability increases incrementally over time with the persistent impacts of rainfall. The physical damage to houses differs significantly from the total collapse of the house, to negligible cracks in walls. This is largely because houses have varying levels of physical vulnerability, which is discussed in 4.2, and because the severity of the landslide can also differ. Therefore, the physical impacts of landslides are best explained according to a 'spectrum' that indicates the different degrees of property damage. Table 9 specifies the types of physical damage that can occur.

Seven household informants said that their house or dwelling unit[24] had previously suffered 'total collapse'[25]; two had suffered 'partial collapse'[26]; seven had suffered 'very serious' damage[27]; three had suffered 'moderate' damage[28] and one had suffered 'light' damage[29]. See images 2, 3 and 4 for examples of 'total collapse'; 'partial collapse', and 'very serious damage' respectively. 29% of people across the research site had suffered damage to their house from landslips, which further illustrates the widespread effects of landslides across the research site (survey). I also observed or was told of thirteen other houses that were 'very seriously' damaged or 'partially' or 'totally' collapsed during data collection from January to June 2012.

[24] Here, dwelling unit indicates that a single household was occupying a dwelling unit located in a house occupied by multiple households. From hereon in, when discussing the physical impacts of hazards, 'house' will be used to refer to a dwelling unit occupied by a single household or where a single household occupies the entire house.
[25] Monica, Julio, Faya Norma, Federico, Valeria, Fabiola
[26] Felix, Nadimo
[27] Teresa, Rebeca, Silvia, Sofia, Josefina, Alejandra, Jaime
[28] Camila, Amalia, Maria-Jose
[29] Paulina

Table 9 The physical impacts of hazards

Level of damage	Explanation
None	Building is intact
Negligible	Hairline cracks in walls. No distortion of structure
Light	Resettlement of foundations and distortion of structure and inclination of walls that does not compromise stability.
Moderate	Substantial cracking of walls and/or floors, or walls are slightly perpendicular.
Serious	Walls are slightly perpendicular. Open cracks in walls. Floors inclined and ground has shifted. Walls will need to be replaced. Doors and windows too distorted to use.
Very serious	Walls are very perpendicular. Building structure is grossly distorted. Seriously cracked floors and walls. Walls will have at least partially collapsed
Partial collapse	Collapse of some, but not all walls. Parts of the structure may totally collapse in the near future and significant displacement of floors
Total collapse	All or a single structure in the plot have entirely collapsed

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Source: Adapted from Alexander (1986)

Image 2 'Total Collapse' from a landslide

Source: Author

Image 3 'Partial collapse' from a landslide

Source: Author

Image 4 'Very serious' damage from a landslide

Source: Author

Image 5 Cracked walls due to water damage

Source: Author

Rainwater is the second local natural hazard; it exacerbates ground instability which can lead to landslides, and it can cause the walls of houses to become damp and crack, or collapse entirely (see image 5). The spectrum of damage in Table 9 is also appropriate to describe the physical impacts of rainwater on the house. Thirty-two interviewees of the forty-eight case households said that their house had suffered or was currently suffering from incremental damage caused by rainwater. The household survey also shows that 53% of houses across the research site had, or were currently experiencing damage from rainwater, which again demonstrates the extent of this problem and reflects Bull-Kamaga et al. (2003) and Desinventar's (2014) work, which argues that less severe impacts can have large cumulative impacts which amount to large-scale economic loss and damage.

In a context of persistent, less extreme hazards, such as rainfall; 'light' damage can graduate into more serious damage if hazards become more severe due to greater ground instability or longer periods of rainfall for example, or if disaster risk reduction (DRR) strategies are not carried out (Bull-Kamanga, Diagne et al. 2003). For example, the persistent impacts of rainfall which can lead to a landslide and damage to walls of a house can take place over a matter of months (Eliza) or up to twenty years (Olivia). This is heavily determined by rainfall patterns, exposure to rainwater and the materials used to build the house. The influence of rainwater explains why most landslides and water damage occur during the rainy season, from December to March. As 5.2 will show, many residents perceive that rainfall patterns have changed; some residents say that the rainy season now lasts longer (Paulo-Jaime, Bianca, Rebeca, Pastor), others say rainfall is now more intense i.e. heavier (Juanita, Teresa, Consuela, Monica, Eliza, Silvia Felipina), and others commented that periods of rainfall are now longer in duration (Builder2, Teresa).

Exposure

In addition to the characteristics of hazards, exposure is also a critical component of DR (Blaikie et al. 2004). Exposure to rainfall which can directly damage houses or exacerbate ground instability is not equal across households. This is because the path of surface water is heavily determined by topography, density, the architectural design of houses and urban planning features.

The neighbourhoods have become increasingly densely populated since people first arrived in the 1950s and sought to maximise the use of available space in the plot

(Blaikie, Cannon et al. 2004, Wamsler 2014). This affects people's DR in two ways. Firstly it increases the likelihood of a landslide as the soil becomes more unstable as more houses are built and as infrastructure services such as water lines are introduced (Aleotti and Chowdhury 1999). Secondly, because houses are built so close together, people's exposure to rainwater and the likelihood that a landslide will occur is increasingly shaped by the design and construction features of adjacent houses. This is because many houses do not have gutters around the roof of the house or they have inclined roofs designed to discharge water away from the house. Problematically, this often results in rainwater being discharged from the roof of one house directly onto adjacent houses (see Table 3 in 2.4).

In addition when the neighbourhoods became legally and politically recognised as TBOs in 1999, surface drains were introduced, roads were paved and raised pavements were constructed (Echavarri-Valdez; Aponte-Gonzalez; Nadimo). Surface drains channel water away from houses, and downhill towards the main road at the bottom of the Cerro.[30] The surfacing of roads prevents the filtration of water underground, and raised pavements also help to channel surface water away from houses. Despite these improvements, installation of these urban planning features is not universal across the research site as there are many areas where surface drains, road surfacing and pavements are yet to be introduced. Therefore surface water is directed towards some houses and/or filters into the surrounding soil, whilst other houses are less exposed to surface water because they are located closer to drains, road surfacing or pavements.

This section has shown that rainfall incrementally damages the house and exacerbates ground stability. Furthermore, 'light' damage has the potential to lead to more severe damage if DR is not addressed and if rainfall becomes more extreme from the effects of climate change e.g. longer periods of rainfall, heavier rainfall. Impacts are widespread across the research site and so they have large collective impacts, which is consistent with Bull-Kamanga et al. (2003). The exposure of a house to rainfall which can lead to erosion of the house and/or a landslide is highly asymmetric because of urban planning features and the design of houses. The latter is why exposure to surface water is often dependent on the design of adjacent houses. Finally, the impact of hazards has a

[30] Although water is discharged away from the neighbourhoods, I observed the main road flooding because of the limited capacity of the drainage system on two separate occasions during heavy rainfall. As such, the drainage systems may only be transferring risk from one place to another (Etkin 1999).

distinct timescale because of annual rainfall patterns, whereby impacts of hazards predominantly taking place during the rainy season, from December through to March. This has distinct effects on people's perceptions of risk and how they address DR, which are discussed in Chapter Five and Six respectively.

As section 2.2 revealed, notions of disasters as biophysical or 'natural' in origin were debunked with the theoretical introduction of vulnerability. The next section explores the vulnerability of residents within and across households, with particular focus on the role of the house.

4.2 Vulnerability: The importance of the house

The vulnerability of a socio-ecological system determines its "ability to anticipate, cope with, resist and recover from the impact of a hazard" (Blaikie et al 2004: 11). Therefore the vulnerability level of a socio-ecological system such as the household is directly related to its ability to reduce DR, which is explored in Chapter Six. Chapter Two showed that many studies have systematically measured vulnerability by investigating the level and quality of physical, political, social, economic and human capital. Accordingly, the following discussion of residents' vulnerability is broken down into four sections.

Physical capital is first discussed, with a focus on the role of building codes which prescribe how houses should be built and which can facilitate people to build less vulnerable houses (Greene and Rojas 2008, Ofori 2008)[31]. The particular condition of residents' houses is also sketched which helps determine how susceptible a household is to the physical impacts of rainwater and landslides. Second, 'political capital' is broken down into a discussion of the effects of house-ownership and land tenure as both shape residents' ability to self-build the house and access to basic services which are both linked to physical vulnerability. The 'official' approaches of the Municipal House to address DR are also explored. The third section on 'social capital' investigates the social networks and relationships between residents and the potential of these relationships for vulnerability reduction. The final section will explore residents' access to economic

[31] Although Chapter Two highlighted that urban planning features such as roads and infrastructure are part of physical capital, they are not discussed in the following section. The effects of urban planning on exposure to hazards was discussed in 4.1 and exploration of access to basic services and their quality are discussed in the section on political capital when discussing legal land tenure.
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and human capital. It will also discuss the stability of these two different forms of capitals. Economic capital heavily determines a household's ability to invest in the house in ways that may reduce DR and to recover following the impact of hazards. Additionally, higher levels of human capital in the form of health, education and nutrition are linked to higher levels of economic capital.

Although the chapter is structured into sections, this research acknowledges that each of the five capitals are heavily interlinked and are largely influenced by the design and construction features of the house, which will be captured in the discussion. As sketched in Chapter Two, this research does not propose that residents' access to these different capitals occurs in a vacuum at the neighbourhood level. Rather, residents' levels of physical, political, social, economic and human capital are determined by economic and political processes and their interaction with different social groups based on gender and ethnicity for example. Therefore discussion will focus on the effects of these processes, which are largely located beyond the locale at the meso and macro levels.

Physical capital

The condition of houses significantly dictates residents' vulnerability. Houses can be built in ways that are less physically vulnerable, whereby the house can undergo change or stress from a hazard and still remain within the set of natural or desirable states (Lorch 2005, Bosher 2008). Reflecting a trend in cities of the Global South, all of the residents live in self-build houses, which may have been self-built by the current occupiers or by residents who previously occupied the plot (Greene and Rojas 2008, Wakely and Riley 2011) [32]. Further, across 94% of households some form of reconstruction to the house has taken place (the particulars of this 'reconstruction' are discussed below). 41% of households employed local construction workers to help with these decisions and to carry out the physical labour.

Construction is legally circumscribed by prescriptive building codes and regulations that

[32] As highlighted in 1.1 and Chapter Two, 'self-build' does not necessarily mean that urban dwellers construct the entire building themselves and in the absence of construction workers for example. Rather, the decisions about where, how and when they want to build is what constitutes self-build (Greene and Amarillo 2008).

were produced and are enforced by the Municipal House[33]. However, this section will show that they are inadequately enforced and residents are largely left to govern the construction of their house in isolation from regulation by urban authorities. The building codes were formulated within the Cochabamba municipality and subsequently adopted by the Valle Hermoso Municipal House in 2004 where architects and engineers modified them to suit the particular needs and topography of Cerro Lourdes (Shamelo, and Echavarri-Valdez). Accordingly, households with a 'minuta de compraventa' (proof that the house has been bought) and 'derechos reales' (legal land title) must employ an architect to design the proposed construction. This plan is then sent to the Valle Hermoso Municipal House to be approved or rejected. Shamelo, a senior housing officer in the Office for urban development of the Valle Hermoso Municipal House indicated that one of their principal functions is to reduce the physical vulnerability of houses to local hazards;

> Some sectors have more flexibility to build, more height. On this hill the height is limited [to three storeys] because it is dangerous otherwise and you cannot build the house closer than one metre from the edge of the road[34]. All houses must be built with a retaining wall behind. There are specific rules and regulations in this sector. Standards exist for other parts of the city as one hill is not the same as another. Some areas are weaker or more fragile and others are rocky, and others may be allowed more plants and others not; it depends on the reports the architects have.

The codes make it mandatory to build a retaining wall, to carry out tests to check that the ground is stable for construction and to build the house on a deep foundation. In addition, houses must be built three metres away from houses in other plots. This is to prevent rainwater discharging onto adjacent houses and/or other plots and to avoid high density across the neighbourhoods which can exacerbate ground instability. If building regulations are not complied with, the Municipal House has the jurisdiction to fine household members, and can order the demolition of the house (Shamelo). Non-compliancy is identified through random spot checks by officials of the Municipal House.

Interviews with household informants showed that many are aware there are building

[33] These codes are not available online. I asked for the names and specific documents detailing the building codes during interviews with officials in the Municipal House. However, none were able to locate the codes. That the officials in the Municipal House found it difficult to locate the codes suggests that they are not easily accessed by the public and helps to explain why many residents are not fully aware of these codes.

[34] This is for vehicles to access roads and to ensure there is room to install surface drains.

codes and that they prescribe residents to consult an architect, to limit the height of the house, and to incorporate a retaining wall and a deep foundation. They also understand that these architectural features can reduce the physical impacts of rainwater and landslides; Chapters Five and Six will respectively show that this understanding significantly shapes residents' perceptions of risk and their responses. However, many households do not comply with all of the regulations. Reflecting Arimah and Adeagbo (2000) and Green (2008), higher economic cost is one of the principal reasons. Furthermore, and as highlighted in 4.1, residents want to maximise the use of space in the plot and so many houses are not built three metres apart, which exacerbates the interdependency of exposure to discharged rainwater from adjacent houses. Finally, some residents perceive a low likelihood that their house will be identified by officials of the Municipal House as one resident commented;

> Our house has no building plan. I was worried the mayor was going to find out that we were building without permission. That they were going to come, but they did not come. They don't care about us; they only care about the main street where all the businesses are. It is all about money. Everything is about the quick win that they can get from us, by fining us (Maria).

Of the fifty-three household informants that were interviewed, only Gracia and Samantha had received a fine for contravening building codes. Informal conversations with residents revealed that this was a rarity and an interview with Shamelo indicated that insufficient resources within the Municipal House also hinder the enforcement of building codes and that there is a lack of will within the Municipal House to enforce codes;

> The maximum that the local government can do is give a financial penalty to the people that do not enforce the laws. We can even arrive to the demolition. But we cannot oblige every neighbour, we do not have the capacity, we are very limited in this aspect…In extreme situations we have to go and demolish, only in extreme cases we are obliged to go for their own good. But this is contrary to what we do because if you put yourself in their position, it has cost them money and it took a while to build, so it is a very sensitive situation, and it is negative on our part.

Aside from inadequate resources, Shamelo indicates that building codes are not strictly enforced because it would contradict and reverse the State-led improvements of the neighbourhoods which have taken place since they became political entities in 1999. As such, residents are effectively left to manage the construction of their house in absence of external governmental support or accountability.

There has been widespread change in local architecture and houses are diverse in terms of materials, design and construction techniques. The site was originally dominated by houses known as 'medias aguas', which are principally made of adobe, which are sun dried bricks made of mud, water and straw (see image 6). Problematically, medias aguas are regarded as low-quality housing, particularly because adobe increases residents' physical vulnerability to rainwater because it incrementally cracks from the persistent, less extreme impacts of rainwater, which can lead to the 'total' collapse of walls if not addressed.

Image 6 Adobe material

Source: Author

Image 7 'Medias aguas' composed of multiple adobe single structures

Source: Author

Image 8 Single room used for multiple purposes (cooking, sleeping, eating, socialising)

Source: Author

Image 9 External patio used for multiple purposes

Source: Author

'Medias aguas' are arranged as multiple single structures that are spread out linearly across the plot (see image 7 and figure 8), principally because adobe does not support the construction of houses above two storeys in height. This restrains the size of the

house and the amount of available space, which directly affects living conditions because a single adobe structure may be occupied by a large number of people and used for multiple activities. For example, image 8 shows a single adobe structure that is the dwelling unit of a household of two adults and three children, which is used for cooking, eating, socialising and sleeping (Maria). However, as highlighted in 4.1, houses, including 'medias aguas', typically have an outdoor patio, which is a communal space for activities such as, cooking, cleaning clothes, eating, socialising and storing water (see image 9).

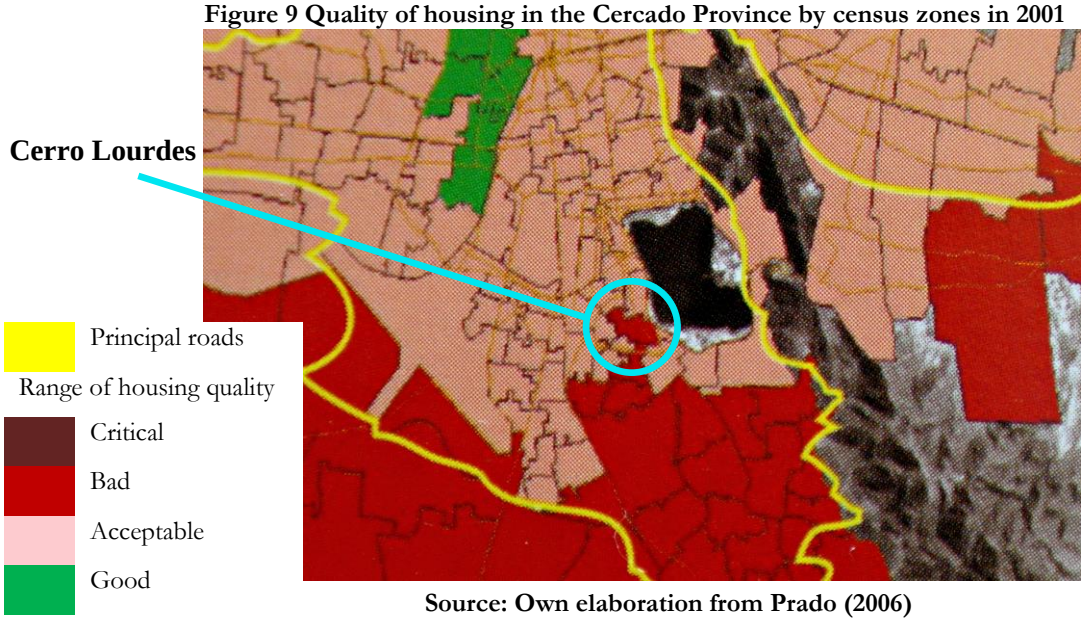
Forty-six of the forty-eight case households investigated, and 85% of households surveyed, built or moved to a 'medias aguas' when they settled in the Cerro[35]. Only Gloria moved directly into a brick house, and Silvia's household built a brick house when they arrived. Despite the physical vulnerability of adobe, there were several reasons why household informants typically built a 'medias aguas' when first settling in the Cerro and which reflects other studies (Turner 1968, Turner 1976, Kellett and Napier 1995, Kellett 2005). First, many residents arrived to the Cerro from rural areas where 'medias aguas' are typical; therefore, many residents were knowledgeable and accustomed to this design and construction type. Second, adobe is much more affordable than brick (Paulo-Jaime, Nadimo, Samantha), which allowed people to quickly build the house. Therefore, 'medias aguas' do not represent sub-standard accommodation which increases vulnerability to local hazards. Rather, 'medias aguas' fulfilled the initial requirements and objectives of residents when settling in the Cerro - shelter. Following this and reflecting Turner (1976), residents then reconstruct, plan to reconstruct or aspire to reconstruct the house, which shows that the construction of 'medias aguas' is the beginning of an incremental process of housing construction.

Reflecting research in Latin America by Forty (2005), adobe is increasingly replaced by brick and concrete, which are less physically vulnerable to the impacts of rainwater. There is also a growing tendency to reinforce concrete with steel, which building codes and local construction workers indicate reduces the vulnerability of houses to landslides. In 31% of plots, all adobe structures have been replaced by brick and concrete structures (survey). In 58% of plots some adobe structures have been maintained and additional single structures made of brick and concrete have been constructed (survey).

[35] 11% of households built or settled in a house made of brick and concrete and 4% in a house made of adobe, brick and concrete (survey).

In the remaining 11% of plots, no changes to the material of the house have been made and an adobe 'medias aguas' remains. This data reflects research by Prado (2006) who analysed census data and found that the quality of housing in the Cerro was of much lower quality in 2001 before widespread transition from adobe to brick took place. His research findings are illustrated in **??? ???** which shows the quality of houses by census zone in 2001, and the categorisation of houses in the Cerro as 'Bad' quality. Furthermore, the trend away from 'low quality' adobe houses is reflected in Table 10 which shows the 1992 and 2001 census, and the upward trend of brick and concrete houses (which are regarded as 'better quality' according to the census) across the research site, the urban provinces of Cochabamba department and urban Bolivia (see Table 10).

Figure 9 Quality of housing in the Cercado Province by census zones in 2001



Source: Own elaboration from Prado (2006)

Table 10 Main material of the walls of houses and the number of houses (%) across the research site, urban provinces of Cochabamba department and urban Bolivia in 1992 and 2001

Material of walls	1992			2001		
	Research site	Urban provinces of Cochabamba department	Urban Bolivia	Research site	Urban provinces of Cochabamba department	Urban Bolivia
Adobe	81	69	65	73	53	53
Brick, cement, concrete	15	19	22	25	36	35
Other (e.g, wood)	4	12	13	2	12	13
Total %	**100**	**100**	**100**	**100**	**100**	**100**

Source: INE (2001)

Brick and concrete has allowed residents to construct stand-alone unitary structures of up to four storeys (see images 10 and 11). However, increasing the size and subsequently the weight of the house can exacerbate ground instability and cause landslides (Aleotti and Chowdhury 1999). Therefore, many houses are now constructed upon a deep foundation and with retaining walls (survey).

Image 10 Example of a multi storey house made of brick and concrete

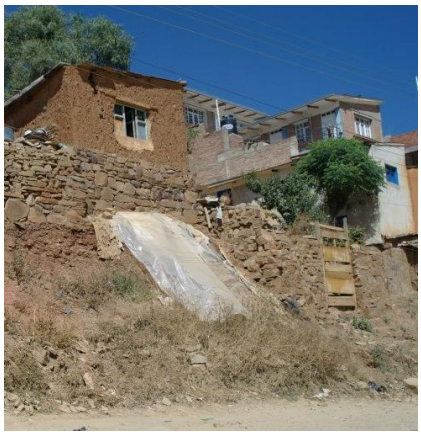
Source: Author

Image 11 Example of a multi storey house made of brick and concrete

Source: Author

Interviews with household informants and local construction workers show that many houses, and overwhelmingly 'medias aguas', are constructed on top of the soil, which increases vulnerability to landslides (see image 12). Construction of 'medias aguas' on top of the soil reflects the architectural practice in rural areas, which people were accustomed to when arriving to the Cerro (Jimena, Faya, Valeria). However, despite the time and labour intensiveness of excavating soil, 50% of residents now live in a house that is built on top of a deep foundation because this construction feature is increasingly included when houses are reconstructed (survey) (see image 13).

Image 12 'Medias aguas' built without a deep foundation

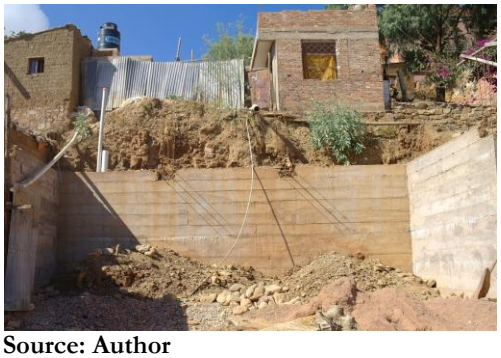


Source: Author

Image 13 Earth being excavated to create a deep foundation

Source: Author

Image 14 A retaining wall



Source: Author

In addition, 43% of households have constructed a retaining wall when they initially settled in the Cerro or afterwards (survey) (see image 14). One local construction worker highlighted the importance of this design feature stating:

> Here, with these problems you must have a retaining wall, and the house above should also have a wall so that the neighbours do not compromise one another. With others who do not have the retaining wall, it all gets soaked during the rainy season and it all falls down (Builder 2).

Despite the increasing number of retaining walls across houses, some are built inadequately and collapse, which causes significant loss of investment. This can occur where residents with minimal or no construction experience undertake this task in order to reduce costs, as Monica explained about her husband;

> He's not a Builder, but he did it all on his own, it was really hard work you know. He was out there on his own [laughs], but it fell down for days, but he didn't make it properly somehow (Monica).

In contrast, households with members that have construction experience are better able to construct effectively and reduce household expenditure. This reflects research by

Morrow (1999), who identifies that household composition directly affects the ability of households to reduce their vulnerability because of the immediate access to particular skills and resources.

How effectively brick/concrete, a deep foundation, and a retaining wall reduce physical vulnerability is beyond the scope of this research as it would require extensive geotechnical, civil engineering and architectural tests. However, the content of building codes and interviews with household informants, officials of the Municipal House and local construction workers, strongly suggest that these three features reduce physical vulnerability to local natural hazards. However, constructing a house of brick, concrete and a retaining wall requires more economic investment than a house made of adobe. Therefore, after a landslide, reconstruction of a brick/concrete house requires greater economic capital than that necessary to reconstruct an adobe 'medias aguas'. This is discussed fully in Chapter Six where this thesis explores the particular strategies that residents living in adobe 'medias aguas' carry out following the physical impacts of local hazards. Here it is shown that residents who are unable to reconstruct brick houses following a disaster can be left living in precarious and uncomfortable living conditions that exacerbates their vulnerability. Ultimately, however, what is important to take from this section is that the design and construction techniques of houses are extremely diverse across the research site; therefore, the physical vulnerability of residents differs significantly across households.

According to literature reviewed in Chapter Two, political capital is heavily related to physical vulnerability. This is now discussed.

Political capital

This section discusses three factors that heavily determine residents' political capital. They are house-ownership, land tenure, and the political and legal status of the neighbourhoods. Discussion in Chapter Two suggests that they can significantly shape people's investment in the house which can lead to lower levels of physical vulnerability. They also heavily determine access and quality of basic services which also shape vulnerability and ability to respond and recover. Finally, political and legal recognition of neighbourhoods may increase the likelihood and quality of institutional and coordinated support to address DR (and access to 'traditional' basic services such as water). However, as Chapter Two also showed, there is often a weak institutional

framework to address DR in 'Southern cities', especially in medium-size cities such as Cochabamba.

According to the household survey, 85% of houses are legally owned by their occupiers who have a 'minuta de compraventa', 13% rent accommodation and 2% have an anticretico contract (see Table 11). Anticretico is a long-term contract where a large amount is paid upfront to the house-owner, which is returned to the tenant in full when they leave (Farfan 2004). Of the case households, five household informants lived in a rented house (Faya, Fabiola and Felix, Eliza, Luna), one interviewee had an anticretico contract (Juan) and the remainder lived in houses that had been bought by the household.

Table 11 Status of house-ownership

Status of house-ownership	Frequency	%
House-owner	316	83
Tenant	48	12.5
Anticretico	6	1.5
No data	12	3
Total	**370**	**100**

Source: Survey

Residents who do not own the house may reconstruct the house on the approval of the landlord; however, consistent with literature, non-house-owners invest very little in the reconstruction of the house (Turner 1976, Gilbert 2008, Lemanski 2011). In addition, and reflecting Gilbert (2008), landlords are more likely to disregard building codes and regulations. For example, four of the five tenants that were interviewed lived in a house that did not have a retaining wall, and not one of these houses was built with a deep foundation. Additionally, four of the five tenants lived in an adobe 'medias aguas' which are more vulnerable to the impacts of rainfall. This is consistent with survey data which shows that 65% of tenants live in a house made of adobe, in contrast to 11% of house-owners that live in an adobe house. In sum and consistent with literature, residents living in rented houses, which makes up 14% of the research site, are less able to reduce their physical vulnerability through housing investment and live in houses that are often more physically vulnerable because of negligible investment by landlords.

As discussed in Chapter Two, security of land tenure often precedes housing consolidation and upgrade as people feel secure that they will not be evicted by urban authorities (Abrams 1966, Turner 1976). Secure housing tenure is also related to formal

access to basic services, which can significantly reduce the impact of hazards and facilitate response and recovery. Many residents have still not registered the house in 'derechos reales' (legal land tenure) or have sold the house, and new residents have only 'inherited' the 'minuta de compraventa'. In 2012 when the survey was carried out, 51% of houses were registered in 'derechos reales', compared to 49% with a 'minuta de compraventa' (survey). In contrast, Echavarri-Valdez, a senior engineer in the office for urban development of the Municipal House, and Shamelo also of the Municipal House, commented that only 20% of houses are registered in 'derechos reales'. Despite this discrepancy, both sets of data indicate that 'derechos reales' is far from universal across the research site. However, the number of houses registered with 'derechos reales' may have increased following the 2012 Ley de bienes y inmuebles ('Real Estate Law') discussed in 2.2. This law makes it significantly easier for indigenous groups to secure land tenure, which typically took many years to secure, and which deterred many indigenous people in Bolivia from applying (Crabtree and Chaplin 2013).

Across the research site, 79% of households with a 'minuta de compraventa' and 83% with 'derechos reales' had reconstructed the house. Further, there is no significant difference in the extent of housing construction between the two groups. This reflects research by Durand-Lasserve and Selod (2009), who argue that residents of legally and politically recognised neighbourhoods do not fear eviction and so are encouraged to consolidate their house. Additionally, significant investments and improvements that were approved and financed by the Municipal House bolster residents' perception of land security. This contradicts Turner (1976) and Abrams (1966), as it is de facto official government acceptance of the continued existence of a neighbourhood and the houses within it that encourages residents to reconstruct their house, rather than individual housing tenure (Strassmann 1984, Gilbert and Ward 1985, Varley 1987, Boonyabancha 2005).

In addition to housing investment, security of land tenure typically precedes formal access to basic services, such as sanitation, water and electricity. The type and quality of these services has the potential to reduce people's vulnerability by lessening the impacts of hazards and facilitating people to recover from disasters (Blaikie et al. 2004). However, as highlighted in 1.3, in Bolivia, the 'minuta de compraventa' entitles households to the same governmental services as households registered in 'derechos reales'. Therefore, since becoming TBOs in 1999, there have been significant

improvements in access and quality of basic services which have equally reduced the vulnerability of households with and without registration in 'derechos reales'.

Prior to 1999, residents used septic tanks and long drops, and many were shared between households living in different plots (INE 2001). Today, each house has a private toilet that is shared by the people living within the plot. Each toilet is connected to a sewage line that is provided by the state owned 'Municipal service for potable water and sewage company' (SEMAPA). Prior to 2003 residents gathered rainwater in tanks, bought water from the private sector, or gathered water from wells located across Cerro Lourdes. In 2003 work began to improve access to water, which was completed in 2005; non-potable water is now provided to every house via pipelines by SEMAPA. However, water is only provided for two to three hours per week, therefore residents use large plastic containers to gather this water and rainwater. The monthly charge for this service is approximately 30 Bolivianos (US$4) per house.

Light and electricity is universally provided to all houses via the public-private provider, 'Empresa de luz y fuerza eléctrica Cochabamba' (ELFEC), which serves the entire metropolitan area of Cochabamba city. Although I never witnessed a power cut, household informants told me that the service is very temperamental. Neighbourhoods of the research site are categorised as low-income, therefore ELFEC charges 30 Bolivianos (US$4) per house per month if less than 100kw is consumed, which is 1.5% of an individual's monthly income. Beyond 100kw, the amount charged is determined by the amount consumed. Residents buy gas canisters for cooking, which cost 22.50 Bolivianos (US$3.25), and last a household one week on average.

The official approach of urban authorities to address disaster risk

The role of the Municipal House has negligible positive impact on residents' vulnerability, and in many cases negatively affects people's ability to reduce risk, which is discussed fully in 6.1. Echavarri-Valdez, of the Municipal House, commented that there was no post disaster response plan in place when the large-scale landslides occurred in 2006 and 2008, and there remain no specific policies to address DR, besides the resettlement programme highlighted in 3.4.

In 2006 and 2008 the Municipal House provided assistance to affected residents in the post disaster phase, which reflects the conventional and reactive disaster management

approach (UNISDR 2005). However, this support was negligible as only blankets, mattresses and food were provided to households that had suffered the most severe physical damage to their house. Consequently, households that may have experienced less severe physical impacts to the house, but significant indirect impacts on levels of social, human and economic capital are effectively marginalised from ex-post disaster support because impacts are narrowly defined as physical within the Municipal House adopts. Therefore, residents are effectively left to recover from disasters in isolation from coordinated and institutional support.

Some household informants commented on the uselessness of these provisions and commented that this support was only provided because the 2006 landslide in Vinateros received media attention;

> They gave us some food and things, nothing really. My sister said 'what are we going to do with rice?'…The thing is, the reporters came here, it was on the news OK. Everybody knew about it. They [the Municipal House] would have done nothing otherwise (Federico).

Supporting this, household informants who experienced the total collapse of their house through small-scale landslides received no municipal help, even when they had visited the Municipal House to ask for it (Fabiola, Valeria). Therefore officials of the Municipal House largely overlook the widespread damage inflicted on individual households by small-scale disasters, which Bull-Kamanga (2003) argues can lead to large-scale disasters and have large cumulative impacts. Therefore, the scale of impacts is particularly significant because the Municipal House is more likely to intervene where there is "massive collective stress" (Kinston and Rosser 1974: 438), or where there is media attention. This is consistent with the wider bias of disaster studies and policies towards large-scale disasters that was identified in Chapter Two (Pelling 2010, Bull-Kamanga et al. 2003).

When officials of the Municipal House were asked "why is there no specific programme to reduce DR and to help residents to recover?", Echavarri-Valdez argued that most houses are not registered with 'derechos reales', and so the Municipal House does not have a legal responsibility to intervene. In contrast, Shamelo commented that the 'minuta de compraventa' places households in a state of 'irregularity' and gives de facto housing tenure with the 'State';

> Some are registered in 'derechos reales' and have property title and some only have the minuta. But they just have to do the process to acquire the property title.

> They are not illegal…People are settled and so are entitled to have rights of ownership. Just because they are not upholding all the rules, does not mean they are illegal, they are just outside of the rule in a status of irregularity (Shamelo).

In contrast to Echavarri-Valdez, Shamelo argues that the 'minuta de compraventa' entitles households to the same governmental services as households registered in 'derechos reales'. This was discussed in 1.3 and the previous section, and is further supported by Sanchez, the head of Urbanism and administrative processes of the Municipal House;

> According to the Political constitution of the State every Bolivian has the predisposition to be given basic services; water, light, sewage. You cannot deny any person. It is what we call a 'constitutional requirement (Sanchez).

Therefore, a lack of legal land title does not explain the insufficient governmental support to address DR. Rather, data indicates that the Municipal House poorly intervenes because of the urban 'vulnerability gap', whereby there is a "lack of knowledge and financial capacity (and sometimes willingness) of urban authorities to reduce risks" (IFRC 2010: 20), particularly in medium-size cities such as Cochabamba (Pelling 2003, Wamsler 2006). Literature reviewed in Chapter Two suggests that this 'gap' is because disasters were for a long time viewed as rural phenomena and the responsibility of disaster specialists. Therefore, urban authorities within 'Southern cities' have negligibly developed frameworks to address urban DR. Building on this literature, data indicates that residents' perceptions that DRR is the responsibility of the household is another factor that exacerbates this 'gap'; however the reasons why people perceive DRR as the responsibility of the household and how this influences the 'vulnerability gap' are discussed in the next Chapter.

At this juncture the thesis argues that the resettlement programme which was briefly discussed in 3.4 is symptomatic of the urban 'vulnerability gap' because it demonstrates a lack of knowledge and willingness to reduce disaster risk within the Municipal House. The resettlement programme fundamentally absolves the Municipal House from any responsibility to intervene to address DR, which ultimately exacerbates the vulnerability of residents. Specifically, in 2008, the Municipal House formulated a resettlement programme that was distributed to residents living in the red and orange zones ('high risk zones') of the 'risk map' (see figure 7 on page 103). The map was accompanied by information, which made three significant statements:

- Residents should not make any type of "construction of considerable

proportions"[36] because the ground is too unstable and "dangerous";
- "No materials or economic resources will be provided [by the Municipal House] for people to reconstruct their houses";
- It is "illegal for residents living in the red and orange zones to sell or inherit their house" (Amarillo 2011, Echavarri Valdez).

These conditions were intended to encourage people living in the red and orange zones to migrate to a rural neighbourhood, villa Siringani in Sipe Sipe municipality, which is thirty kilometres from the research site. The Municipal House also offered US$5000 (34,548 Bolivianos) to house-owners as an incentive, whereas tenants were offered no financial incentive. The resettlement programme was ineffective at encouraging people to resettle for reasons discussed in Chapter Six when exploring how people respond to DR.

Problematically, the risk map does not reveal residents' levels of 'real risk' because it is exclusively based on the visual observation of property damage to houses in Simancas, and the Municipal House's reports about property damage following the 2006 landslide in Vinateros. Shamelo identified this fundamental flaw when he told me:

> Nothing has been done…It has not been addressed as a social problem. That is all we did before and I think it has paralysed the situation…the report says nothing; it is useless. They [the engineers who conducted the report] did not do ground tests…Yes, they went and looked, I know that. But only to see where the damage was…it's useless.

The risk map merely shows where physical damage has occurred in the past and not where impacts may occur. There is no identification or measurement of the severity or frequency of local natural hazards, levels of exposure to hazards or vulnerability levels. Despite this, officials of the Municipal House used this risk map as a visual tool to increase the likelihood that people will resettle.

The effects of the resettlement programme is in line with Blaikie et al. (2004) who classify resettlement as the worst option as it gives the impression that nothing else can be done about disasters. This is the narrative structure that is constructed through the 'official approach' of the Municipal House, and the risk map is a key 'tool' for this. Reflecting this, the map with its 'high risk zones' shown in red and orange, alongside information that says it is too 'dangerous' to build in the area, frame local landslides as

[36] A house above one storey in height is considered to be of 'considerable proportion' (Echavarri-Valdez).

natural phenomena that are beyond the control of residents, which reflects conventional biophysical conceptualisations of disasters (Kates 1971, Burton, Kates et al. 1993). This suggests that resettlement or removal of exposure to landslides is the only effective solution, which implicitly and divisively, removes any responsibility for the Municipal House to intervene in disaster-related issues and places the onus for action on the residents (Felli and Castree 2012)[37].

Fundamentally, the resettlement programme is based upon a technocratic approach that is informed by an "unbounded faith in the ability of experts to apprehend and transform the world" (Heller 2001:375). The result is the imposition of a single policy approach based on a (misguided) biophysical conceptualisation of a disaster, and instrumental rational and technocratic techniques that are deeply depoliticising because they overlook social and political questions about DR (Centeno 2010). As a result, residents are effectively marginalised from any discussion about why they are at risk of disasters, how disasters can be addressed and who is responsible for DRR (Felli and Castree 2012). Ultimately, a weak legal and institutional framework for disaster-related issues leaves residents of the research site largely left to tackle DR in isolation from coordinated governmental support. However, because residents living in red and orange zones are unable to sell their houses and are unable to rebuild, they are effectively trapped in a state of 'limbo' which limits their ability to reduce DR and where they are left living in precarious and vulnerable conditions; this is fully discussed in Chapter Six when exploring how people respond to DR.

Despite weak institutional support to address DR, Chapter Two showed that social capital has the potential to reduce people's vulnerability where governmental support is lacking.

Social capital

Chapter Two highlighted how an individual's social capital, in the form of a larger and more closely located social network, can reduce vulnerability as it increases the likelihood of receiving support to reduce DR and to recover in the ex-post period (Pelling 1998, Adger 2003, Pelling and High 2005). Relationships based on kinship,

[37] As will be shown in Chapters Five and Six, the risk map and the resettlement programme have significant influence on residents' (who are exposed to the map) perceptions of risk and their responses to risk.

friendship or close knit groups create "bonding social capital, which is based on enduring relationships with strong mutual commitments" (Woolcock 2001: 6). Informal conversations and interviews with household informants revealed that there are many families and friends living across the research site. A significant reason is because of the particular migratory patterns of the residents who settled in the Cerro. As 3.2 showed, many residents arrived from mining towns in the departments, Oruro, La Paz and Potosi following the dismantling of COMIBOL in 1986. Then, and reflecting migratory research, migration to the Cerro is likely to have become a self-perpetuating process that has led to neighbourhoods with a high number of residents that may know each other prior to settlement in the Cerro (De Haas 2010). This is relevant to social capital because the movements of people "take root among pre-existing social networks that shape trust, reciprocity and collective identity (that is, factors relevant to social capital)" (Tarrow 1998: 235). However, extensive and cohesive personal networks are not universal and there are residents, such as Fabiola and Lucia who appear to have low levels of bonding social capital;

> Author: "Do you know many people on the hill?"
> Lucia: "Who do I know? Here on the hill? I know their faces. I know my neighbours and the people in my little church here, I see the people. But we arrived three months ago. They don't know us very well, not at all. The children are making friends in school."

Lucia and Fabiola have a relatively low level of bonding social capital because they recently arrived from two provinces of Cochabamba where they did not know other residents of the Cerro. However, they are likely to establish bonding social capital through membership in their respective Evangelical and Mormon churches or through other social activities across the research site. In this way levels of social capital are not static over time, just as vulnerability is not static, but can change with the increasing and decreasing levels and quality of social, economic, political, human and physical capital.

A principal way that bonding social capital is formed is through membership in religious institutions (Furbey, Dinham et al. 2006). Through the vernacular of social capital, the literature on religious congregations and churches indicate that they are social resources that generate personal networks, norms, and relationships that help individuals and neighbourhoods attain certain objectives (Putnam 1993, Putnam 2000). As profiled in section 3.2, 93% of residents identify with a particular denomination of Christianity (survey). 69.5% identify as Catholic, 18.6% as Evangelical Christians, 5.1% identify as Adventist, and Pentecostals and Mormons are represented but at a much

lower rate.[38] 7% do not identify with any religion (see Table 12). Regular church attendance is said to forge and strengthen social capital (Furbey, Dinham et al. 2006). However, data from interviews with residents and the two church leaders show there is great disparity in the church attendance among residents, therefore levels of bonding social capital within and across religious groups may vary significantly.

Table 12 Incidence of self-identification with a religious faith

Religion	% of population
Catholic	69.5
Evangelical Christian	18.6
Adventist	5.1
No Religion	6.8
Total	**100**

Source: Survey

In addition, churches also host many social events such as retreats and parties, which also present opportunities to further strengthen 'bonding' social capital. However, observation at events in the two Evangelical churches where I volunteered indicates that attendance is again unequal and may be indicative of other churches in the research site (Pastor). Furthermore, it is probable that levels of social capital will differ based on an individual's role or place within the church, which can differ from being a committee member of the church to a church member for example.

Aside from membership in churches, research has suggested that alcohol consumption in bars can significantly increase an individual's bonding social capital with other drinkers (Theall, Scribner et al. 2009). This is relevant to the research site as one of the most explicit social activities across the research site was the communal consumption of alcohol. As 3.4 touched on when discussing the difficulties of interviewing men, some residents consume alcohol in informal bars known as 'chicherias'. 'Chicherias' are built inside of people's houses and are locally known as spaces for 'binge drinking', for want of another term and to borrow one from England. Therefore, 'chicherias' represent spaces where residents may increase bonding social capital; although observation and interviews indicate this is predominantly relevant to men. However, other research suggests that a high incidence of alcohol consumption in neighbourhoods can negatively affect the levels of trust at the community level (Theall, Scribner et al. 2009).

[38] Semi structured interviews and observation of churches show that Mormonism and Pentacostalism are present across the communities; however this did not register in the survey data.

Interestingly, and as is discussed below, data indicates that levels of social capital are decreasing at the neighbourhood level; however, data cannot confirm if and how the effects of 'chicherias' have contributed to this trend.

In contrast to bonding social capital, "bridging" social capital encompasses relationships between people who may not be friends or family, but may have overlapping interests (Woolcock 2001: 6). Given the interdependent nature of local DR discussed in 4.1, 'bridging' social capital between residents that live in adjacent houses is particularly important as it can be used to facilitate collective and mutually beneficial efforts to reduce DR (Adger 2003). However, bridging social capital is often reduced when residents identify that the design and construction features of their neighbour's house increases the exposure of their own house to rainwater. Interviews show that this often results in residents blaming and transferring responsibility for the impact of hazards to people living in adjacent houses. For example, five household informants (Fabiola, Valeria, Camila, Maria-Jose, Amalia) who experienced small-scale landslides, and fourteen who suffered property damage because of the impacts of rainwater, told me that these impacts were ultimately their neighbour's fault. For example, Jaime whose house experienced 'very serious' damage from rainwater commented:

> So water enters from here [the house located in the plot above]. It's a problem, they just don't understand…So it's like this, our house is adobe, it's wearing out, it's washing away, washing, washing, washing, each time it rains it washes away. A little hole here, another here. It is his [the neighbor's] fault. He doesn't fix it. He doesn't have any guttering that can get rid of the water properly. I can't fix it. It's his problem.

The interdependent nature of local risk often produces tension and arguments between members of neighbouring plots. This reduces the potential to forge bridging social capital which can encourage collaborative DRR. However, this does not always result in antagonism as other residents such as Consuela and Paulo-Jaime recognise that problems with rainwater runoff is unavoidable given the topography of the Cerro. This recognition and effective acceptance of risk interdependence encourages residents such as Consuela to carry out DRR strategies on behalf of people living in adjacent houses, which is discussed in Chapter Six.

As briefly mentioned above, data also indicates low levels of bridging capital at the neighbourhood level; this manifests as the increasing prioritisation of 'personal' or household needs over collective goals. This reduces the probability of neighbourhood

level DRR strategies such as establishing local committees for risk reduction, and campaigning for the inclusion of DRR into the agenda of the local community committee (see Table 3 in Chapter Two for more examples). Progression from collective to individual objectives reflects seminal research on urban settlement consolidation in the Global South (Gilbert and Ward 1985, Huchzermeyer 2004). According to this literature, when neighbourhoods become legal and political entities (TBOs) and begin receiving formal external support, residents typically pursue collective and traditional development needs such as access to water, sanitation, electricity and road paving. However, once these development goals have been largely achieved, as they have across the research site, residents typically prioritise and pursue more individualistic needs (Gilbert and Ward 1985, Huchzermeyer 2004). This 'progression' is demonstrated by the increasing tendency of residents to prioritise the needs of the self and/or their household over the needs of the neighbourhood, as the President of Simancas commented:

> I do not like that people mainly use the [TBO] meetings for personal gain…I would say that more people only come for personal purposes now; that is the negative (President of Simancas).

Interviews and observation at seven TBO meetings indicated that discussion is typically dominated by residents' concerns at the household level. For example, attendees often raised concern about the need to lay the road outside of their house or a lack of transport links nearby their house. Although residents living in multiple houses would benefit from improved roads and transport connections, concerns are predominantly articulated as personal. A decreasing number of attendees at monthly meetings also demonstrates the tendency of residents to overlook neighbourhood level development (President of Simancas, President of Vinateros) and two residents stated that many residents only attend in order to avoid the fine of 10 Bolivianos (equivalent to US$1.45 or 1.5% of a residents' average monthly income) (Cristiana, Eliza).

Building on this, eight household informants and the Presidents of Vinateros and Amposta all used the word "individualistic" to describe the residents of their respective neighbourhoods. Some residents commented that this has negatively affected the ability of households to recover from the impacts of hazards. For example, when discussing the 'total' collapse of her house due to the 2006 landslide in Vinateros, Norma stated:

> If something happens to you, the neighbours are a disgrace. They just look at you, they don't say anything, nothing. Here the people are very individualistic, we are not united and there is no collaboration. Things have changed a lot since I have been here…They [neighbours] don't agree to help [with recovery], the

> mayor came, but only helped with the debris so that we would vote for him, nothing more.

Reflecting this, Josefina who experienced 'very serious' damage following a small-scale landslide stated:

> The neighbours here don't care. Later they came to steal big rocks caused by the damage. Here the people don't care if something happens to you. If you are attacked on the street or whatever, the people don't care.

Low levels of social capital, which can encourage individualism is in line with Wamsler's (2014) research on DR in cities of the Global South, where she argues that this is one of the principal reasons why DRR typically takes place at the household level[39]. Therefore, it is not only lack of an effective institutional framework to address DR that creates a situation where residents are effectively left to reduce their own DR. Rather, this discussion shows that low levels of bridging social capital between residents living in adjacent plots and at the neighbourhood level also reduce the potential to forge collective DRR strategies.

Economic and human capital

Higher levels of human capital in the form of health and education (Bebbington 1999) are linked to higher levels of economic capital (Moser 2006). Furthermore, higher levels of economic capital increases the potential to reduce risk through investment in the house (Bosher 2008) or support migration to less hazardous areas for example (Wamsler 2014). Higher and more stable incomes can also aid in recovery after the impacts of hazards (Cannon 1994, Adger 1999, Adger 2006). Residents access economic capital in four principal ways which this section discusses: Domestic labour markets, foreign labour markets, cash transfers and bank loans. However, reflecting discussion in Chapter Two, access to these different sources of income is not uniform and is heavily influenced by broader economic and political structures and how they differently affect residents based on gender and ethnicity for example and household composition (Moore 2001, Kothari 2003).

Although one or more households may occupy the same house, decision-making and income expenditure is not communal. Reflecting Varley (1994), decision-making and spending is typically internal to a single household. There is an average of two income

[39] This research acknowledges that longitudinal data would increase the certainty that collective objectives have been replaced by individual ones. However, current data does suggest low bridging capital at the neighbourhood level.

earners per household, with a range of one to six. The average income of a household is 2,580Bolivianos (US$518) (survey). However, as Chapter Two highlighted, the 'unitary' conceptualisation of a household is problematic as intra-household power relations and conflicting interests heavily determine decisions and consensus building related to financial investments (Grootaert, Kanbur et al. 1995, Agarwal 1997). The following discussion will capture this and discussion begins with domestic labour markets.

Domestic labour markets

Across the research site, 35% of residents are employed in local commerce and services, principally in La Cancha market; 20% are employed in manufacturing and 10% in the construction industry (survey)[40]. Disaggregated by gender, the two most important forms of employment for men are manufacturing and construction (48% of adult men), followed by commerce and services (17% of adult men). In contrast, commerce and services represents the most important form of employment for women (55% of adult women), and the second most important is unpaid domestic work (18% of women) (survey).

Women earn an average 1300 Bolivianos (US$188) per month and men earn an average 2000 Bolivianos (US$290) per month. Therefore, by income, women are on average, more economically vulnerable than men. This gender dimension of economic vulnerability is compounded by Bolivian social norms, which determine women's responsibility over domestic duties, which affects women's disaster risk in two particular ways. Firstly, and in line with Enarson (1998), this increases women's exposure to hazards and increases the likelihood that they will directly experience the physical impacts of hazards. Secondly, because many women do not engage in income generating activities, and/or have lower incomes than men, their household bargaining power can be weaker than men (Agarwal 1997, Enarson 1998). This can have direct implications for addressing DR because women may be more inclined to prioritise housing construction in order to address DR for example. However, they may not be able to sufficiently influence the housing construction process because of lower bargaining power, and so the extent to which DR is addressed at the household level can be significantly affected.

[40] Other activities include: technicians and professional support (13.5%); agriculture and fishing (7%) scientific professionals (5%); office work (5%) and public administration and business (1.5%) (INE 2001).

Lower household bargaining power among women is not the norm however; survey and interview data indicates that decision making about economic expenditure is largely shared between men and women adults of a household. This is particularly so in terms of decision making about the design and construction features of self-build houses, as 85% of survey respondents indicated that both male and female members of the household took equal part in this decision making process. Furthermore, although women are more likely to experience the physical impact of hazards because they spend more time in the house, this research finds that there is no significant difference across genders in terms of how much the house is perceived as a resource to address DR. In other words, men and women are equally likely to prioritise DRR when self-building the house because designing and constructing the house in a way that addresses DR has become a 'local architectural norm' which is not exclusive to particular groups such as women. The specific reasons for this will become clearer in Chapter Six when discussing how and why residents design and construct their houses in particular ways.

In line with other research across urban neighbourhoods in the Global South, many women use the house as an asset for income generation, which increases their economic capital (Moser 1998, Moser 2010). Of the forty-eight case households investigated, nineteen used the house for income generation and ten of these businesses were run by women. Two houses were built with a 'chicheria' (see image 15)[41]; eight houses contained a small shop[42] (see image 16); five incorporated work spaces used to produce products such as hats, clothes and ice cream that are sold locally[43]. Finally four households rented out rooms to lodgers[44].

Despite the positive effects on women's economic vulnerability and bargaining power, reliance on the house for income can exacerbate the economic impacts of a disaster. For example, Josefina lived with her elderly parents who each received 200 Bolivianos ($US29) per month as part of a National conditional transfer ('Renta Dignidad') for the over 60s. As this is a small amount, the household predominantly relies on Josefina's shop to generate income. However, after the house experienced 'very serious damage' from a landslide in 2008, Josefina was unable to return the shop

[41] Luis, Vicente
[42] Josefina, Amalia, Valentina, Daniela, Samantha, Vicente, Paulina, Jimena
[43] Felix, Juan, Romina, Sofia, Harry
[44] Ana, Camila, Lucia, Pepe

to its former state, largely because she is financially unable to reconstruct it, so is not earning the same amount she earned before the landslide. This situation of economic vulnerability is exacerbated by her location in the 'red zone' of the risk map. Accordingly she is unable to sell the house, which would generate income that may allow her to leave the house or rebuild it. Instead she remains living in a badly damaged house. Therefore, and consistent with Cannon (1994), households that predominantly rely on the house as a productive asset to generate income are more vulnerable to the impact of hazards than residents who receive multiple and diverse sources of income.

Image 15 A 'Chicheria' built inside of a house

Source: Author

Image 16 Small shop built inside of the house

Source: Author

Residents' access to collective and individual goods such as work is also shaped by ethnicity, which is often influenced by structural racism in labour markets. This is particularly pertinent to the research site as 54% of the adult population in District 6 identify as Quechua, and 15.5% identify as Aymara (CEDIB 2006)[45]. In Bolivia, indigenous populations typically have much lower levels of schooling, receive lower income earnings and experience lower rates of return to schooling than non-indigenous populations in Bolivia (Hall and Patrinos 2012, Kelley 1988, Psacharopoulos 1993, Patrinos and Psacharopoulos 1996). Consequently they are widely excluded from formal sector jobs with typically higher wages. For example, in 2002, approximately 84% of the Bolivian indigenous population and 67% of the non-indigenous population worked in the informal sector (Hall and Patrinos 2012). However, a lower income among indigenous people is not universal across the research site. Reflecting research on La Cancha market in Cochabamba city, small businesses that are run by indigenous

[45] Census data uses self-identification to measure indigeneity.

residents can be exceptionally lucrative (Calderón Gutiérrez and Rivera 1984). For example, Valeria, a sixty-two year old woman who self-identifies as Quechua earns 2100 Bolivianos (US$304) per month, which is 800 Bolivianos (US$116) more than the average of women across the research site.

As discussed in Chapter Two, since Evo Morales became Bolivian President in 2005, there have been significant policy changes that aim to address structural racism against indigenous groups, and conditional cash transfers represent just one. The Renta Dignidad (Dignity Pension) entitles all over 60s to 2400 Bolivianos ($US347) per year, which is distributed as monthly instalments of 200 Bolivianos ($US29) (Gonzales 2011)[46]. Across the research site, 15% of households have one or more members that receive Renta Dignidad (survey). My data does not disaggregate how Renta Dignidad is spent. However, an extra source of income can be invested in ways to reduce DR such as housing construction, or to aid in the recovery phase. Studies on the impact of the Renta Dignidad support this, as beneficiaries typically spend their monthly benefit in three main areas: food, housing and services (Gonzales 2011). Gonzales (2011) also argues that Renta Dignidad contributes to the transformation of the social role of elderly people in Bolivia by increasing their bargaining power within the household.

Other residents receive the Bono Escolar Juancito Pinto ('School Bond') (BJP) which is a cash benefit given to the main guardian of school children aged six to twelve (Sugiyama 2011). This focuses on increasing school enrolment and completion among lower income groups in order to increase levels of human capital that can be harnessed to break intergenerational poverty (Appleton, Kingdon Geeta et al. 2003). Accordingly, a household receives 200 Bolivianos (US$29) per student per year, which is paid in cash to the guardian at the end of the year. Survey respondents and household informants did not specify the Bono Escolar Juancito Pinto, which may indicate that people do not consider it a significant source of income. Despite this, and reflecting E, R et al. (2011), it appears that the Bono Escolar Juancito Pinto may have contributed to positive outcomes on school attendance and levels of education. On average, the first generation completed eight and a half years of education in contrast to the second generation's twelve years (survey). The intergenerational increase in the completed years

[46] People can receive this as a lump sum at the end of the year. However, survey data indicates that most recipients collect Renta Dignidad on a monthly basis.

of education has facilitated the second generation to access formal employment and higher incomes in professional jobs such as teaching, engineering and I.T (survey).

Additionally, residents identify investment in education as a long-term strategy that has the potential to access jobs and higher income earning potential. For example, when asked "are there any other ways that you could increase your income?" six household informants referenced their children's education. For example, Felipina told me:

> They [Felipina's two children] are going to school, they are getting an education. We didn't have that [Felipina and her husband]. This way they will get a good job, they will earn more money this way right?

In Chapter Two, discussion of Wamsler (2011) showed that higher education levels have been linked with a greater understanding and awareness of DR and how to reduce DR. In contrast, the present research does not find any significance here as identification of the causes of disasters and how to reduce risk are widespread among residents regardless of formal education (this is fully discussed in Chapter Five).

Discussion of domestic labour markets and cash transfers shows that the amounts and stability of economic capital is asymmetrical within and across households. However, despite improvements in access to domestic labour markets and the introduction of universal cash transfers since 2005, many residents have increasingly turned to transnational migration in order to access foreign labour markets, particularly in Argentina and increasingly in Spain.

Foreign labour markets

In line with the 'new economics of migration', migration is essentially economic in nature as people migrate temporarily or circulatory to improve their standard of living in their home neighbourhood (Massey 1990). When the household survey was conducted, 33% of households had one or more members that previously or currently lived and worked outside of the neighbourhood (survey). Principal destinations are Spain (51% of migrants), Argentina (27%), Brazil (9%), other provinces of Bolivia (7%), followed by Italy, Chile and the United States (equal 1.2%). Trends reflect Bolivian migration, which has shifted from Argentina towards Spain since the economic crisis in 2001 and the consequent floating of the Argentine peso (Bastia 2007). Also in line with trends in Cochabamba (Roman 2009), women are increasingly migrating, as 54% of

migrants that left the research site between 2002 and 2012 were women. This is 21% more women migrants than between 1992 to 2001 (survey).

Data on migrants shows that 20% save in the host neighbourhood and return with this economic capital, and 62% send home economic remittances. The average remittance is 1100 Bolivianos (US$160). 61% of remitting migrants remit each month; 20% remit every two months and 7% send small amounts (typically US$50) or gifts during special occasions[47]. However, households that predominantly or exclusively rely on remittances for income can become particularly economically vulnerable if remittances become unstable or stop. Demonstrating this, survey data shows that 36% of migrants gradually remit less and 4% stopped sending remittances altogether (survey)[48]. 38% of the time remittances stopped or reduced because there was less work available in the host community, 23% of migrants decided that they prefer to save in the host community and return with economic capital; 5% of the time, the exchange rate affected the amount of remittances, and in 13% of households, separation or extra-marital affairs were to blame (see Table 13). The latter is the case for Eliza, whose husband migrated to Spain in 2006 with the intention of sending remittances to cover basic living costs and save to buy a house;

> He would send money each month for my sons and I was saving, but then he stopped sending me anymore…He said it's because he has no job and that there is no work. I said to him if there is no work then why don't you come home, otherwise I wanted to go to Spain because he was going out with another woman in Spain. This woman called me from Spain, but because I was working, David [Eliza's son] answered and she said to him that her Father is never coming home. Then when speaking to me she said that she is his wife.

After one year all economic remittances stopped and the family no longer hears from Eliza's husband.

Table 13 Reasons why migrants send less or stop sending remittances

Reason	%
Less work in the host community	41
Prefer to save in the host community and return with economic capital	26
Exchange rate changed	8
Separation or extra-marital affairs	15
Total	**100**

Source: Survey

[47] The remaining 12% of migrants send home remittances on a three to six month pattern.
[48] 53% of migrants send the same amount and 4% increased the amount.

Interestingly, 48% of survey respondents stated that a member of the household had considered migration as a means to earn income, but had decided against it. Of this number, 17.5% were deterred because of a perception that migration can damage the 'family unit' through divorce, separation or children 'suffering' because of the absence of their parents. Other reasons included a preference to stay in Bolivia (54%), a perception that that there is no work in destination countries (7%), and a lack of resources to migrate (54%)[49] (see Table 14). Despite this, residents have the opportunity to access economic capital through bank loans, which are now discussed.

Table 14 Reasons why people decide against migration as a strategy to earn extra income

Reason	%
Prefer to stay in Bolivia/Home neighbourhood	54
There is no work there	7
Lack of resources to migrate	54
Potential to damage the family	17.5

Source: Survey

Bank Loans

Within Bolivia, people can access private loans through several institutions: credit cooperatives, commercial banks or microfinance institutions[50]. These organisations allow people to quickly accumulate large sums of capital, which are paid back on a monthly basis. People also borrow loans from family members; however, this does not allow access to large amounts that are available from formal loan organisations. However, it does circumvent the formal requirements which deter or obstruct many residents from seeking formal loans. 12% of residents, including eleven household informants had taken out loans, which can each be up to US$20,000. Two household informants had taken out a single loan and the remaining nine had taken out multiple loans or planned to take out another.

All fifty-three household informants were aware of bank loans as an alternative form of access to income. However, many residents do not adopt this as an economic strategy because there are several criteria for taking out a loan, which restricts access for many. The requirements are: proof of house-ownership ('minuta de compraventa'); proof of

[49] Survey respondents were able to give multiple answers to this question. Answers were not disaggregated by gender.

[50] Credit unions are not for profit member-owned financial cooperatives largely funded by voluntary deposits. Commercial banks are for profit institutions owned by stakeholders. Microfinance institutions are typically funded by external loans, grants and/or investors (World Council 2014).

secure land tenure ('derechos reales') proof of the value of the house[51]; certificates of all the children of the household[52]; proof of employment[53] and evidence of how the applicant will pay back the loan. Even where residents satisfy all requirements, many choose not to take out a loan because they calculate that they may not be able to pay back the loan. Of the household informants, only Victoria stated that she was having difficulties paying back a loan that her Mother had taken out in 2006. However, the other ten interviewees said that they were satisfying the repayments, which suggests that there is a thorough assessment of applications and that residents carefully consider this strategy before applying.

As with the sections on physical, political and social capital, this discussion of economic and human capital has shown that residents are differently able to access and accumulate these capitals within and across households. Furthermore, the stability and amount of these incomes can fluctuate which shows that multiple and diverse sources of income are preferential. The next section draws the Chapter together to highlight important findings about the DR of residents across the research site.

CONCLUSIONS

This Chapter explored the DR of residents within and across households. This required investigation of local hazards, residents' exposure to these hazards and their vulnerability. Although the research site experienced two large-scale landslides which affected many residents in 2006 and 2008; small-scale impacts linked to persistent, less extreme rainfall and landslides are far more common. Specifically rainwater which can damage the structure of the house and increase ground instability, which leads to landslides. Accordingly, resident's DR increases incrementally over long periods of time with the persistent impacts of water. Physical damage to property may include negligible cracks in walls to more extreme damage such as the total collapse of the house. Furthermore, and consistent with Bull-Kamanga (2003), persistent impacts of rainwater, can turn 'light' damage such as cracks in walls into more serious damage if DR is not

[51] The value of the house dictates how much can be borrowed by residents.
[52] This is used to help evaluate whether people can pay back loans. The 'logic' is that the more children a person has, the harder they will find it to pay back the loan.
[53] If a person works informally on the street for example, they do not need a certificate. A person from the lending organisation will go to the stated place of work and investigate. This is usually a matter of asking people who work in the vicinity or any Presidents of the retailers whether the applicant works, when they started work and their hours of work. Proof of income through expenses forms is also required.

addressed. In addition, the physical impacts of hazards on houses have a distinct timescale which predominantly take place during the rainy season, from December through to March. As Chapter Five and Six will respectively show, because DR incrementally increases over time, and because impacts typically occur during the rainy season, this heavily influences residents' perceptions of risk and ultimately their responses.

Residents' exposure to rainwater and landslides is asymmetric within and across households. This is because of topography, density of the neighbourhoods, and because urban planning features such as surface drains, pavements and road surfacing are not universal across the research site. The design of houses and in particular the inclusion of guttering and the inclination of the roof are also influential and differ across houses. Finally residents' social roles based on gender in particular also expose some residents to hazards more than others. Critically, the interdependent characteristic of residents' exposure to rainwater can jeopardise levels of bridging social capital between residents, which hinder the probability of collaborative efforts to reduce DR and is one reason why DRR typically takes place at the household level, as Chapter Six will show.

Investigation of residents' levels of physical, political, social, economic and human capital revealed a pattern of heterogeneous vulnerability across and within households. Therefore, residents are also differently able to reduce their DR, which is explored in Chapter Six. A pattern of heterogeneity moves away from the homogenisation of whole neighbourhoods, which Chapter Two showed is typical among studies that apply structural approaches to measure vulnerability. Residents' vulnerability is the result of a complex set of parameters that can be largely, though not exclusively quantified (Alwang, Siegel et al. 2001, Adger 2006). Vulnerability is dynamic and in a state of flux as political and economic processes differently interact with different social groups based on age, gender and indigeneity. How effectively and the extent to which a household uses these forms of capital to reduce vulnerability is highly dependent on the composition of the household and the intra-household power dynamics. Reflecting Agarwal (1997), women's typically lower wages and domestic responsibilities, increases their economic vulnerability, and can, though not always, reduce their household bargaining power. However, gendered economic vulnerability is often circumvented by women who use the house as a productive asset.

The house is the most visually salient loss from small-scale disasters, and according to Bosher (2008) is also one of the most central resources for reducing DR. Across the research site the design and construction features of the house significantly shape the physical impacts of hazards and residents' ability to accumulate social, political, economic and human capitals. Therefore, the next Chapter pays particular attention to how the design and construction features of the house shape residents' perceptions of risk. Building on this, Chapter Six explores how and why residents design and construct their houses in particular ways in order to address DR.

Another significant finding of the chapter is how residents are effectively left to tackle their DR at the household level, in isolation from coordinated and institutional support. This is indicative of the urban 'vulnerability gap' as there is an acute lack of knowledge, resources and willingness within the Municipal House to address DR (IFRC 2010). This Chapter showed that the resettlement programme and accompanying risk map are a direct manifestation of this 'gap'. Problematically, the resettlement programme is based on a narrative structure that local landslides are natural and beyond human control, which reflects the conventional biophysical understanding of disasters. In line with Felli and Castree (2012) this places the onus of responsibility to reduce vulnerability on the residents and is reinforced by instrumental and technocratic language and techniques, and the employment of architects and engineers who are framed as objective experts (Centeno 2010). The effect of this 'official approach' on risk perceptions and responses are discussed in Chapter Five and Six respectively.

Now that the heterogeneity of residents' DR has been revealed, the next chapter builds on this and explores how residents perceive their risk of a disaster. The design and construction features of houses, the resettlement programme and the risk map are particularly central to this. However, other influential factors such as experience and the timescale of hazards are given particular attention.

CHAPTER FIVE: THE RISK PERCEPTIONS OF RESIDENTS

This chapter explores how residents perceive their risk of a disaster. In particular it identifies the particular characteristics of residents' risk perceptions and the factors that shape them. It also identifies any significant overlaps or differences in residents' 'real' risk which was explored in Chapter Four and their perceived risk. As outlined in 2.3, this research distinguishes between 'real risk' and 'risk perception'. Research question 1 was answered in Chapter Four by applying a 'naturalist' model of risk that is largely applied across disaster research and policies to identify 'objective' levels of disaster risk (DR). This approach is useful as it allows this thesis to explore how and why 'real' and perceived risk differs, and it permits a standardised measurement of risk that can be applied across space and time. However, literature reviewed in Chapter Two has shown that risk perceptions, do not always mirror 'objective' risk. This is because an individual's perception of risk is the subjective assessment of the probability of a particular event occurring, and how concerned a person is with the consequences (Sjöberg, Moen et al. 2004).

According to the conceptual understanding of a risk perception that was outlined in Chapter Two, a risk perception is constituted by how an individual understands and copes with signals about dangers, vulnerabilities and uncertainties (Jasanoff 1998). This research views risk perceptions as products of social construction. Accordingly characteristics such as scientific or technical definitions, personal experiences, social norms, emotion, imagery, trust, values and worldviews shape risk perceptions (O'Connor, Bord et al. 1999, Slovic 2000, Leiserowitz 2006, Weber 2010). Therefore, it is important to consider how residents' social roles which are largely determined by gender and age for example, shape residents' experience of the social world and subsequently their risk perceptions. For example, Chapter Four showed that gender heavily shapes residents' levels of exposure to hazards and the likelihood that they will directly experience the impact of hazards. Therefore this chapter will show how this influences perceptions of risk. As such, the individual is the unit of analysis; however, any emerging patterns within or across groups will be revealed.

The chapter begins by exploring how residents understand the causes of disasters; whether caused by humans, a natural phenomenon or the result of divine determinism. This establishes whether residents see DR as internal or external to their behaviour,

which is important for understanding how residents respond to DR and which is explored in Chapter Six. The factors that shape residents understanding of the causes of local disasters are explored and discussion begins by exploring how residents understand the process of local DR, with particular emphasis on the effect of persistent, less extreme hazards linked to incrementally increasing risk. The effects of horizontal risk communication which take place in the absence of universal vertical risk communication are also discussed. In particular, focus is on risk communication facilitated through informal social networks between members of the neighbourhoods, which include local construction workers.

The second half of the chapter investigates the factors that shape residents' perceptions of risk and the nature of residents' perceptions. This is critical for understanding how and why residents respond to local DR which is given attention in the following chapter. According to the conceptualisation of risk perceptions laid out in Chapter Two, this requires investigation of factors beyond the properties of 'real' risk. Building on Chapter Four, residents' subjective interpretation of the risk map and resettlement programme is first given attention. This is followed by exploration of the effect of residents' indirect and direct experience with the impacts of hazards which the literature reviewed in Chapter Two suggests is often the most influential factor on risk perceptions. Particular attention is also given to residents' perception of their physical vulnerability, which is largely bound by the design and construction features of the house. This has large overlap with residents' 'real' risk and the factors that shape their perceptions of risk. As Chapter Four identified, local DR has a particularly distinctive temporal scale as it incrementally increases with the persistent impacts of rainwater; this chapter also explores how this effects risk perceptions. Finally and again drawing on Chapter Four which showed that the impacts of hazards typically take place during rainfall and the rainy season more broadly, this chapter explores how rainfall patterns shape residents' perceptions of risk.

5.1 Identifying disasters as human made

Uncovering how residents understand the cause of local disasters is critical for understanding residents' risk perceptions and the disaster risk reduction (DRR) strategies that they carry out (or not) because it reveals where an individual identifies the locus of control for DRR (Weiner 1985, Peterson, Maier et al. 1993, McClure and Williams 1996, Lindell and Perry 2000). Individuals, who ascribe the cause of a disaster

to the particular characteristics of the hazard or divine determinism, do not generally perceive they have the ability to reduce their DR. However, the overwhelming majority of residents believe that disasters are caused by local natural hazards interacting with inadequate housing design and construction techniques. Put differently, residents understand that disasters are the result of the overlap between hazards, exposure and their (physical) vulnerability, which reflects the same interpretation of a disaster found among disaster experts and practitioners following the introduction of the concept vulnerability in the 1980s. This helps to challenge the idea that 'non-experts' lack the ability to understand the cause of disasters, which is one of the elements that has maintained an implicit binary between 'risk experts' and 'ordinary' people in disaster studies and policies. A corollary of this binary has been the marginalisation of the skills, knowledge and resources of vulnerable people which would enable them to contribute to more multi-scalar DRR interventions.

Although 93% of residents identify with a religious faith (see Table 12 in 3.2 for statistics), religiousness has minimal influence on how people understand the cause of local disasters. Residents tend to adopt a secular understanding of disasters, with only two household informants (Gemita and Faya) claiming that the impacts of hazards were punishments from God;

> Because like they say, the power of God is great. If he wants a house to fall down he can. He can make everything fall down because water can take away all things (Gemita).

Despite their religious interpretations, Gemita and Faya's understandings are not in opposition to, or mutually exclusive of scientific explanations. Reflecting recent research by Cherry (2013), their faith based understandings intermingle with secular explanations of disasters. They understand that rainfall is linked to the physical impacts of hazards; however, they simultaneously retain religious interpretations, as they perceive that God controls rainfall. Therefore, although they understand that the locus of control is within the hands of God, they understand that local natural hazards are linked to the physical impacts of a disaster. Problematically however, their interpretations omit the influence of vulnerability for the cause of disasters.

In contrast, the remaining fifty-one of the fifty-three residents that were interviewed perceive the physical damage to their house as a consequence of exposure to rainwater and landslides interacting with their physical vulnerability, i.e. the design and

construction features of their house. This interpretation of disasters as human made is revealed when residents were asked "why was your house damaged?" or "why are houses damaged?" All fifty-one (excluding Gemita and Faya) referenced the design and construction features of houses as one of the most critical elements that dictates the impacts of hazards [54]. Although household informants' recognise that physical vulnerability can influence risk of a disaster, most view the impacts of hazards as "inevitable." Interviews with residents revealed that many residents perceive that reconstruction of the house in order to reduce physical vulnerability may delay the physical impacts of local hazards, but it cannot totally eradicate risk. Demonstrating this, Luis commented:

> You can build well, the Builders here are able, they are good, they know their work and the terrain here. But it is the terrain that is the problem. It is affected by the rain you see, there is no solution…here it is inevitable.

Therefore, and although household informants understand that disasters are caused by hazards interacting with their physical vulnerability, they ultimately place greater emphasis on the role of local natural hazards. As such, the impacts of hazards are understood as an unavoidable and anticipated consequence of living in a hazardous area like Cerro Lourdes. Although residents perceive the impacts from hazards as inevitable, the widespread perception that appropriate housing construction delays the physical impacts of hazards remains influential on their risk perceptions and how they respond. These are discussed in section 5.2 and Chapter Six respectively.

Interviews showed that residents do not interpret disasters as natural phenomena or acts of God for two principal reasons. Firstly, the repetitive and slow-onset effects of local natural hazards allow residents to visually observe and monitor the effects of hazards on the house over time. Secondly, information provided through building codes, local construction workers and personal narratives within informal social networks is also critical. The role of horizontal dialogic communication about DR is particularly important across the research site because there is a lack of top-down risk information as identified in the previous chapter.

[54] The particular design and construction features which residents perceive reduce DR are discussed in section 5.2.

The observable and persistent impacts of hazards

This section explores how impacts from persistent, less extreme rainfall which incrementally increase local DR, allow residents to identify the role of the house for DR. As Chapter Four showed, the period of incremental change which slowly increases risk may occur over many years through an increased intensity and/or frequency of rainfall (Siegele 2012). This characteristic of local DR allows residents to visually monitor the physical impacts of rainwater on the structure of the house, which provides a visual indicator that design and construction features significantly shape how and to what extent hazards affect the house. Additionally, and although not observable, residents understand that rainfall incrementally exacerbates ground instability, which may lead to landslides.

As such, residents understand that small effects from local hazards (rainfall) accumulate over time and can be 'tipped' into more serious impacts during periods of heavy rain. Renn et al. (2011) identify this as a 'delay effect', where there is a dormant period between initial events and actual damage. The fact that residents understand this process, contradicts Sterman (2008) who argues that vulnerable groups often find it difficult to understand that risk accumulates over time with the consistency of hazards. Reflecting Blaikie et al. (2004), this encourages residents to take anticipatory and long-term measures to reduce current and future risk (see section 6.3).

Horizontal and dialogic risk communication

Residents receive significant information about the nature of DR through dialogic communication that is ongoing between residents, including local construction workers. In Chapter Four the research showed that there is a negligible amount of vertical risk communication from the Municipal House to the residents. What are available are the building codes, the 'risk map' and the information about the resettlement programme. However, the risk map and the information that accompany it are largely targeted to people living in the red and orange zones in a bid to encourage migration away from the Cerro. Beyond this there is a very negligible amount of top-down media coverage about local disasters and DR, which is subsequently discussed in 5.2[55].

[55] It is likely that residents have been exposed to media sources about disasters and DR in other locations; however, there is very little media information that is specifically about the research site.

Despite a lack of top-down communication, critical dialogue and learning about DR does not depend on one way and monologic communication about local DR. Across the research site, many residents learn about the cause of disasters through interpersonal communication. Felder reflects on this type of learning when commenting:

> Every meaningful lesson or belief I've garnered in my life came from someone I value explaining the issue to me and involving me in the process of figuring out the solution (quoted in Gumucio-Dagron 2001: 4).

Local interpersonal communication in the form of personal narratives, story-telling and recommendations from construction workers to clients (residents) fill the 'gap' left by an absence of top-down risk information. Horizontal communication about DR is particularly important in urban settings such as Cerro Lourdes where there is a 'vulnerability gap' because local urban authorities, such as the Valle Hermoso Municipal House do not effectively engage in DR issues (IFRC 2010, Wamsler 2014). Until this 'gap' is filled by an effective legal and institutional DRM framework, and until information from urban authorities is accurate, multi-directional exchanges of information between residents of the research site will remain one of the most important and valuable means of learning about local risk. In this sense, personal communication effectively precludes and substitutes for the Municipal House's information, which incorrectly frames local landslides as natural and beyond human control. These sources and processes of horizontal risk communication are now discussed, beginning with the role of local construction workers.

The survey showed that 46% of households employed local construction workers to reconstruct the house (survey). These construction workers are predominantly sourced from residents living in the Cerro, which is not surprising as 48% of male residents work in 'manufacturing and construction' (survey). Many other households used household members with (and sometimes without) construction experience. 35% of survey respondents and all eight construction workers that were interviewed indicated that there is often a dialogical approach between members of the household and Builders when deciding on the design and construction features of the house. As many local construction workers have direct experience and knowledge about suitable housing construction for addressing local DR, construction workers regularly recommend certain architectural features to residents and highlight their appropriateness for reducing the impacts of local hazards. Unlike building codes, which are imposed on residents, this information is recommended; therefore residents decide

whether they want to adopt these recommendations based on desirability and available resources for example. In sum, the knowledge and experience of local construction workers horizontally diffuses throughout the research site and provides another important source of information about the role of physical vulnerability for DRR.

Another form of horizontal communication takes place in the personal narratives between residents. Through interpersonal communication, residents learn about the function of the house and the impact that local hazards have on houses. This stems from residents' personal experience and/or the observation of other residents' experiences. This is illustrated by Isabel's response when she was asked why she decided to build a retaining wall;

> We arrived here [to the Cerro] in 1999 and we saw houses down there fall down. Then after, the people started to build these, what do you call them? Retaining walls right. To stop the ground moving, to stop the landslips. Mr. Villarroel [Isabel's neighbour] told us, he said 'you must build one of these, it is dangerous without a wall'.

As the physical impacts of rainwater and landslides on houses are frequent, DR is a continuous issue that residents either observe or engage in conversations about, which increases the role and importance of interpersonal communication. Drawing on the issue of trust that was discussed in Chapter Two, Siegrist and Cvetkovich (2000) and Paton (2008) argue that people take note of information from a source that they trust. This helps to explain why many residents garner information about local DR from people within their social networks, but most importantly, that they trust in the reliability of this information because it originates from people that residents often have personal relationships with.

This section has shown that interpersonal communication about DR plays an important and effective role for residents to understand the process of DR and how it can be addressed. This challenges the idea that vulnerable people cannot effectively understand the process of DR in isolation from 'risk experts' which maintains interventions such as vertical risk communication. Despite the findings of this research, it is acknowledged that dissemination of top-down information about DR certainly has a role to play in DRR; however, this information must be accurate and sensitive to the local social context. Problematically, this research has shown that the risk map is based on an inaccurate representation of DR, the building codes are not easily accessible and are often difficult to comply with because of increased costs. Finally, the 'official approach'

to resettle people is informed by a reductive understanding of human behaviour and in many cases increases the DR of residents living in the 'high risk' zones. This latter point is fully outlined in Chapter Six when discussing why many residents did not resettle.

So far Chapter Five has shown that residents understand disasters according to the same fundamental principles as 'risk experts', i.e. exposure, hazard, vulnerability. Therefore, they understand disasters as human made phenomena and that the locus of control to reduce risk is internal to human action. More specifically, residents understand that local DR increases incrementally with the persistent impacts of rainfall and they identify the design and construction features of the house as their most influential source of vulnerability. With these findings in mind, the next half of this chapter discusses the factors that construct residents' risk perceptions and the particular nature of their risk perceptions.

5.2 Constructing risk perceptions

Supporting seminal work on perceptions by Katz and Lazarsfeld (1970), residents' perceptions are powerfully constructed by a diversity of primary and secondary influences that filter residents' interpretations of signals about local DR. Interview data shows that there are four principal factors that have significant influence on residents' risk perceptions.

The first factor is the risk map which was discussed in section 4.2; however, this map only shapes the risk perceptions of a small amount of residents because of its targeted dissemination. The second factor is previous experience, which may be direct experience with hazards, or indirect/vicarious experience. The third factor, and which builds upon findings in 4.2 and 5.1, is residents' perception of their physical vulnerability, which they understand to be shaped by the design and construction of their house. This represents a particularly novel approach for understanding risk perceptions as the physical form of the house has been largely overlooked in the literature. This particular discussion of the house also highlights how residents' perceptions of risk are not exclusively shaped by their past and present experiences as the majority of literature purports, but also by their ability to consider future DR scenarios. The final factor links to one of the findings of Chapter Four, where this researched showed that the physical impacts of hazards are largely experienced during the rainy season. Accordingly, this chapter sets out to explore the effect of rainfall

patterns on risk perceptions, which allows this research to show that risk perceptions are far more fluid over time than the majority of literature suggests.

Top-down, 'expert' led risk communication

As discussed in Chapter Two, secondary information can shape the perceptions of people with and without direct experience. These sources of information disseminate a particular interpretation of DR to the public (Renn, Burns et al. 1992). The Municipal House and the media represent two sources of information that provide top-down risk communication to residents in the Cerro. However, according to the social constructivist approach which this research adopts, the ways that residents interpret this information is determined by many factors such as experience and trust in these sources. Therefore, a social constructivist approach allows this research to analyse and explain how and why the risk perceptions of residents do not automatically reflect the particular interpretation of local DR that is provided through the media and the Municipal House.

Chapter Two showed that the effect of the media on risk perceptions has received significant interest in the literature, and research tends to conclude that media coverage can intensify or attenuate an individual's concern with DR when coverage is consistent and over long periods of time (Krimsky and Golding 1992, Development Media International 2014). However, across the research site, the media has minimal impact on residents' risk perceptions. The reasons for this help to demonstrate the inherent and problematic bias of the media towards large-scale disasters, which diverts public and policy attention away from persistent, less extreme hazards that are linked to small-scale disasters which are experienced across the research site.

Media coverage of the impact of hazards across the research site consisted of newspaper and radio coverage in the days following the 2006 and 2008 landslide, and two radio appearances in 2011 by a small group of residents that mobilised to seek support from the municipality (see section 6.2 for a discussion about this mobilisation of residents). There was also a 'follow-up' newspaper article in 2011 about the "uncomfortable and precarious living conditions" that some residents continue to live in across Simancas (Amarillo 2011). However, the small-scale disasters that are more common across the research site have received no media coverage. This is in line with research on media coverage of chronic famines, where Ram (1995: 173) argues that the

media is good at covering large-scale dramatic crises and not "low key" and "tame" small-scale disasters. Furthermore, Wachinger and Renn (2010) argue that any effects of the media on perceptions will wane over time unless coverage is consistent. Therefore, media coverage has a short impression on residents' perceptions of DR as coverage is sporadic, minimal, and ignores small-scale disasters. However, and supporting Llasat-Botija et al. (2007), the rare coverage of large-scale disasters appears to have greater impact on the perceptions of people who live outside of the case site. Informal conversations with approximately eight or nine Cocabambinos revealed that Cerro Lourdes has a reputation for having problems with large-scale landslides. This is likely because they have only been exposed to secondary media accounts of disasters, which skew coverage towards the larger scale landslides of 2006 and 2008.

As discussed in previous chapters, the Municipal House also provides top-down risk information in the form of a risk map. There has been a limited amount of research on the effect of these types of risk maps on people's perceptions (Crozier and Glade 2006). The Municipal House employed this map as a visual tool to justify and encourage the resettlement of residents living in the orange and red zones ('high risk' zones). Problematically, the risk map quickly translates a representation of local DR as a natural process that is beyond human control, whereby 'escape' is the only viable solution. In this way, the risk map illustrates what Castree (2014: 56) calls the "discursive nature of vision", whereby an image can "at a stroke, condense myriad and complex meanings that would otherwise have to be communicated at length on a page or verbally." Despite the map being based on an inaccurate measurement of DR, this simplified depiction of local risk has distinct influence on the risk perceptions of residents who are exposed to it.

Twenty-two household informants were exposed to the risk map. Fifteen were located in the red or orange zones and seven in the yellow and green zones. Of the twenty-two, seventeen directly referenced the map during interviews and results show that zoning information has distinct effects on people's perceptions. Supporting Crozier and Glade (2006) and Siegrist and Gutscher (2006), people living in a low-risk zone tend to deemphasise the likelihood of a disaster and potential damage. Jazmin who was living in a 'low risk' zone demonstrated this when commenting:

> They [the Municipal House] made this map. It says it; it is not as dangerous. This street here [where Jazmin lives], this part is safer. It's further down, down by Calle Padula. It's a disaster down there; very ugly.

This research is not arguing that residents living in the green and yellow zone disregard DR; on the contrary and as discussed in 5.1, the physical impact of hazards are seen as inevitable. However, location in the yellow and green zones significantly shapes risk perceptions in three particular ways. Firstly it attenuates residents' perception of how much damage will be experienced; secondly, an individual typically perceives they have more effect on how much damage will be experienced; thirdly, and linked to this, an individual is more likely to perceive that impacts will occur further into the future. In contrast, residents in high-risk zones perceive that the impact of hazards will occur sooner and that impacts will be more severe. This is because they place far more emphasis on the role of the hazard than the design and construction of their house when making a subjective calculation of DR. For example, Josefina who lives in the 'red' zone and who was brought into dicussion in Chapter Four, commented:

> It would be in vain. Why invest when it could happen again, and it probably will. Look at the state of the house, look. It would cost [money] to repair this house now. I'm not repairing it precisely because it is going to fall down again. It's the red zone here. It's a pointless investment; it's an investment in vain.

One of the reasons why zoning has significant sway over people's perceptions is because the results that inform the risk map and associated recommendations are framed as 'objective', 'scientifically rigorous' and 'expert led', which frames them as unquestionable (Hajer and Versteeg 2005, Felli and Castree 2012). The employment of professionals such as architects and engineers who use technocratic and scientific language and techniques is central in creating this 'objective' and 'professional' veneer, which is intimidating for residents to challenge (Centeno 2010). As Chapter Two highlighted, this reflects a technocratic approach to address DR (Kates 1971, Burton, Kates et al. 1993, Bankhoff 2001), and which ultimately depoliticises the issue of disasters and discourages residents from asking social and political questions about why they are at risk and who is responsible for DRR (Felli and Castree 2012).

Some residents living in high risk zones adopt an apathetic attitude that human action will do little to prevent damage, and it may first appear that the risk map induces fatalism and 'learned helplessness', which Blaikie et al. (2004) warn is a possibility of 'zoning'. However, aside from the narrative structure of 'natural disasters' which the Municipal House constructs, there are other explanations why residents perceive DR as largely insurmountable. Firstly, residents in these zones are not allowed to reconstruct the house, (see section 4.2) and secondly, they typically lack the resources needed to reconstruct the house; largely because of the indirect impacts of the resettlement

programme (this is fully discussed in 6.1). Therefore, the reasons for an apparent apathy towards DRR are as much about an individual's interpretation of the risk map as their assessment of their available resources to reconstruct the house. This finding is particularly illustrative of social constructivist thinking, as it shows how individuals subjectively consider more than the characteristics of 'real' risk that were defined and represented by the risk map and resettlement programme of the Municipal House. It also demonstrates the importance of what this research terms 'perceived control'. In other words, individuals who perceive that they have a large ability to reduce DR are more likely to adopt a proactive attitude to DRR, whereas people who perceive DR as a natural process and beyond their resources are less inclined to pursue DRR.

Although the risk map can shape risk perceptions, only twenty-two of the fifty-three household informants reported that they had ever seen the map. This is because the Municipal House targeted residents located in the red and orange zones in a bid to encourage resettlement. Furthermore, the influence that the risk map has on perceptions is interdependent on previous experience. For example, Teresa and Valeria suffered 'very serious damage' and 'total collapse' of their house respectively. They were both aware of the risk map and both live in the green (low risk) zone. Despite this, both women express significant apprehension about disasters because their previous experience undermines their trust in the information provided by the Municipal House. Wachinger and Renn (2010) would argue that this is because previous experience typically has the most significant effect on risk perceptions.

Direct and indirect experience

In line with many studies, direct and indirect experience with the physical impacts of local hazards are a significant and strong predictor of risk perceptions (Grothmann and Reusswig 2006, Siegrist and Gutscher 2006, Ruin, Gaillard et al. 2007, Miceli, Sotgiu et al. 2008, Wachinger and Renn 2010, Wachinger, Renn et al. 2013). However, the particular ways that experience affects risk perceptions is heavily determined by several factors; for example, the severity of experience, the time since the impacts occurred and residents' social roles based on gender and age. These are discussed throughout this section.

All household informants, TBO Presidents and local construction workers are aware of local hazards and their potential impacts. This is learnt through direct personal

experience or indirect experience. As Chapter Two identified, direct experience is internal, whereby impacts have direct consequences to an individual's property. Witnessing hazards which negatively affect other individuals is another form of direct experience (Weinstein 1989). Indirect (or vicarious) experience is external and occurs when an individual is exposed to secondary sources of information about disasters (Dunwoody and Peters 1992, Breakwell 2007). These may be personal narratives from other residents, 'official' information from the Municipal House or media coverage, which were all discussed in the previous section. Additionally, many streets across the research site contain one or more houses that have 'serious' damage to the 'total collapse' of the house which brings a continuous reminder of the impacts of local hazards[56].

When all fifty-three household informants were asked "is there anything that you dislike about living in this neighbourhood?" thirty-six referenced the "disasters", "landslips" or how "houses fall down." This group is composed of twenty-seven residents who experienced 'very serious', 'partial collapse' or 'total collapse' of the house, two informants who suffered 'serious damage', two who experienced 'moderate damage', one informant who experienced 'light' damage and four informants with no direct experience (see Table 9 for a description of these impacts). Therefore, 61% of household informants with direct experience referenced the impact of hazards as an element of their neighbourhood that they dislike. Therefore, interviews show that residents with direct experience are more likely to perceive that the impacts of hazards are more probable and that the consequences will be more negative. Weinstein (1989) argues that this is because direct experience provides more vivid and easily recalled information and greater personal involvement.

In addition and reflecting other research, interview data shows that residents with experience of more serious impacts tend to perceive that a disaster is more likely, that outcomes will be more severe and typically express a greater concern about disasters (Ruin et al. 2007, Felgentreff 2003, Finucane, et al. 2000). Specifically, this refers to residents with experience of personal injury, total collapse, partial collapse, very serious damage and serious damage to the house (Ruin et al. 2007, Felgentreff 2003)[57]. Teresa

[56] These houses are predominantly 'medias aguas'.
[57] This data principally looks at the relationship between property damage and risk perceptions; however, the indirect impacts on social and economic capitals may also shape people's risk perceptions. However,

demonstrated this when describing her Father's high levels of fear after being hospitalised when the roof of his house collapsed on top of him;

> My Dad really worries. He never worried like this before. One of these days, when he was not working, it [the 'medias aguas'] just fell down. Two floors fell on his head. He lost his memory for a month…He was here in Harry Williams hospital, but with great help from the Lord and prayers, he was about to die in the room, but they brought him back from the dead.

Related to the experience of Teresa's Father, residents who experienced 'partial' or 'total' collapse of the house were more likely to perceive personal injury as a likely outcome of the impact of hazards, which produces a greater level of concern. For example, Romina experienced the 'total collapse' of her house and stated "I only care about my children. We can just replace material things, but not life." Romina and eight other informants[58] who had suffered 'serious damage' to 'total collapse' of the house made explicit references to the possibility that personal injury may result from the impacts of hazards. In contrast and reflecting Krasovskaia, Gottschalk et al. (2001), individuals that suffer minor damage such as 'negligible', 'light' or 'moderate' damage are aware that the impacts of hazards are likely, however they do not perceive that impacts will be severe and not one referenced personal injury.

Supporting previous research, people with indirect experience are generally less concerned and/or apprehensive about the impacts of hazards (Peacock et al. 2005, Grothmann and Reusswig, 2006, Siegrist and Gutscher 2006). Only four out of sixteen residents with indirect experience referenced disasters as their greatest dislike about the neighborhood. The remaining twelve interviewees with indirect experience who did not identify local disasters as one of their dislikes about their neighbourhood are aware of local disasters and perceive that they are also at risk. However, they demonstrate normalisation bias as they see potential impacts as less serious and that they will be experienced further in the future (Weinstein 1980, Paton, Smith et al. 2000).

This section has so far shown that people with direct and indirect experience perceive risk of small-scale disasters as important. This is particularly significant because it contradicts research reviewed in Chapter Two which argues that there is a 'risk

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this data cannot draw conclusions about this relationship because this research focuses on physical property damage; therefore, this represents a potential for further research.

[58] Marcela, Alejandra, Norma, Paulo-Jaime, Faya, Valeria, Fabiola, Juanita

hierarchy' because people are less concerned with natural hazards linked to disasters, and are typically more concerned with problems like 'food on their plate', paying school fees, getting water, crime, road accidents and so on (Barberi et al. 2008, Blaikie et al. 2004, IFRC 2014, Lavigne et al. 2008). These studies argue that people are more concerned with these problems because they "apply much higher significance to problems of everyday life and issues that they have to confront for normal survival, most of which are linked to their livelihoods" (IFRC 2014: 67). However, the importance which residents give to local natural hazards and their link with small-scale disasters indicates that people do consider them to be 'everyday' or chronic local problems. This is because of the persistent and observable impacts of rainfall (albeit during the rainy season), because small-scale disasters are frequently experienced by households and because these impacts are visually observable which provides a consistent reminder of the problem. As Chapter Six will show, this perception that local natural hazards and their associated impacts are local problems significantly encourages people to carry out anticipatory strategies to address this risk.

One of the ways that residents reduce their apprehension about potential impacts even where they perceive they are likely and will have negative impacts is by using humour. For example, when Fabiola was asked "is there anything you dislike about your house?", she replied with a sense of nonchalance despite experiencing the 'total collapse' of the two houses that she previously rented;

> Ah yes, that it's going to fall down again [laughs]. Two houses. Two different houses here. It is a worry when it rains that it will fall down, that there will be landslips, this is the problem.

She demonstrates how humour can distance one's self from a problem such as the impacts of natural hazards and allow residents to look at the problem with perspective (Martin and Lefcourt 1983). This research is not suggesting that Fabiola does not worry, but that she uses humour as an attitudinal coping strategy that reduces her sense of dread about potential disasters and their impacts.

Chapter Four discussed how women are more likely to directly experience the physical impact of hazards because they spend more time in the house due to their responsibility of domestic duties. This has consequences for risk perceptions, which reflects Miceli et al. (2008), who showed that because women's social roles often mean they are more likely to directly experience the impacts of hazards, they are more able to vividly and

rapidly recall this experience which can exacerbate risk perceptions (Weinstein 1989). For example, Carla lives in a house where all of the men work outside of the house and all five women take care of domestic duties and spend most of their time in their 'medias aguas' house. She told me that all five of the women were at home when one of the adobe single structures totally collapsed following the long-term impacts of rainwater. However, in contrast, Victoria commented that the men living in the house are less concerned with DR and addressing it through reconstruction of the house;

> They [the men] give a little bit of interest and then they don't have any interest. All the brothers don't want to help….We [the women] are scared the house will fall on us. The men are not afraid.

Therefore this research finds a particularly gendered construction of risk perceptions due to the social roles of women. This is also in line with Momsen (2010 cited in Jabeen 2012) who argues that women are often the first to notice the subtle changes in the ordinary environment and are also more likely to want to respond to them. However, this thesis is not arguing that men are unconcerned with the impact of hazards. Rather, men are aware of the potential of impacts from hazards but typically have low levels of apprehension because they are less likely to have been at home when the most severe impacts of hazards on the house occur. Consequently they do not typically have the rapid and vivid recall of these events. Despite a gendered construction of risk perceptions, results show there is no significant difference between genders in terms of intentions to self-build the house in order to address DR. Men and women equally want to reconstruct the house in order to reduce DR and reasons for this are fully discussed in Chapter Six.

Risk perceptions are also affected by 'relative vulnerability', whereby residents perceive themselves as less vulnerable to the impacts of hazards than other residents (Perloff and Fetzer 1986). This occurs when residents simultaneously experience the same hazard, but the physical impacts are differently experienced. For example Cristiana lives in a house located on a street in Vinateros that was affected by the large-scale landslide in 2006. Many of the houses on this street were severely damaged; however, Cristiana's four-storey brick house only suffered negligible damage. This was minimal property damage compared to the houses on her street that experienced 'very serious' damage or 'total' or 'partial' collapse of the house. Relative vulnerability helps to explain why Cristiana is far less concerned about disasters than her neighbours Norma, Silvia and Sofia whose houses experienced more severe impacts. Therefore perceptions of risk

have an element of relativity, in which people gauge their current level of risk by comparing their experience with that of others.

Finally, direct experience and its effect on risk perceptions has a distinct temporal dimension because residents' concern with the impact of hazards is most acute in the initial period after impacts, but gradually diminishes over time. Supporting Weinsten and Nicolich (1993), this process is most explicit for people who have experienced more severe impacts (physical injury, 'total' or 'partial' collapse of the house) because anxiety is greater in the period following impacts[59]. For example, following the 'total collapse' of her rented house, Fabiola and her family moved to live in another house in Simancas. She said that at first her children expressed fear about another landslide; however, this reduced over time;

> Bit by bit they got more confidence and now they are not scared. It has passed, because now water enters [the plot] but we dug, we dug around the house so that the water goes away. I told them, this house is safe (Fabiola).

Fabiola demonstrated how risk perceptions are not constant over time because they increase and attenuate following a disaster (Weinstein and Nicolich 1993). Furthermore, Fabiola referenced that she was able to appease her children's risk perceptions by commenting on the house, which highlights how residents place significant emphasis on the design and construction features of the house when gauging their levels of DR. The following section explores the particular dimensions of housing design and construction features that residents associate with lower levels of DR and the particular effects this has on risk perceptions.

Design and construction features of the house: Perceived physical vulnerability

This research finds that there are significant overlaps in residents' 'real' risk as identified in Chapter Four, and their perceived risk, because the inclusion or exclusion of particular design and construction features of the house significantly shape residents' risk perceptions. In particular, people associate brick and/or concrete, a retaining wall and a deep foundation with lower levels of DR. For example, when Cristiana, was asked "Why was your house not damaged as much as your neighbours?", she specifically referenced the construction features of her house;

[59] Previous research on post disaster stress argues that over time levels of stress and apprehension about the potential manifestations of DR will return to pre impact levels, which tend to be average across groups(Weisaeth 2007). Findings cannot verify how long this return to 'regular' levels takes as the time period of data collection period was limited.

> Because it is built well…With my house nothing happened. I had brick on the top bit and a two storey adobe house on the bottom bit, that fell down…There is a secret to construction. You have to dig until you find the hardest part of the ground. You can't just build because it will give…They [construction workers] dug and dug and dug until they found the hard bit. If you don't find the hard bit you just can't build because the soil will give way. Then they put huge metal posts, right? Special posts like crow's feet.

The design and construction features of the house significantly shape residents' risk perceptions. As discussed in 5.1, fifty-one of the fifty-three household informants understood disasters as the result of the interaction between hazards and vulnerability and all fifty-one referenced particular design and construction features of the house as important elements dictating the impacts of local hazards. Interviews show that residents living in a house with one or more of these housing construction features are less apprehensive about DR than people with none.

Despite this and as 5.1 showed, residents see the impacts of hazards as "inevitable"; therefore, residents do not perceive the house as a resource that can entirely remove all risk, but that it can significantly reduce the severity of impacts and delay the onset of impacts further into the future. Therefore residents' risk perceptions are not exclusively bound by their past and present experiences, which disaster literature often proposes. In contrast findings show that the temporal structuring of residents' risk perceptions is sophisticated because residents' recognise that their future DR is connected to the ongoing, subtle and often visually observable impacts of hazards on their house. Therefore residents do not perceive that distant and future disaster scenarios are generally abstracted from their everyday lives, which helps this research to contradict research which argues that vulnerable groups in the Global South tend to think and behave in the short-term, reflecting a 'hand to mouth' lifestyle (see Chambers 2006 for a critique of this perspective).

This finding is particularly relevant to disaster research and policies because it challenges the pervasive idea that 'risk experts' and elites focus on future DR scenarios, whereas 'non-experts' are said to be bound by their understanding of the past and the present. On the contrary, residents across the research site think in the long-term, and these 'forecasts' about future risk heavily shape how they address disaster risk, as Chapter Six will show. As such, the thesis suggests that residents' perceptions of slow-onset DR are broadly in line with the long-term temporal scale that is often used for understanding and adapting to the impacts of climate change.

With regards to the particular construction features that shape perceptions, the material of the house is the most influential. Forty-eight of the fifty-three household informants and all eight of the local construction workers commented that brick and concrete is much more appropriate for houses because "the adobe gets wet you see, it's so humid, it's horrible. It washes away with the rain and falls down." (Gloria). 85% of residents currently or previously lived in a 'medias aguas' because they built or settled in a 'medias aguas' when they arrived to the Cerro (survey). Of this number, 53% of survey respondents stated that their 'medias aguas' had been damaged by rainwater[60] (survey). Given the widespread problem with adobe, it is probable that the 15% of residents who have not lived in a 'medias aguas' learn about the vulnerability of adobe through secondary sources and personal networks across the Cerro in particular.

In addition, residents also understand that a retaining wall significantly reduces the likelihood of the ground slipping forward and causing a landslide as Eliza demonstrates when she commented:

> The rain runs down, it's torrential sometimes. Sometimes you can't walk in the streets. It poured down here [from the house above onto the back of Eliza's house], all over the house and made the ground soft like sand, and whoosh it gave. We need to build a [retaining] wall. The neighbours all have one you see. They don't have this problem.

Problematically, 57% of houses do not have a retaining wall (see section 4.2). In addition to a retaining wall, residents associate a deep foundation with lower levels of vulnerability, and 50% of houses have a deep foundation. However as Chapter Four showed, most 'medias aguas' are built without a deep foundation in contrast to brick houses which are more likely to be built on top of a deep foundation.

The organisation of houses can also have an interesting effect on risk perceptions. Chapter Four highlighted that many houses are composed of single structures that are constructed of adobe or brick or sometimes a combination of the two. In the latter case where a house is composed of single structures that are each made of a different material, some residents commented that they associate the structures made of brick as safer than the adobe structures. Therefore risk perceptions have a distinct spatial dimension which sometimes results in residents using certain parts of the house that

[60] This is not disaggregated by the extent of property damage such as 'partial collapse'; 'total collapse'.

they perceive as less vulnerable during rainfall when their risk perceptions are typically higher (this is discussed in section 6.2).

The perception and understanding that certain construction techniques can reduce DR is not isolated to a certain part of the population, such as men or construction workers. Rather there is a widespread understanding of how the house can be used to reduce physical vulnerability. For example, interviews show that first generation, indigenous women such as Valeria who had migrated from a small rural town in Potosi was not limited to knowledge about the architecture of vernacular 'medias aguas'. She, like most interviewees told me why brick, retaining walls and a deep foundation are fundamental for living in the Cerro because of landslides and the effects of rainfall. However, the reasons why people identify the significance of these construction features for reducing risk, but do not adopt them are fully explored in Chapter Six.

Ultimately, because houses are extremely diverse, the effect of 'perceived physical vulnerability' on risk perceptions is also diverse. Some houses are adobe, whereas others are brick; some have retaining walls and some do not; some are built on deep foundations whereas others are not. As such, diverse local architecture combined with residents' awareness that the house determines DR contributes to heterogeneous perceptions of risk across households and sometimes within houses if different materials are used to construct different parts of the house. However, the risk perceptions of residents who live in a house with all three design features have significantly lower risk perceptions than residents who live in a 'medias aguas' without a deep foundation or retaining wall. Nevertheless, even where all three features are present, residents do not perceive that they have 'zero risk'. Rather residents understand that their future risk of a disaster can be delayed and the impacts can be lessened through appropriate housing construction.

In addition to residents' consideration of their future levels of risk, results show that residents' risk perceptions are heavily shaped by the time-scale of local natural hazards, namely local rainfall patterns.

The time-scale of local natural hazards: Fluctuating risk perceptions

Covello and Mumpower (1985) argue that people's responses to DR are affected by their perceptions of rainfall patterns. As such, this section investigates people's

perceptions of rainfall and its relationship with their perceptions of risk. Results show that risk perceptions are not as static as literature often suggests as they tend to rise and fall with the pattern of rainfall. With regards to landslides, the latent and incremental effects of rainfall on ground stability make it difficult for residents to predict the onset of a landslide (Siegele 2012). However, because residents understand that their DR incrementally increases with the persistent effects of rainfall on ground stability (see section 5.1), many interviewees perceive that their risk is higher during the rainy season (December to March) and particularly so during periods of heavy rainfall. Illustrating this, Fabiola told me:

> The first year that we lived here, a year and a half, no water entered the house and then my children said to me 'mummy, it's going to rain, it's going to fall down'…They were really scared. Each time that it rained hard I would not leave them alone…we are all scared because every time it rains, it [the 'medias aguas'] falls down a little bit. This house gives me fear. Water enters and it gets completely soaked.

As such, risk perceptions are not constant over time, but oscillate in line with rainfall patterns. The risk perceptions of residents tend to increase during rainfall and the rainy season more broadly. However, emotional responses are not generally as fearful as Fabiola and her children's. Rather interviews show that residents' concern with the impacts of hazards comes to the forefront during rainfall. This is not necessarily because they perceive that they will immediately experience the physical impacts of hazards, but instead because the rainfall acts as a visual reminder of the risk of a disaster, which is compounded by residents' understanding that the persistent impacts of rainwater incrementally increase their risk of a disaster. This plays out in distinct ways in terms of when and how people choose to act to reduce their DR (see section 6.2).

In addition residents perceive that rainfall patterns have changed. Some claim that the rainy season now lasts longer[61], others state that rainfall is now more intense i.e. heavier[62], and finally, others say that periods of rainfall are now longer in duration[63]. They also perceive that disasters are far more common now and some link this to changes in rainfall patterns[64]. As a result many residents perceive that local DR is increasing as a result of these changes in rainfall patterns. When people were asked about these weather changes, they consistently replied that it was the result of "cambio

[61] Paulo-Jaime, Bianca, Rebeca, Pastor
[62] Juanita, Teresa, Consuela, Monica, Eliza, Silvia Felipina
[63] Builder 2, Teresa
[64] Bianca, Juanita

climatico" (climate change). In fact, across Bolivia and irrespective of income, gender, ethnicity and age, people are increasingly aware of 'cambio climatico' and its links with the changes in rainfall patterns that they are witnessing (Oxfam International 2009). It is not a concept that is exclusively found within the vocabularies of scientists and elites. This is in large part a consequence of the Bolivian government's energetic and widely publicised agenda on climate change issues, which includes hosting the 2010 World People's Conference on Climate Change and the Rights of Mother Earth in Tiquipaya, just 14km from the case site[65].

CONCLUSIONS

This chapter has shown that residents' *risk perceptions are asymmetrical* within and between households. Additionally risk perceptions are *not constant over time* and residents understand that *risk increases incrementally* with the persistent impacts of rainfall. The chapter also showed that residents predominantly identify that control over DR *is internal to human action*. Residents understand the cause of disasters according to the same 'scientific' principles as 'risk experts' - disasters are symptomatic of the interaction between exposure to hazards and vulnerability. As such, residents understand that they are able to reconstruct their house in ways that reduce DR. They do not perceive that they can achieve 'zero risk'; however the house represents a resource that can significantly delay the impacts of hazards and reduce the negative outcomes. Key to this understanding is the horizontal communication about risk that takes place between informal personal networks. Furthermore, this takes place in a context of negligible top-down risk communication. Where this information is provided (by the Municipal House), it is targeted to certain sections of the population and provides an eschewed and inaccurate understanding of DR in order to further the resettlement agenda of the Municipal House.

Ultimately residents understand DR according to the same fundamental principles as 'risk experts'. In addition, this learning predominantly takes place in isolation from 'expert knowledge and information', which provides evidence of the ability of vulnerable groups to 'scientifically' understand the causes of disasters. It also challenges

[65] The World People's Conference on Climate Change and the Rights of Mother Earth was a global gathering of civil society and governments hosted by the government of Bolivia from April 19–22, 2010. It was attended by around 30,000 people from over 100 countries (De Angelis 2011).

the idea that these same groups require top-down and expert led information about their risk if they are to fully comprehend their situation.

The second half of the chapter explored the nature of risk perceptions. Consistent with a social constructivist understanding of risk perceptions, this discussion showed that what constitutes a threat for people is more to do with individual perceptions than attributes of 'real risk'. Residents' risk perceptions are asymmetric within and across households because of the diverse ways that people experience and interpret signals about their DR (Jasanoff 1998). Risk information provided through the Municipal House certainly affects people's risk perceptions as people living in the red and orange zones are more likely to have higher risk perceptions and an apathetic attitude about their ability to address DR (Crozier and Glade 2006, Siegrist and Gutscher 2006). However, this information is not widely disseminated. Furthermore, the resettlement programme reduces the ability of some residents to reconstruct the house, sell the house, and has indirect negative effects on their capital resources. This is problematic as it exacerbates their perception that the locus of control for DR is beyond their action, which subsequently increases their apathy towards DRR.

Reflecting previous research, the nature of previous experience with hazards has significant influence on people's perceptions (Siegrist and Gutscher 2006, Finucane et al. 2000, Ruin et al. 2007, Felgentreff 2003, Krasovskaia et al. 2001). Residents with direct and severe experience tend to perceive that disasters are more likely and that the outcomes will be more negative. However, people with indirect experience also perceive they are at risk, but typically perceive potential impacts to be less severe and in the more distant future. In addition, people place significant importance on the effects of natural hazards which contradicts research which has argued, for example, that people are more concerned with problems like income and security linked to their livelihoods (Barberi 2008, Blaikie et al. 2004, IFRC 2014, Lavigne et al. 2008). This chapter argued that this is because of the persistent impacts of local natural hazard which constructs people to perceive this as an everyday problem.

Across people with direct and indirect experience, the design and construction of the house significantly shapes their risk perceptions. Certain construction features are widely used by residents to gauge their levels of DR. However, because local architecture is highly diverse, residents' risk perceptions are differently affected by the

design and construction features of their house. Building on this, people explain that certain design features make the house "last longer" against local hazards. As such, residents do not think that 'zero risk' is achievable. Furthermore, the chapter argued that this shows the long-term temporal scale of residents' risk perceptions, which is more in line with the temporal scale used in the climate change adaptation literature. This is because people identify that their present behaviour and experience with the persistent impacts of hazards are not abstracted from their future risk. Chapter Six will build on this finding and show that it has a distinctive effect on how residents respond to DR. Related to this, risk perceptions are not constant over time. Contradicting Sterman (2008), residents recognise that DR may increase over time with the incremental and consistent impacts of rainfall. As such, risk perceptions are higher during the rainy season and heavy rainfall, which also has distinct effects on people's DRR strategies discussed in the next chapter.

Some studies show that higher risk perceptions catalyse risk reducing or protective action (Grothmann and Reusswig 2006, Plapp and Werner 2006, Siegrist and Gutscher 2006, Miceli, Sotgiu et al. 2008, Heitz, Spaeter et al. 2009). Conversely, other research argues that people with high risk perceptions and experience seldom take any action to reduce their risk and that the relationship between risk perceptions and action is not very strong (Karanci, Aksit et al. 2005, Haynes, Barclay et al. 2008, Hall and Slothower 2009, Jóhannesdóttir and Gísladóttir 2010). In light of these contradictory studies, the next chapter discusses how residents respond to local DR in order to reveal any significance between levels of risk perception and the DRR strategies that residents carry out.

CHAPTER SIX: RESPONSES TO DISASTER RISK

This chapter will explore the different situations of residents and the disaster risk reduction (DRR) strategies that they carry out. The chapter begins by discussing residents who have been relocated from 'high risk' zones with the support of government cash incentives. It also discusses residents who are unable to migrate and/or rebuild their damaged houses because they are ineligible for the cash incentives of the Municipal House and/or have limited resources, which is largely a result of the resettlement programme of the Municipal House. The chapter also discusses the many residents who do not want to migrate away from the Cerro, and the variety of disaster risk reduction strategies that they carry out. Attention is given to short-term and ad hoc strategies as well as the reconstruction of housing which represents a long-term DRR strategy. The previous chapter showed that residents perceive that disaster risk is largely internal to human action because they perceive that the house is the most important resource to address disaster risk. Furthermore, the chapter showed that risk perceptions are heterogeneous within and across households and that they are not static over time. This chapter will pay particular attention to the influence of these particular risk perceptions on residents' DRR strategies, which makes this chapter particularly critical for addressing the research aim.

The chapter begins by discussing migration as a strategy to avoid local hazards. This helps to explain why many residents continue to live in an area where they are exposed to hazards and their potential impacts. Literature has highlighted the importance of livelihoods as benefits which encourage people to live in hazardous areas (Shepherd et al., 2013; DFID, 2005). However this research also finds other benefits that residents perceive and which have received negligible attention in the disaster studies literature. Furthermore, this part of the chapter builds on Chapters Four and Five and discusses how the resettlement programme which was coordinated by the Municipal House, shapes the ability of residents to address disaster risk (DR) when living in the 'high risk' zones. Following this the chapter will explore the DRR strategies that residents carry out, which require them to interact with the physical form of the house. The chapter will discuss the effectiveness of these strategies by drawing on interview data from residents. This section will also explore why DRR strategies typically take place at the household level. Previous studies suggest that low levels of social capital within urban neighbourhoods (Wamsler 2014) and the urban 'vulnerability gap' (IFRC 2010) are

primary reasons; however this chapter suggests new reasons for this.

There is significant discussion about the widespread and dramatic architectural change that has taken place across the research site, and which has created a broad shift away from the rural vernacular architecture of 'medias aguas'. This part of the chapter will identify the particular design and construction features of houses and will explore why residents have reconstructed their houses. There is consideration about whether people with high or low risk perceptions are more or less likely to reconstruct the house in a bid to reduce disaster risk. As outlined in Chapter Two, this research adopts a more holistic conceptualisation of the house than that normally taken in disaster studies, which recognises that the house is not merely a physical resource to address DR. Therefore, this part of the chapter will explore the design and construction features of the house that residents may not associate with DRR, and their reasons for incorporating them into the house. This will allow this research to holistically understand the reasons behind housing design and construction features by looking beyond the DRR dimensions of housing and to other functions of the house that may influence social and economic processes for example (Kellet 2005). This will allow this research to make a more nuanced analysis of the influence that people's risk perceptions have on the way they design and construct the house. Results which inform this section are based on a discursive analysis of interviews with residents and their 'ideal house' drawings.

6.1 Migration and 'staying put'

Chapter Two showed that migration is a form of DRR as it removes exposure to hazards (see Table 3). This section shows that migration away from the research site or to other parts of the Cerro is one of the strategies that residents carry out. However, others do not want to migrate because of several factors, which illustrate Starr's (1969) idea of voluntariness to live with a certain level of risk if there are associated benefits. In addition, migration is not universally available as many are unable to migrate because of insufficient resources and/or the indirect effects of the resettlement programme, discussed in previous chapters. This section explores why some migrate, while others do not; discussion begins with the effects of the zoning and resettlement programme.

The ineffectiveness of the resettlement programme

As discussed in 4.2, the Municipal House formulated a resettlement programme and

created a risk zone map to encourage migration away from 'high risk' areas in Vinateros and Simancas. Problematically, this resettlement programme was based on a narrative structure that disasters are naturally occurring phenomena that are beyond human control. The Municipal House also made it illegal to sell or inherit the house and restricted the reconstruction of houses to one storey. I was told by household informants and the President of Simancas that many houses in Vinateros and Simancas had been abandoned soon after the landslides. This is supported by local newspaper reports, which indicated that many people from Simancas went to Argentina, Brazil and Spain, while others moved to live in the houses of their relatives (Amarillo 2011). Determining the driver of this migration is conceptually, methodologically and empirically difficult as there are often multiple causes (Massey 1990). Residents that permanently migrated away from the Cerro may have done so for reasons other than DRR. This may include the municipality's US$5000 incentive, or for the 'pull' of work in another area (Lee 1966).

Despite the migration of some, the resettlement programme was largely ineffective, because many households decided against resettlement to villa Siringani in rural Cochabamba. Interviews with household informants and the Presidents of Simancas and Vinateros showed that many residents remained living in the red and orange ('high risk') zones;

> After [the landslide], people from the municipal house came to verify, to see who was affected, the houses that fell down, taking photos for example. They offered US$5000 because they wanted them to abandon the houses and go elsewhere. Some went, some decided to leave. Most did not want to go; they rejected the US$5000 (President of Simancas).

The ineffectiveness of the resettlement programme is also substantiated by local media reports about Simancas where it was reported that members of thirty-three of the eighty-five affected households were still living in the 'high risk' zones (Amarillo 2011). One of the principal reasons why the resettlement programme was ineffective is because it did not acknowledge and capture the social, cultural and economic reasons why people choose to live in a 'risky' area. Here it is useful to draw on the idea of 'residential satisfaction', which is defined as "the positive or negative feeling that occupants have for where they live" (Weidemann and Anderson 1985: 155). This helps to investigate what makes the Cerro a desirable place to live and why people refused to resettle.

Proximity to the city centre is a principal factor; it is heavily linked to livelihoods because it provides greater income earning opportunities and access to services than peripheral or rural areas, where there are less job opportunities, food is often more expensive and support services are not close by, which can reduce household income and increase household expenditure (Chan 1995, DFID 2005, Mitlin and Satterthwaite 2013, Shepherd, Tom Mitchell et al. 2013). Josefina illustrates the importance of proximity when commenting on why she decided against resettlement;

> It was a disaster. We managed to go to the Municipal House, the authorities, and the only solution was to take us to another neighbourhood. This neighbourhood was super far. I don't know if you will go there one day, it's in Siringani. It's super, super far. So because of this the people opposed it…I prefer to stay here with my shop.

Residents' unwillingness to relocate to Siringani supports Blaikie et al. (2004) who refer to resettlement as the most undesirable solution to DR because of the effective omission of local social, economic and cultural patterns that often make this solution highly disruptive and unsuitable for the affected populations.

The unsuitability of the resettlement programme will also be explained further in 6.2 when exploring the responses of people who remained living in the red and orange zones. As discussed in 5.2, the resettlement programme and the accompanying risk map contributed to an apathetic attitude about the possibility to reduce DR among people living in the red and orange zones because landslides were framed as beyond human control. This manifested as a lack of effort to reconstruct the house. Further to this, the ban on the sale of the house had a significant effect because the prospect of losing significant economic capital through the effective abandonment of the house discouraged house-owners from permanently leaving. Josefina again demonstrated these issues when asked why she did not leave or invest in the reconstruction of her house after experiencing 'very serious' property damage;

> It would be in vain. Why invest when it could happen again, and it probably will. Look at the state of the house, look. It would cost [money] to repair this house now. I'm not repairing it precisely because it is going to fall down again. It's the red zone here. It's a pointless investment, it's an investment in vain …We were thinking about selling [the house], but they will not let us sell either…Before the house was valued at nearly $60 – 70,000. Now nobody wants to buy it for even $600[66].

[66] Although the Municipal House banned the sale of houses, residents and the President of Simancas commented that some former residents sold their house for a much lower price than it would have been worth if it was not in the 'high risk' zone. Informants stated that this was possible because the Municipal

The 'official approach' of the Municipal House was effective at discouraging reconstruction of the house. However, it was less successful at encouraging migration away from the area because it is based on a reductive and narrow conceptualisation of human behavior in disaster-prone contexts. In other words it is based on the assumption that residents are a passive audience whose behavior will be primarily dictated by the content of this 'official' risk information and that there is a linear relationship between risk information, recipients' risk perceptions and their responses (IFRC 2014). In other words, residents living in 'high risk' areas will ultimately remove themselves from the area (Felli and Castree 2012).

This critique can also be made of the resettlement programme as it gives minimal consideration of how social, cultural, political and economic factors shape people's willingness and ability to migrate (Moore 2001, Kothari 2003). Consequently, residents living in the red and orange zones are trapped in 'limbo' where they are unwilling to reduce their physical vulnerability through reconstruction of the house, but are also unable to migrate because of the potential significant economic losses and are unwilling to migrate because of residential satisfaction. This is again demonstrated by the local newspaper, Los Tiempos which reported that thirty-three of the eighty-five affected households in Simancas were living "in poor conditions" three years after the landslide, "with broken window panes, sloped roofs, large cracks and holes in walls, collapsing walls and debris dumped in the street" (Amarillo 2011). Therefore, residents such as Josefina continue to live in precarious and uncomfortable living conditions, which exacerbate their DR.

'Voluntariness' to live with risk

Outside of the red and orange zones, household informants identified many diverse reasons why they choose to live in an area that they know is 'risky' and where the impacts of hazards are 'inevitable'. The thesis argues that this demonstrates Starr's (1969) idea of voluntariness as residents are willing to live with this risk because they identify significant benefits of living in the cerro.

Some residents move to plots in the Cerro that they perceive are less exposed to hazards. For example, despite experiencing the 'partial collapse' of her house, Jimena

House does not effectively enforce the rule of 'no resale' of houses, which is unsurprising as Chapter Four showed that the Municipal House lacks the resources to enforce building regulations either.

wanted to remain living in the Cerro and so moved her household to a plot located four blocks further up and still within Simancas. For Jimena, living in a plot that was less exposed to surface water was paramount; however she also wanted better access to transport links and a larger plot to build a bigger house;

> The other house I had was too small and it was on a slope, at the bottom of a slope. Lots of water entered and damaged the house when it rained, and it was uncomfortable. Here it's more comfortable, it's flatter, and so the buses can pass by the house here too.

Jimena shows that residents' decisions to migrate within a disaster prone area are not mono-causal because people negotiate DRR and non-DRR factors when deciding where and why they want to move. Despite this, fifty-two of the fifty-three household informants did not move and remained living in the same house, despite their awareness and/or experience of the impacts of hazards. Instead of signposting their lack of resources to migrate, many informants identified a diversity of factors that encourage 'residential satisfaction'. Illustrating this, Paulo-Jaime commented:

> Why would I leave here? We have everything. Close to the centre; you can get there by foot. We have light, water, we have everything complete right? A lot has improved, but everything bit by bit has improved.

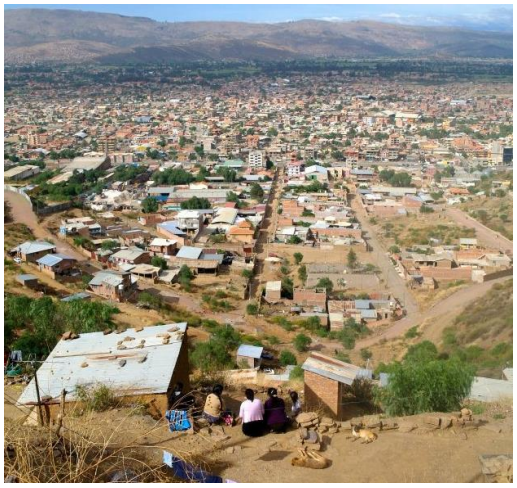
As with residents living in the 'high risk' zones these informants highlighted the importance of proximity to income earning opportunities and access to services. Residents choose to remain in a disaster-prone area because they perceive worse living conditions in Siringani, which is in line with Heijmans (2001). However, people's preference to stay in the Cerro and the same house is not only explained by benefits to livelihoods and access to services, which previous studies have largely used to explain why people remain in hazardous areas (e.g. DFID 2005, Shepherd 2013). Other reasons include the desire to maintain socio-spatial support networks such as family and friends, as well as institutions that provide access to education and religious services. For example, Samantha highlighted the importance of schools and church as institutions to build and maintain personal networks;

> They have a good school for my children here and the other reason? The church, I attend the church every Sunday and I work in COMPASSION. They are just some of the reasons.

Other reasons include the "peacefulness" of the Cerro (eighteen household informants), which refers to the small amount of traffic in the Cerro and how the area lacks the 'hustle and bustle' of the city centre. Six household informants also referenced the "beautiful view" from the Cerro as a significant 'draw' (see image 17). Eleven

residents also told me that they feel accustomed to the area as they have lived there for many years. Further, and as pointed out in 5.2, some residents do not perceive that the impacts of hazards will be particularly severe and they also perceive that severe impacts will only occur in the very distant future.

Image 17 The "beautiful view" from Cerro Lourdes



Source: Author

Recent research in climate change adaptation has also used the idea of 'place attachment' to understand why people do not think that the effects of climate change are sufficient reasons to migrate (Adger et al. 2011, Novaczek et al. 2011, Baxter and Armitage 2012, Graham et al. 2013). Place attachment is:

> A positive affective bond between an individual and a specific place, the main characteristic of which is the tendency of the individual to maintain closeness to such a place (Hidalgo and Hernandez 2001: 274).

This is a particularly useful idea to explain residents' strong sense of belonging and identity with the area and their house in particular. For example, although Josefina lives in the red zone and lacks the ability to migrate because of the effects of the resettlement programme, she and her parents also have an emotional attachment and association with the house, which discourages them from migrating;

> He [Josefina's father] says 'No no, I made this house, how could I sell it?'...My Mother does not want to sell either because of the memories because they grew up here, they brought us up here, they don't want to move (Josefina).

Supporting this, Gemita told me:

> I like this house, I like that I grew up since being a little girl here. Lots of adventures have happened here, lots of things here, so I have a good memory of this house.

As such, residents prefer to stay in the Cerro and their house in particular, because they feel rootedness, belonging and comfort, cannot be underestimated and is a significant reason why people do not migrate.

The effect of residential satisfaction and place attachment illustrate Starr's (1969) idea of 'voluntariness' which was discussed in Chapter Two. Accordingly, a society is willing to accept risks to the extent that they are associated with benefits such as proximity to income earning opportunities or a sense of belonging as this section showed. However, as Jasanoff (1998) argues, this 'voluntariness' is heavily bound up with people's freedom of action and ability to reduce their risk. Therefore the next section investigates the DRR strategies that are related to the house which residents carry out.

6.2 Disaster risk reduction strategies

Interviews with residents showed that a diversity of strategies which relate to the house are carried out in order to reduce DR. These focus on hazard reduction and avoidance, and the reduction of physical vulnerability through reconstruction of the house; however, the latter strategies are discussed in section 6.3. A number of these strategies have been identified in previous research and are listed in Table 3 in Chapter Two. Results show that residents often carry out DRR strategies during rainfall when concern and awareness with disaster risk temporarily increases because people understand that risk increases incrementally with the persistent impacts of rainfall (see section 5.2). Finally, many residents move to the part of the house that they perceive as less vulnerable during rainfall, which also highlights the spatial dimension of risk perceptions that was also discussed in Chapter Five.

Previous chapters have highlighted that the Municipal House negligibly intervenes to address local DR. The second half of the section further explores the role of the municipal house for DRR, and begins by exploring the collective mobilisation of residents, which resulted in 'official' municipal support to address DR in the aftermath of the large landslide in 2006. However, further investigation of the reasons for this intervention help this thesis to reveal that negligible intervention by the municipal house cannot be sufficiently explained as the result of "lack of knowledge and financial capacity (and sometimes willingness) of" (IFRC 2010: 20) the Municipal House. Rather this section shows that a broad perception that DRR is the responsibility of the

household discourages residents from seeking municipal support, which further exacerbates the weak institutional framework that is currently in place in Cochabamba.

Hazard avoidance and reduction

During rainfall, when residents' concern with disaster risk typically increases, fourteen household informants told me that they place buckets inside and around the house to gather rainwater. In addition, twenty-four household informants told me that they or a member of their household sweep rainwater into the street and/or surface drains during, or immediately after rainfall. Informants recognise that these strategies prevent rainwater from seeping underground and gradually destabilizing soil, but they are also carried out in order to maintain the cleanliness of the house (Consuela, Juanita, Silvia). In addition and as Chapter Four first highlighted, some residents such as Consuela and Paulo-Jaime accept that problems with rainwater runoff between houses are unavoidable because of local topography. This sometimes, though not always, encourages residents to sweep away rainwater in order to reduce their own and their neighbours' DR because as Consuela commented, "Everybody suffers, we cannot just resign ourselves to this. Because all the neighbours suffer the same; they all complain about it right?"

In addition, Chapter Five showed that risk perceptions have a distinct spatial dimension because residents often disaggregated the house into 'more vulnerable' and 'less vulnerable' spaces if it is constructed of different single structures made of different materials. As a result, some household informants will occupy the parts of the house they perceive as least physically vulnerable during heavy rainfall when their concern with disaster risk increases (Fabiola, Eliza, Romina). For example, Romina's house was divided into two separate structures; an adobe unit composed of two bedrooms to the left of the plot, and a brick/concrete structure composed of one bedroom and a living area to the right of the plot. During her interview she told me:

> My son lives up in the room above and when it rains hard we all sleep here [in the brick/concrete structure]. I bring him down because he is scared and it's safer in this room. Come here I tell him" so that all my children are with me. When it is not raining they go up to their room.

This strategy does not reduce the exposure of the adobe part of the house; however, it as a short-term solution that can remove people from the potential physical impacts of hazards. Accordingly this section has so far shown that people carry out risk reducing

strategies during rainfall when risk perceptions temporarily increase. However, it is not whether an individual's risk perception is high or low that is most influential. Rather, it is because concern with disaster risk temporarily increases during rainfall because people are aware that risk increases with the incremental impacts of rainfall.

Image 18 Plastic sheets placed on the ground to avoid rainwater filtering underground

Source: Author

Image 19 External walls of a house supported by wooden poles

Source: Author

Five household informants place large plastic sheets around the base of the house to prevent rain exacerbating ground instability (see image 18). This is overwhelmingly used for 'medias aguas', which are typically constructed without a deep foundation, (see section 4.2) and was observed across approximately four or five dozen houses across the research site during data collection. However, once again, interviews revealed that people tend to perceive this as a short-term solution;

> Yes, we put plastic down, but the plastic started melting in the sun…We did it to cover the soil, but we saw that it does not completely work as some water is still getting underneath (Fabiola).

Despite this, people with direct and indirect experience of landslides apply this method. Observation and horizontal communication of information about local risk and risk reduction helps to explain the widespread awareness and adoption of this technique. Again, people with high and low perceptions of risk also apply this strategy because it is awareness that rainwater incrementally increases risk that is most important and not

how apprehensive an individual is. Another strategy to redirect water away from the house is to dig small channels around the house that redirect water into the street[67].

Other residents, such as Josefina and Felix respond after the impacts of landslides by placing wooden poles around the interior and exterior of the house to prevent the total collapse of the walls and/or roof (see image 19). Given people's understanding that these are short-term strategies which only prevent the house from further damage, they do not substantially assuage (and sometimes increase) concern;

> There is not much we can do, look at this place. I fill the holes [with cement], put these poles around. It's a real worry. We live stressed here. Some people call it stress. I call it pain or some other things. We do not live in peace, there is no reason to. We are desperate because perhaps it can fall down. Look these cracks are huge (Felix).

This method was only observed among tenants living in rented brick houses and informants living in brick houses that were located in the 'high risk' zones. The latter again shows how the resettlement programme effectively paralysed people from reconstructing the house. However, it also suggests that it is more difficult to recover in the ex-post period if living in a brick house because it requires significantly more resources than if the house was made of adobe, which is a cheaper material. Furthermore, tenants are more likely to use this short-term strategy because they rely on their landlord for investment, and landlords are often reluctant to invest in the house (Gilbert and Ward 1985). Fabiola illustrated this when she answered the question, "Is there anything that you can do to prevent damage to your house?";

> Fabiola: We cannot build anything…I went to the landlord and I said to him 'the water is entering the house', and he said "no it isn't" and after we said that it was going to happen, and then suddenly like that the landslip came. After we said that there needed to be a retaining wall. All he said was "ok, if I'm going to build a retaining wall I'm going to need a lot of money."
> Researcher: Is he going to pay?
> Fabiola: Well he said he was going to get a bank loan for it. My husband thinks he will, but I'm really not so sure, at all. It is a lot of money.

As Chapter Four showed, tenants are unwilling to invest in a house they do not own and so they are largely dependent on the landlord to reduce their physical vulnerability (Gilbert 1998, Turner 1976). Consequently, tenants such as Fabiola and Felix continue

[67] Although water is directed away from the house, it may be directed to streets that are not paved or do not have surface drains. Therefore, the exposure of residents living in neighbouring houses may increase in a form of risk transference. Data cannot confirm the extent of this problem; however, because surface drains and road paving are not universal throughout the research site, it is likely that this may be a problem.

to live in precarious conditions for extensive periods after experiencing a disaster. However, building on the idea that the material of the house affects how quickly people can recover; Luna, a tenant who was living in an adobe house that suffered very serious damage said that her landlord covered expenses to rebuild the house within two weeks. The ability of people to recover from the impact of hazards depending on the material of the house is returned to in section 6.3. The next section explores how and when residents seek municipal support to address disaster risk and why this is not a widely used approach for many residents.

Seeking Municipal assistance and the problem of perceived 'personal responsibility'

Another strategy is to seek assistance from the Municipal House to reduce physical vulnerability. However, results show that for this to be effective it requires the mobilisation of residents into grassroots networks, plus significant time and energy (Satterthwaite and Mitlin 2013). Following the 2006 landslide in Vinateros, repeated social pressure from approximately thirty-five residents forced the (reluctant) Municipal House to carry out capital intensive projects to reduce the hazard exposure and physical vulnerability of several residents, "We had to just keep going and going, insisting and asking until they got tired and gave in a bit, and told us 'Yes'" (Federico). The landslide and their collective efforts also received media attention.

Image 20 Section of the retaining wall that the Municipal House constructed in Vinateros following the landslide in 2006

Source: Author

After less than two years of persistence, the local government approved the financing and construction of a retaining wall that stretches approximately 150 metres along one road in Vinateros and which lines the back of several houses (see image 20). This has

significantly reduced the amount of rainwater that enters houses from the road above (Norma, Federico). However, household informants commented that this assistance was an exception that only occurred because of persistent collective pressure from within and beyond the Cerro;

> We [the affected people] have to ask for help, they had to go to the radio and the reporters and they had to ask them. If you don't ask, you get nothing. You have to ask like this, we have to cry so that they help us (Federico).

In contrast to this collective mobilisation, people who experience small-scale disasters and who seek official support from the Municipal House are more likely to be ignored, as Rebeca commented, "they won't do anything, it is a waste of a trufi [bus] ride; nothing more", and Fabiola who told me "I went twice. They did nothing. They don't care." This is consistent with the wider bias of disaster policies towards large-scale disasters that was identified in Chapter Two (Pelling 2010, Bull-Kamanga et al. 2003). One of the reasons the Municipal House negligibly intervenes is because of insufficient municipal resources and skills to address DR, which is symptomatic of the urban 'vulnerability gap' in Cochabamba that was discussed in Chapter Four (IFRC 2010). Furthermore, absence of a legal and political framework for DRR ultimately discourages residents from seeking support along formal political channels (Bull-Kamanga, Diagne et al. 2003). However, the negligible intervention by the Municipal House is not exclusively because of a bias towards large-scale disasters or a lack of knowledge, skills and resources to intervene.

Interviews with household informants and the Presidents of the neighbourhoods show that the Municipal House is not perceived as a significant actor in the reduction of local DR and many people do not seek 'official' governmental support. This is because people do not think the Municipal House will intervene, but also because DRR is a relatively new field of urban development and so has taken a 'back seat' to 'traditional' development projects (IFRC 2010). As Chapter Four showed, monthly neighbourhood meetings have been instrumental for residents to identify and prioritise more conventional development issues such as access to basic services and transport, which are seen as more 'traditional' collective goods. In line with Rahman, Mohammad et al. (2012), residents consider these to fall within the remit of local authorities and from the perspective of urban authorities, they are considered more populist and easier to address. However, another reason why residents do not typically seek municipal support, and which has not been identified in disaster literature is because residents

largely perceive DRR as the responsibility of the household. This perception of 'personal responsibility' is significantly constructed by the characteristics of local DR and because residents broadly view the construction of the house as a personal project.

The impacts of hazards are geographically spread out across the research site and are small-scale, effecting a single house or small number of residents. This can be contrasted to the "massive collective stress" (Kinston and Rosser 1974: 438) of the large-scale disaster in 2006, which catalysed the mobilisation of residents. In addition, housing construction is understood by residents and neighbourhood Presidents as a project that is the responsibility of the household. When this perception is combined with the perception that the design and construction of the house is the most effective resource for DRR, which was discussed in Chapter Five, it constructs a narrative that the impacts of hazards are because the household has not constructed the house appropriately. Similar to the effects of the risk zone map, this perception of 'personal responsibility' to address DR steers residents' attention away from social and political questions about why the Municipal House is not intervening more effectively in DRR and discourages residents from seeking municipal support to address DR. This builds on Wamsler (2014) who argues that DRR typically takes place at the household level because of low levels of social capital in urban neighbourhoods and because of the urban 'vulnerability gap'.

The perception that DR is a problem that should be addressed at the household and not the neighbourhood level was observable during monthly neighbourhood meetings as issues of DR were seldom raised. Section 3.3 showed that the neighbourhoods became TBOs in 1999 with their own municipal vigilance committee (VC) that is headed by a neighbourhood President. As section 3.3 discussed, TBO status allows consensus building politics at the neighbourhood level, so that the VC can justify and present an Annual Operative Plan (AOP) to the local Municipal House, which approves plans and provides fiscal resources (Klein 2011, Kohl and Farthing 2006, Landaeta 2004, Lalander and Altman 2003). The mechanism for building consensus is through the monthly neighbourhood meetings where residents have the opportunity to raise concerns about issues they think should be improved. Therefore, this political and administrative system provides the opportunity for residents to identify, prioritise and establish collective DRR (Landaeta 2004).

Despite this opportunity, observation at seven monthly meetings and interviews with the neighbourhood Presidents and officials in the Municipal House suggest that DRR is seldom given explicit and energetic attention by residents during these meetings because of the perception of 'personal responsibility' to address DR. Therefore the Municipal House does not receive AOPs which make explicit reference to DRR and so is not inclined to intervene with projects to specifically address DR. The President of Simancas made explicit reference to the 'individualisation' of DRR through appropriate housing construction when discussing his plan for the development of the neighbourhood;

> I have a five year plan to consolidate all the streets, to improve all the services as they are in bad condition, to renew them. With our resources you subsequently have to make your own house. You have to ensure your own safety here; you have to improve yourself as an institution.

The strategies discussed in this section differ in relation to the time and labour required, and how the house is used or interacted with, to address disaster risk. In addition, and with the exception of seeking governmental support, people typically perceive these strategies as short-term solutions or even increasing their vulnerability, where poles are used to keep walls from entirely collapsing for example. Solutions such as sweeping water and using plastic sheets are carried out by people with high and low risk perceptions because residents are aware that disaster risk increases incrementally with the impacts of rainwater. Therefore, it is awareness and understanding of disaster risk, rather than the particular characteristic of the risk perception that is most influential. This awareness and understanding of disaster risk also encourages people to carry out different strategies during rainfall. People living in 'high risk' zones who typically have an apathetic attitude that future impacts are inevitable and little can be done to prevent this take very few actions and often do not reconstruct the house. However, this is as much to do with their ability to reconstruct their house as the perceptions of risk as natural and external to human action.

Some residents sought aid from the Municipal House; however this is largely ineffective because of a poor legal and institutional DRR framework and because it largely requires collective mobilisation of residents. As shown in Chapter Five, residents largely perceive the design and construction of the house as the most effective resource to reduce DR; however, residents also perceive housing construction as the responsibility of the household. This discourages mobilisation of residents to address DR and most

DRR typically takes place at the household level through a focus on construction of the house. Problematically, this perception of 'personal responsibility' suggests that any impacts of hazards on to the house are the result of inappropriate housing construction by the household. The next section discusses the particular ways and reasons that residents design and construct their houses to address disaster risk.

6.3 Reconstruction of the house

As Chapter Five discussed and section 6.2 re-iterated, residents perceive the design and construction features of the house as the most effective resource for reducing DR. This section investigates how residents reconstruct their house in order to address DR. In doing this, the section also explores how risk perceptions shape the way residents self-build the house. Chapter Five showed that risk perceptions are highly asymmetric within and across households, and that they can differ over time and even depending where an individual is located – whether in an adobe structure or a brick structure which are perceived as less vulnerable. They also have a long-term temporal scale as residents do not consider their future disaster risk as generally abstracted from their present behavior and the ongoing impacts of rainfall. This section will make sense of how this diversity of risk perceptions can be traced in the way people design and construct their houses.

Suitable shelter is a basic need and housing is universally considered a commodity that is intrinsically desirable or socially valuable (Greene and Amarillo 2008). Many people living in cities of the Global South self-build their houses and this has been vastly documented in different literatures (e.g. Turner 1976, Gilbert and Ward 1985, Kellett 2005, Green 2008, Wakely and Riley 2011, Jabeen 2012, Mitlin and Satterthwaite 2013). 94% of house-owners in the research site had (re)constructed their house in diverse ways, which may include modest changes or the entire reconstruction of the house[68] (survey). Few households are able to save enough to purchase new homes and few qualify to purchase houses built by the formal sector, which is a common pattern across Latin America (Greene and Amarillo 2008). Consequently, and as Chapter Four showed, most people live in self-built houses that are constructed by members of the household,

[68] The survey classifies the following as reconstructions to the house: Destroying adobe rooms and building rooms made of brick and/or concrete; Building brick and/or concrete rooms, but maintaining some adobe rooms; Building adobe rooms; Constructing more levels; A retaining wall; A deep foundation; A new roof; A new floor; Covering adobe walls with cement or 'Other' such as, a garage for a car or new windows.

friends, family or the informal branch of the construction industry (Greene and Amarillo 2008). Reflecting Turner's (1976) seminal work on housing, local construction is typically incremental in nature as people invest periodically when they have the financial resources. However, where people do not reconstruct the house, even when they would like to, there are several reasons, which previous chapters have explored. Firstly, people do not own the house. Secondly, people located in the red and orange zones are apathetic about reconstruction and the resettlement programme effectively paralyses many people from reconstructing the house. Finally, residents may not have sufficient capital resources.

Image 21 Adobe being covered in cement ('reboque')

Source: Author

Image 22 Inclined roof to discharge rainwater away from the house

Source: Author

Across the research site, 11% of house-owners originally built an adobe 'medias aguas' when arriving in the Cerro, and they have made 'modest' modifications that do not fundamentally change the structure of the house. For example, 47% of residents used a technique called 'reboque', whereby the exterior of adobe houses are covered with a layer of cement (see image 21). This reduces the damage caused by rainwater and allows people to paint the house. Other people living in 'medias aguas' change the inclination of the roof so that rainwater is discharged away from the house (see image 22). However, as Chapter Four showed, this can potentially cause problems as water may be redirected to adjacent houses.

In contrast, and as highlighted in the previous two chapters, many residents have made fundamental changes to their house which they associate with DRR. 31% of house-owners have destroyed all adobe structures and replaced them with unitary brick and

concrete structures (survey). 50% built the house on top of a deep foundation when they (re)constructed the house. 43% of residents have incorporated a retaining wall since first settling on the hill. 64% of survey respondents felt safer after making reconstructions to their house. However, when this question was controlled for respondents that had constructed brick and/or concrete rooms, a retaining wall, or a deep foundation, 97% of respondents said that they felt safer against the impacts of local natural hazards (survey). Although direct cause and effect cannot be confirmed, this does give an initial indication that people incorporate these design features in order to reduce their risk.

Problematically and as section 6.2 highlighted, the increasing use of brick can make it difficult for people to recover from the impacts of hazards as brick is more expensive than adobe and often requires the employment of local construction workers. Therefore household informants told me that they carry out strategies that either return the house to its former vulnerable state or increase the physical vulnerability of the house. For example, 53% of people fill cracked walls and roofs of brick/concrete houses with cement (see image 23). Residents say that this is cheap and minimal labour is required; however, again they perceive it as a short-term solution that can increase their vulnerability and make living conditions uncomfortable as Juan commented:

> Author: "What do you like about your house?"
> Juan: "I don't like anything, this house worries me, I'm tired of it. Look at it all, cracks everywhere. Cracks cracks cracks [gesturing to the walls]. I've filled it all with cement, but it worries me that it will all fall down…So that's how it is. In whatever moment when it rains it could fall down…It's going to fall down; every year it worries me when it rains, but I don't have the money."

In this regard, adobe may help households to recover more quickly following hazard impacts; however, people are increasingly turning to brick/concrete houses for wide varieties of reasons that are discussed below.

Image 23 A large crack in a brick wall that has been filled with cement

Source: Author

The extent of housing reconstruction goes far beyond the materials of the house, the incorporation of a retaining wall and a deep foundation to address DR. Results show that there is a widespread and significant architectural transition that is taking place across the research site as less adobe medias agues are being built and more single unitary brick/concrete houses are replacing them. In fact each time I visited the Cerro, with the exception of Sundays when people do not typically work, I observed at least two or three brick houses being constructed (see image 24). Construction features such as brick, a retaining wall and a deep foundation, which residents largely associate with DRR, have emerged as central design features of the 'new' brick houses that are proliferating across the research site and Cerro more broadly. However, in order to understand why residents are reconstructing their houses and fundamentally altering local architecture it is important to explore features of the 'new architecture' that people do not necessarily associate with DRR.

Image 24 Local construction workers working on a house

Source: Author

As Chapter Two discussed, some studies of self-build houses in 'Southern cities' have applied the analytical lens of materiality in order to challenge the idea that the house essentially responds to the basic material need for shelter and economic security. This particular literature conceptualises the house as more than a physical resource to provide shelter, and has shown that people may build their house in order to transform social and economic processes as well as providing physical functions such as shelter (Kellett 2005, Kellet and Napier 1995). The following discussion will identify the non-DRR design and construction features of the 'new' houses. Following this I will discuss why residents chose this particular architecture based on data from interviews and the participatory drawings of household informants. This takes a more anthropocentric understanding of houses that will ultimately help the thesis to identify how and to what extent people's risk perceptions and the pursuit of DRR shape the way they self-build their houses (Hernández, Millington et al. 2005).

The 'new' houses are easy to visually distinguish from adobe 'medias aguas' in terms of materials, height, size, shape/layout, decoration of their facades, colour, and the use of gates/fences. However, they are also very dissimilar in and among themselves because they incorporate these design features to varying degrees. Despite the heterogeneity of the 'new' houses, residents collectively refer to them houses as 'casas bonitas' (pretty houses). This is not because they are architecturally consistent, but because they share and are broadly identifiable by particular features such as brick, their colourful facades, their size and their unitary structure.

As discussed in 4.2 and above, houses are increasingly made of brick and with a deep foundation and a retaining wall. Furthermore, 31% of houses are now constructed as stand-alone unitary structures composed of two, three or even four levels. 30% of survey respondents have increased the height of their house, which can create a dramatic visual contrast to 'medias aguas' (see images 25 and 26) (survey). As a result of this, houses are divided into a greater number of individual rooms; therefore there are more bedrooms and fewer people sharing a single room than usual with 'medias aguas' where space is limited because the adobe material restricts the height of houses. In addition and as highlighted in Chapter Four, many 'casas bonitas' are constructed with a shop, bar or workspace.

Image 25 A multi storey 'casa bonita' towering over a single storey 'medias aguas'

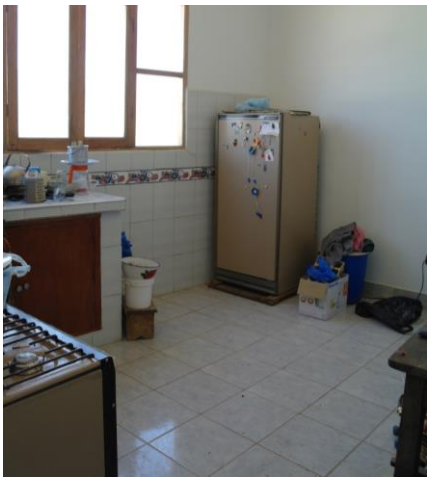
Source: Author

Image 26 Example of a 'casa bonita'

Source: Author

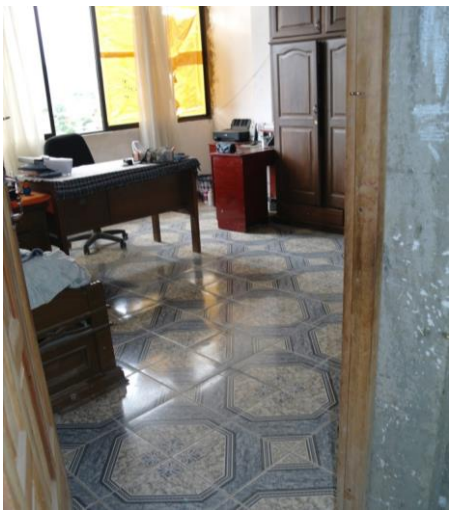
'Casas bonitas' maintain the internal patio that is characteristic of 'medias aguas'. However, with the increased space of 'casas bonitas', bathrooms and kitchens are being built inside the unitary structure of the house, and there may be 'modern' appliances such as fridges and microwaves and 'western' style work surfaces that are made of ceramic (see image 27). This represents a sharp contrast to 'medias aguas' where people prepare and cook food in the patio and where a free standing bathroom was typically located. Residents are also increasingly incorporating ceramic tiles into the interior of the house to cover walls and floors (see image 27 and 28).

Image 27 Example of an internal kitchen with ceramic tiles and 'modern' appliances



Source: Author

Image 28 Example of a house with ceramic tiles



Source: Author

Image 29 Example of a house with a large fence and trees obscuring the house

Source: Author

Externally, 'medias aguas' may have a small waist-high fence demarcating the house from the street. However, many new houses are built with large metal fences, or gates or trees are used which conceal the front of the house and the household activities (see image 29). Other external features of the 'casas bonitas' include colourful and elaborately decorated facades, which contrast to the adobe exterior of 'medias aguas', which are sometimes, though not always, covered in a layer of cement ('reboque') that may be painted. Roofs of 'medias aguas' are usually made of corrugated iron. However, 'casas bonitas' often have roofs made of clay tile or flat cement roofs if intending to increase the height of the house. Finally, 'casas bonitas' are more likely to have glass or opaque windows, in contrast to the empty or mesh covered windows of the 'medias aguas'.

Household informants have not incorporated all of the architectural features described above. For example, only 31% of house-owners have destroyed all adobe structures and replaced them with a unitary brick and concrete structures and 58% have built new brick structures whilst maintain some adobe structures (survey). Interviews with household informants show that people want to destroy the adobe structures and replace them with brick structures, whether a single unitary structure or multiple linear structures. However, the principal reason why people have not done this is because of a lack of resources. Demonstrating this, 83% of survey respondents state that they would "First invest in the house," if they had more money and this jumped to a staggering 94% when controlled for people living in adobe 'medias aguas'. Interviewees showed that there is no sentimentality about 'medias aguas' as residents do not express nostalgia about sharing space and the sense of rural tradition that 'medias aguas' invoke for

example. On the contrary, people consistently identify the 'inadequacies' of 'medias aguas' and there is widespread aspiration to 'upgrade' to a 'casa bonita' with many of the design and construction features outlined above.

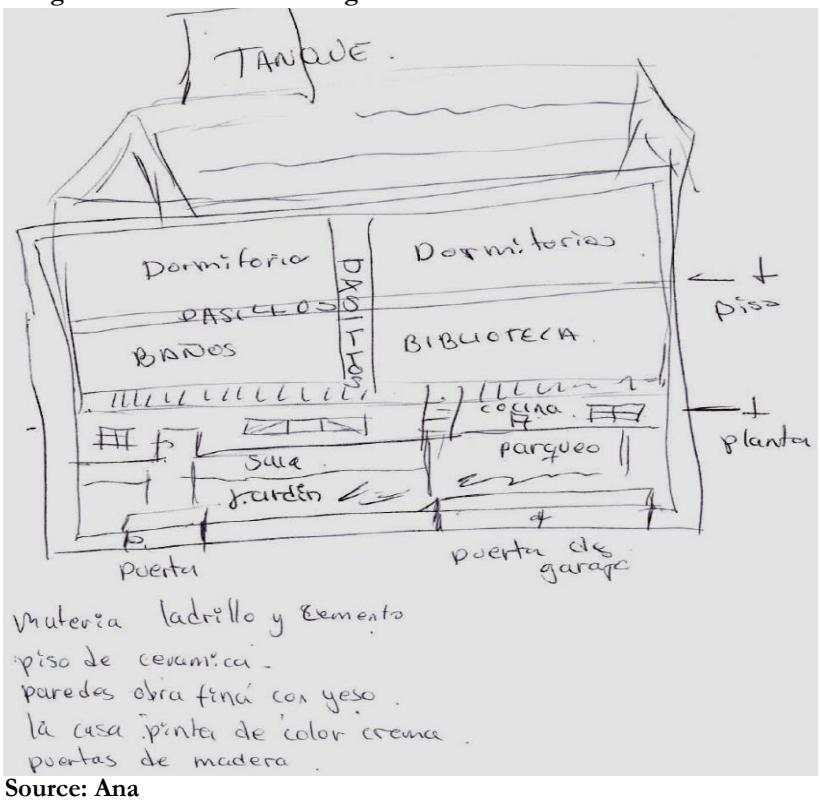
Interviews with household informants, architects and local construction workers show that the design and construction features of the 'casa bonita' have become a local architectural norm that people aspire to, regardless of an individual's perception of DR. This is also supported by residents' drawings of their 'ideal house', as the drawings consistently mirror many elements of the 'casa bonita'. For example they display the use of brick and concrete to construct a unitary structure, an internal kitchen, multiple bedrooms, a decorative exterior, glass windows and a tiled roof (see images 30 and 31). This is the case even where household informants have experienced 'total' or 'partial' collapse of the house, which indicates that the many other features of the 'casa bonita' are equally important for risk reduction. However, household informants drew, wrote or verbally indicated that their ideal house would have a deep foundation and retaining wall, which demonstrates the importance of DRR and how it has become good practice to construct your house with these features

Image 30 'Ideal house' drawing[69]

Source: Daniela

[69] Translation of terms: *Teja;* Tile*; Paloma*: Doves; *Juntos*: Together; *Ladrillo y cemento*: Brick and cement; *Con familia*: With family; *Animales*: Animals; *Jardin*: Garden; *Tienda*: Shop; *Aqui (Cerro)*: Here (hill); *Cuartos para alquiler:* Rooms to rent.

Image 31 'Ideal house' drawing[70]

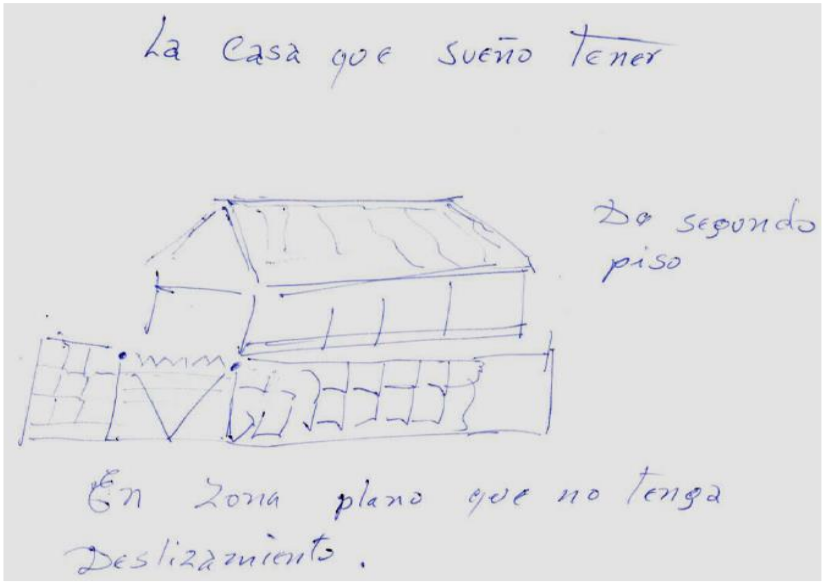


Source: Ana

In contrast, some household informants who had experienced more severe physical impacts from hazards placed more emphasis on the house as a resource to reduce risk. This was evident when investigating how they describe and draw their 'ideal house'. For example, Valeria, Fabiola, Felix and Nadimo had suffered 'total collapse' or 'partial collapse' of their houses following landslides. Interestingly, their 'ideal houses' were strikingly modest (see images 32 and 33). They placed greater emphasis on risk reducing architectural features and all four wanted a one or two storey house, which contrasts to other informants who drew three, four and sometimes six storey 'ideal houses'. Further, they did not tend to emphasise or indulge in outlining the aesthetics of the house. They were more likely to emphasise the function of the house as a place of 'safety' from natural hazards. Felix also wrote that he would prefer a house located in "A flat zone." Additionally, all four informants took the time to write 'Retaining wall' or 'Rocks to secure the house' (Nadimo) or 'Made of bricks with a lot of cement' (Fabiola). They did not tend to draw elaborate houses with tiled roofs, an internal patio, a garage or even windows, which are features that were common in other 'ideal house' drawings.

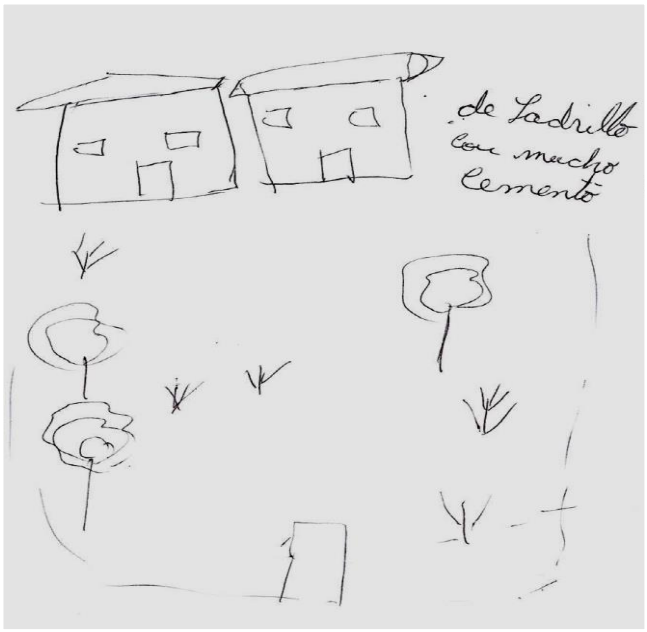
[70] Translation of terms: *Tanque*: Water tank; *Dormitorio*: Bedroom; *Baño*: Bathroom; *Biblioteca*: Library; *Sala*: Living Room; *Puerta*: Door; *Puerta de garaje*: Garage door; *Cocina*: Kitchen; *Piso*: Level; *Planta*: Ground level; *Parqueo*: Parking; *Jardin*: Garden.

Image 32 'Ideal house' drawing[71]



Source: Felix

Image 33 'Ideal house' drawing[72]



Source: Fabiola

The ability of these particular residents to reconstruct their house appears to be a significant reason why their 'ideal house' drawings place more emphasis on DRR and are generally more modest than most. For example Fabiola and Felix are both tenants and so are unable to reconstruct the house. Therefore it is not only their previous experience with hazards that encourages them to draw more 'modest' 'ideal house'

[71] Translation of terms: *La casa que sueño tener*: The house I dream to have; *De Segundo piso*: [Constructed] of two levels; *En zona plano que no tenga deslizamientos*: In a flat zone that does not have landslides.
[72] Translation of terms: *De ladrillo con mucho cemento*: made of brick and a lot of cement.

drawings, but also because they perceive that they have low ability to actually reconstruct the house. Despite this, 'modest' 'ideal house' drawings that place significant emphasis on DRR are not consistent across household informants that had suffered the most serious impacts or have lower ability to reconstruct the house. Other people with severe experiences with hazards and high risk perceptions were consistent in drawing the 'grandiose' houses that people with experience of less serious impacts were inclined to draw. For example, Daniela experienced the partial collapse of her house; however she commented during interview and indicated in her 'ideal house' drawing (see above) that she is in the process of constructing a 'casa bonita' which strengthens the idea that many features of the 'casa bonita' including a retaining wall and deep foundation have become local 'architectural norms' that people aspire to have.

Image 34 Example of a house design used by local architects

Source: Author

Image 35 Example of model houses used by local architects

Source: Author

The idea that the 'casa bonita' has now become the local architectural norm is also evident in the blueprints and models that local architects use when working with residents of the Cerro, and which are strikingly similar to the casas bonitas (see images

34 and 35). An architect who had been employed by two residents supports this idea when he indicated that 'medias aguas' are no longer desirable to residents of the Cerro;

> We [architects] were never needed. This hill, where you are speaking about was a place of the 'medias aguas'. But now a lot has changed. Now the architects are designing huge houses that were never there before. People do not want the 'medias aguas', this is not the way people do it now, they do not want that now (Arcenio).

Although architects are rarely employed by residents, this does indicate that the 'casa bonita' now represents an architectural norm across the research site.

When household informants were asked, "why did you build your house like this?", people with high and low risk perceptions replied with variations that emphasise DRR such as "Because it is stronger" or "Because it lasts longer." However, deeper scrutiny of interviews and the 'ideal house' drawings demonstrate that people have an abundance of tacit knowledge about how they perceive the house and relate to the space within it and the materials it is made of. This shows that there are multiple and overlapping reasons why people reconstruct the house and it cannot be concluded that DRR is the catalyst or main determining factor (Stevenson 2008). Furthermore, and critically for the research aim, 'risk reducing construction features' such as brick, a deep foundation and a retention wall have become 'good practice' that people incorporate when they reconstruct the house or when they aspire to reconstruct the house. This is because people are aware of local disaster risk and how the house can be used to reduce risk, which was discussed in Chapter Five. However, unlike a deep foundation and retaining wall, there are many reasons why people are increasingly turning to brick and concrete.

Discussion in this chapter and Chapter Five show that residents consistently identify that brick and concrete reduce their disaster risk. However there are many other reasons why people are increasingly turning to brick. Men and women prefer brick because it is easier to clean and "maintain the cleanliness of the house" (Gracia, Monica, Valeria, Samantha). However, because women are responsible for domestic duties they placed more emphasis and importance on this element than men. Therefore brick and ceramic, which is also increasingly used to cover floors and walls save women time and labour which allows them to become more efficient domestic workers according to Blunt and Dowling's (2006) work based in the Global North. In addition to efficient domesticity, brick is also preferred for aesthetic reasons and personal taste.

Some residents such as Jazmin and Federico prefer brick to adobe because it does not attract 'vinchucas', which are small parasites that can cause a fatal disease known as 'chagas'. Finally, some household informants (Rebeca, Harry) told me that adobe increases the internal humidity of the house, which can make living conditions uncomfortable, whereas brick houses are much cooler.

As highlighted above and in Chapter Four, brick allows residents to increase the size of the house. This has encouraged people to construct a bar or a shop which provides a source of income and which transforms the house into a productive asset. Increasing the size of the house has also allowed people to construct more rooms which sleep fewer people and which subsequently increases the privacy and comfort of household members. This is particularly salient in a context where up to nine household members can share a single dwelling unit (Victoria), and where a single room may be used for multiple activities such as sleeping, socializing, eating and cooking because of limited space in adobe 'medias aguas' (see section 4.2). Illustrating the importance of privacy Jimena commented:

> He [Jimena's son] does not want to sleep in the same room as his mother [laughs]. It was okay when he was little, but he has his own family now. They don't want to share a room with me and Javier [Jimena's husband]. Even I don't want to sleep in the same bedroom as my husband [laughs]. No no, he should have his space and we should have our own too.

As Jimena shows this allows households to have their own private dwelling unit, which is important in a context where the second generation have their own children, but lack the resources to leave the house. Therefore a private room does not only signify a place to sleep, but the ability of individuals or whole households to physically demarcate their lives as independent from the rest of the house or household.

Image 36 Space being used to store and display souvenirs and religious ornaments

Source: Author

Image 37 Display of photographs of family members and events

Source: Author

Increasing the size of the house has also increased storage space which allows residents to maintain the order and cleanliness of the house. Some household informants also commented that greater space has encouraged them to display ornaments, souvenirs and photographs that were previously hidden away in boxes (see images 36 and 37). On several occasions men and women household informants showed me objects that were sent or brought by a member of the household who had migrated overseas, or photos of family members and significant events such as weddings. Blunt (2006) suggests that this allows people to express their life histories, tastes and beliefs, which helps to construct a sense of 'homeliness'. Although the ability to display objects does not represent a central reason for housing reconstruction, it does represent another, albeit tacit, benefit of reconstruction.

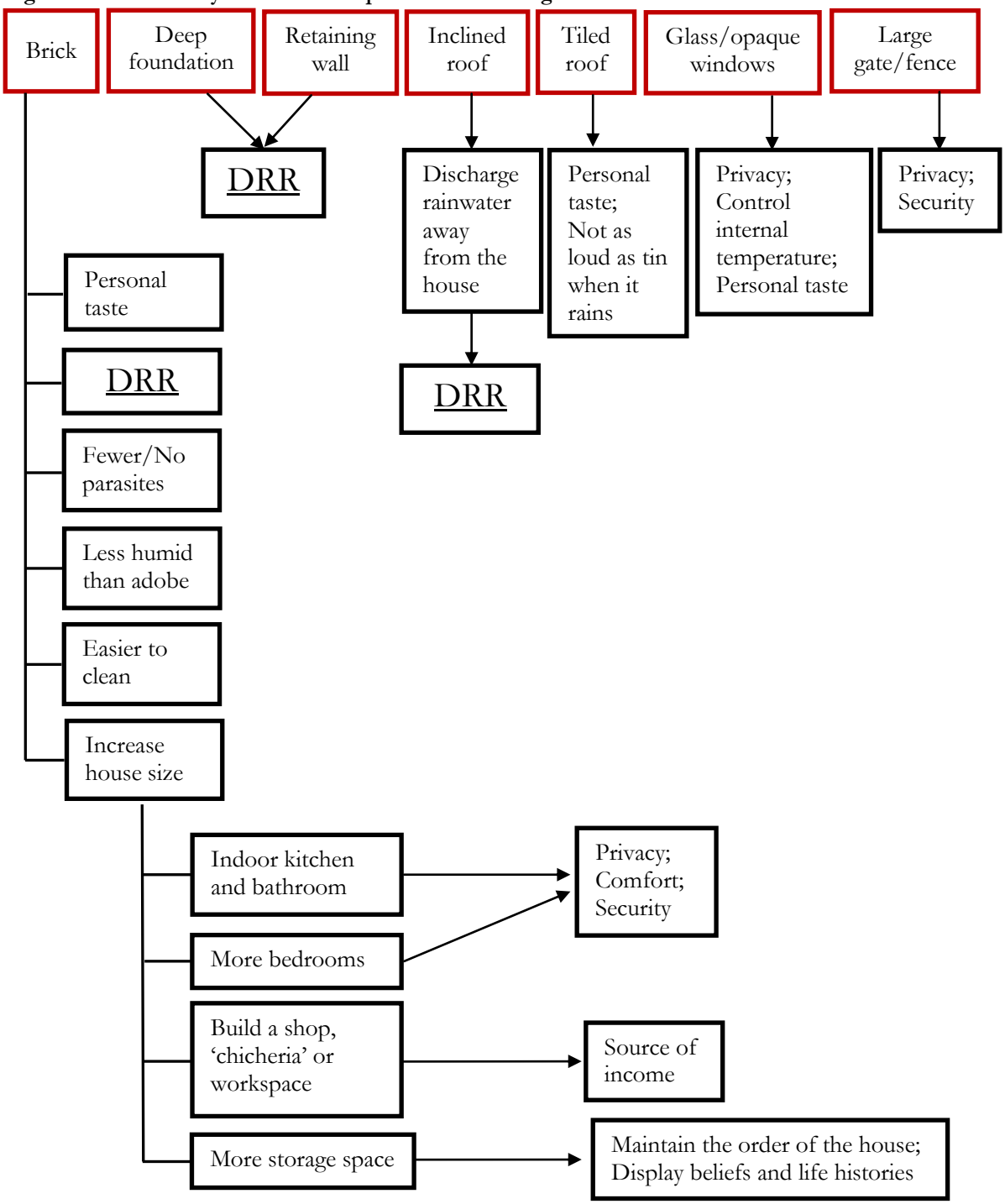
The incorporation of the kitchen and bathroom inside of the house is also linked to privacy and comfort, and efficient domesticity highlighted above. Ceramic work surfaces and 'modern' devices such as fridges and microwaves allow women to use their domestic time more efficiently. The increasing construction of large fences and opaque windows also constitutes another physical manifestation for residents seeking privacy. Passers-by were able to see, talk and communicate with people living in 'medias aguas' as there was typically a waist-high fence. However the construction of large gates and fences obscure the activities of household members. Additionally, the fences are also very important for security as multiple household informants stated that the threat of people stealing from the house is of great concern (Monica, Gloria, Rebeca, Romina).

Figure 9 on page 207 illustrates the identified reasons why residents incorporate certain design and construction features into the house.

Although gendered reasons such as increasing the efficiency of women's domestic duties are an important motivation for reconstruction, this cannot be explained as a direct result of an interview sample that was made up of more women (thirty-four) than men (eleven). Male interviewees also referenced the usefulness of brick and ceramic as it is easier to clean (Felix, Federico, Paulo-Jaime, Alfonso, Pepe). However, female household informants tended to spend more time reflecting on how the house affects their domestic duties.

Interviews also showed that the decision making process behind the design and reconstruction of the house does not tend to have a clear gender dimension. Thirty-nine household informants (eleven men and twenty-eight women) were asked "Who makes decisions about the design and construction of the house?" All eleven men and twenty-one of the women said that it was a collaborative effort between the male and female household members. The suggestion of a more collaborative and less gendered decision making process is also evidenced in the survey which asked "Why was the house built with this design?" Answers were given as multiple choice and ranked by priority. 78% ranked 'Household member's idea' as the first priority. When this answer was disaggregated by gender, it showed that in 81% of the households the decision was made between a man and a woman (see the survey in Appendix 2). Additionally, and as revealed in section 5.1, 46% of households employed local construction workers to reconstruct the house. In these circumstances, builders steer the design of the house; however, it is the household members who have the ultimate say over the fundamental design of the house such as the materials, the shape and the internal layout. This was revealed though interviews with residents and local construction workers alike.

Figure 10 Reasons why residents incorporate certain design and construction features into the house



Source: Author's interpretation

CONCLUSIONS

This chapter has shown that in spite of residents' awareness of local DR, many remain living in the research site and engage in diverse strategies to address their disaster risk. Residents remain living in the Cerro for two principal reasons. First, they do not have

the resources to leave; second people do not want to leave because they have high levels of residential satisfaction and place attachment. The latter point is particularly significant because previous research has tended to highlight that people choose to live in 'risky' areas because of benefits to their livelihoods (e.g. DFID 2005, Shepherd et al. 2013). In contrast this chapter showed that a sense of belonging, memories and identity are also important and which builds on recent research on climate change adaptation (Adger et al. 2011, Novaczek et al. 2011, Baxter and Armitage 2012, Graham et al. 2013). Therefore, this thesis has shown that people's decision to stay in the Cerro is not due to a 'bounded rationality'; rather, there are factors that prevent migration, but moreover, residents demonstrate Starr's (1969) idea of 'voluntariness' to remain living in a hazardous area as they perceive other benefits.

Interestingly this chapter showed that particular factors construct residents to perceive that DRR is the responsibility of the household. In particular, the risk map, the perception that the house is the most effective resource to address DR and the perception that it is the responsibility of the household to design and construct the house. This is compounded by the small-scale nature of local disasters which helps to frame the impacts of hazards as the result of inappropriate housing construction. Subsequently residents are less inclined to seek help from the Municipal House to address DR, which this chapter argued exacerbates the urban 'vulnerability gap' as the Municipal House is less inclined to develop the skills, knowledge and willingness to address DR in the absence of social pressure from residents. This builds on Wamsler (2014) who argues that low levels of social capital in urban neighbourhoods and weak institutions to address DR are important reasons why DRR typically takes place at the household level. It also provides another reason why there is a vulnerability gap in 'Southern cities'. Previous research has argued that the vulnerability gap is because disasters have been seen as rural phenomena and the responsibility of specialist disaster agencies (IFRC 2010, Pelling 2010, Wamsler 2006); however, this chapter shows that a lack of pressure from urban dwellers is also influential in hindering the development of more effective institutional frameworks to address DR.

Consequently, residents carry out different DRR strategies around the house which were identified in Table 3 in Chapter Two. Many are ad hoc and are perceived by household informants as short-term solutions in comparison to more extensive reconstructions to the house. Interestingly these short-term solutions are predominantly

mono causal in nature. In other words, the research found that household informants sweep away rainwater and place plastic sheets around the house principally to reduce DR. This was most evident during rainfall when people's awareness and concern with DR would temporarily increase. It is not whether the risk perception is high or low that is influential, but rather because residents are aware that there is a 'delay effect' as DR increases incrementally with the persistent, less extreme impacts of rainfall. For this reason, these types of strategies are carried out by people with high and low risk perceptions.

Many residents reconstruct (or aspire to reconstruct) the house in order to carry out long-term strategies to reduce DR. This directly builds on Chapter Five which showed that the house is widely perceived as the most important resource to address DR. However, closer scrutiny of interviews and participatory drawings indicate that it is not whether a risk perception is high or low that affects how people self-build the house. Rather, it is people's awareness of local DR and understanding that DR can be reduced through appropriate housing construction which has the most important effect. This is because architectural features such as a retaining wall, brick and a deep foundation which people associate with risk reduction are now recognised as 'architectural norms' and good practice that are necessary to incorporate because of the local problem with DR. In this way, risk reducing architectural features are incorporated, or 'mainstreamed' to take Wamsler's (2014) terminology, into the design and construction of the house when people decide (and are able) to reconstruct the house.

In addition the chapter showed that the motivation for reconstruction cannot be isolated to DRR. The factors which shape how people design and construct self-build houses (and aspire to reconstruct) in disaster-prone contexts is a multidimensional process because people negotiate and satisfy their risk perceptions alongside the other values, risks, objectives and aspirations that they have (Turner 1976, Gilbert and Ward 1985, Blunt 2005, Kellett 2005, Blunt and Dowling 2006). As such, DRR is neither the catalyst nor the primary influence on housing construction, but is simply one of many diverse and overlapping factors that shape the self-build housing process. People who are at risk and who are aware of their risk are not a passive audience that will automatically and deliberately act to reduce their DR when provided with information. Rather, this research indicates that people will make more extensive and long-term

investments (in the house, in this particular case) to reduce their present and future risk when they perceive that other social and economic benefits will transpire.

The following chapter brings together the findings from Chapters Four, Five and Six in order to analyse how risk perceptions shape people's responses.

CHAPTER SEVEN: CONCLUSION

The relationship between the risk perceptions and responses of vulnerable groups in cities of the Global South has been labelled unclear and is often categorised as 'weak' in the literature (see Haynes et al. 2008, Wachinger et al 2013). Explanations for this can be broadly categorised into two 'camps'; studies that suggest vulnerable people do not understand the process of disaster risk (DR) or how to reduce it, and studies that suggest people either lack the resources to reduce risk or are more concerned with addressing other risks. This has encouraged the foreclosing of risk perceptions as well as the role, capabilities, resources and knowledge of vulnerable populations when planning and executing DRR interventions in 'Southern cities'. This is problematic as they are also the groups that are often the most severely affected by disasters.

This thesis has explored the relationship between risk perceptions and responses, in order to shed new light on this relationship and to highlight the need to capture the perceptions and disaster risk reduction (DRR) strategies of vulnerable groups when formulating and carrying out DRR interventions in 'Southern cities'. This has been achieved by exploring the factors that shape people's risk perceptions, the nature of these risk perceptions and people's responses. In particular, this research explored the ways that people design and construct self-build houses in order to investigate the effect of risk perceptions on their responses to disaster risk. Furthermore, this relationship has been scrutinised in a context of persistent, less extreme natural hazards that are linked to slow-onset risk of small-scale disasters. Furthermore, the research takes place in a medium-size city, rather than a rural locale or large city, which disaster studies more often focus on.

On the basis of the research aim and conceptual framework outlined in Chapter One and Two respectively, three research questions were identified:

1. **How are people at risk of disasters?**
2. **How do people perceive their disaster risk?**
3. **How do people reduce disaster risk?**

Discussion in Chapters Four, Five and Six revealed three main ideas about the disaster risk, risk perceptions and responses of residents. They are as follows:

- Disaster risk is heterogeneous within and across households, and the design and construction features of the house significantly shape residents' potential disaster risk and their ability to reduce this risk.

- Risk perceptions are heterogeneous within and across households. They are also fluid over time, and residents perceive disaster risk reduction as largely the responsibility of the household.

- It is the fact that a person has perceived they are at risk and understand that disaster risk can be reduced through human action, rather than whether the person has a 'high' or 'low' risk perception that encourages residents to design and construct their houses in ways that reduce their disaster risk. Furthermore, there are many reasons why people design and construct the house in certain ways and DRR is only one of them.

These three sets of findings are now elaborated in 7.1, 7.2 and 7.3 respectively, and then brought together in 7.4 in order to directly address the research aim. The objective of this chapter is to discuss how the findings challenge, confirm or extend wider debates within disaster studies literature that were reviewed in Chapter Two, and to synthesise the implications of this for the problem definition, policy implications and for future research.

7.1 Disaster risk in cities of the Global South

This research broadly contributes to the field of disaster studies, and specifically to literature on urban disasters in the Global South. The focus on small-scale disasters is consequential because it represents a shift away from many studies that focus on rural contexts or large-scale disasters (Pelling 1997, Blaikie, Cannon et al. 2004). Through this focus, the thesis both confirms and extends the scope of literature. First, as is the case in many 'Southern cities', urbanisation has resulted in vulnerable groups moving to urban land that is environmentally hazardous (Pelling 2003). Subsequently, and again reflecting trends in 'Southern cities', migration has increased the density of the Cerro, which is exacerbated by the many residents who try to maximise the use of space in the plot by self-building houses extremely close to one another (Bosher 2008, Lorch 2005, Wamsler 2014), in spite of (poorly enforced) building codes that are designed to prevent such a situation occurring (Arimah and Adeagbo 2000, Green 2008). This creates new hazards, in particular the exposure of houses to rainwater that is discharged from the roofs of adjacent houses.

Analysis of DR revealed three key findings. First, DR is *heterogeneous* within and across households. Exposure to hazards differs between and across households because of the condition of infrastructure and housing construction, and because of the different social roles of residents, which is consistent with Wamsler (2006), who found that women are often more exposed to the impact of hazards because of domestic responsibilities, which keep them at home for longer periods of time. Vulnerability was explored using an agency-oriented approach to investigate the physical, political, social, economic, and human capital of residents. This showed that vulnerability is heterogeneous within and across households, which is again consistent with recent work by Wamsler (2014). This finding challenges structural and integrative approaches to measure vulnerability, which often draw averages, thereby homogenising whole groups and neighbourhoods (Adger 2006, Cannon 2008).

Second, Chapter Four revealed that the form of the *house* significantly shapes the physical vulnerability of residents (Bosher 2008). Considering the impacts of natural hazards, the components of a house, for example the walls, significantly influence the vulnerability of household members, as its materials, along with the construction techniques, influence the impact of persistent hazards such as rainfall, as well as the extent to which a landslide damages the house. However, in line with other research, the form of the house also affects how household members access and consolidate economic, social, human and political capital, which can directly and indirectly support DRR (e.g. Dankelman 2010, Gilbert 2008, Hardoy and Pandiella 2009, Jabeen et al. 2010, Moser 2010, Wamsler 2007). As such, the thesis reveals that the physical form of the house plays a large part in the DR of urban dwellers, both in terms of reducing the impact of hazards and the ability to respond and recover.

Third, the thesis confirms literature which suggests that there is often "lack of knowledge and financial capacity (and sometimes willingness) of urban authorities to reduce risks", particularly in medium-size cities such as Cochabamba (IFRC 2010: 20, Wamsler 2014). This has been termed the urban 'vulnerability gap', and studies suggest that this is largely because disasters are often understood as rural problems or phenomena that fall within the remit of specialised disaster agencies that employ capital intensive solutions (IFRC 2010, Pelling 2010, Wamsler 2006). Interviews with officials in the Municipal House neither confirm nor challenge these explanations. However, findings do build on this work as they suggest this 'gap' is exacerbated in a context of

small-scale disasters, because there is less social pressure exerted on urban authorities to intervene, which discourages incentive to develop knowledge and financial capacity (and willingness) to reduce risks.

The thesis suggests two principal reasons why small-scale disasters are less likely to encourage residents to seek governmental support, which could incentivise or pressurise officials of the Municipal House to intervene. Firstly, Chapter Six showed that residents seldom raise issues concerning DR during monthly neighbourhood meetings, because residents largely perceive that the reduction of risk of small-scale disasters is the *responsibility of the household* (reasons for this perception are explained in 7.2). Therefore, the Annual Operative Plan that is drawn up by the neighbourhood vigilance committee seldom requests municipal support for projects that address DR. Secondly, findings suggest that large-scale disasters, which are associated with "massive collective stress" (Kinston and Rosser 1974: 438), often catalyse people to mobilise and seek governmental support. For example, 6.2 discussed how a large-scale landslide in 2006 motivated a group of approximately thirty-five residents to collectively mobilise and successfully seek DRR support from the Municipal House. However, small-scale disasters are *less likely to motivate collective action* because they affect different households at different times, which hinder residents from coordinating mobilisation. This is then compounded by the perception that DRR is the responsibility of the household, as highlighted above.

Once the 'real' risk of residents was established through a 'naturalist' analysis of risk in Chapter Four, the thesis investigated risk perceptions using an approach which acknowledges and is able to explain why 'real' and perceived risk may not perfectly reflect one another.

7.2 The construction of risk perceptions

Literature within disaster studies often implicitly or explicitly frames vulnerable people in the Global South as unable to comprehend DR, as discussed in 1.1 (see Hall and Slothower 2009, Johannesdottie and Gisladottir 2010, Lewis et al. 2011, Karanci et al. 2005, Siegrist and Gutscher 2006). As such, the research set out to potentially challenge this body of work by investigating the formation and nature of risk perceptions. In light of the literature reviewed in Chapter Two, this research adopted a social constructivist approach, which, in relation to the analysis of risk perceptions, provided this research

with two particular benefits; first, it offered a different focus than that normally taken in disaster studies. In particular, this approach argues that risk perceptions are constructed by the diverse ways that people experience and interpret signals about their DR, which are not always related to the physical properties of 'real risk' (Jasanoff 1998). This allowed this research to explain why 'real' and 'perceived' risk do not perfectly 'match up', rather than suggest that people have failed to understand their DR, which studies that adopt realist approaches to risk perceptions often propose. Second, and building on this point, this approach offered the potential to identify the influence of factors on risk perceptions that may not be directly related to the properties of 'real risk', and which have often been overlooked in research; in particular, the effects of house design and construction features on risk perceptions (Okazaki, Ilki et al. 2008).

Ultimately, this approach enabled the thesis to draw several new insights about the formation and characteristics of risk perceptions, which suggest that vulnerable groups in the Global South largely understand DR, often in sophisticated ways that reflect some, though not all, elements of 'naturalist risk analyses' employed by 'risk experts'. Despite this, risk perceptions and 'real risk' are not mirror images of one another because of other mediating and subjective factors that are not necessarily related to the properties of 'real risk'.

Heterogeneous risk perceptions

A pattern of heterogeneous risk perceptions was identified within and across households. However, this is not exclusively because people evaluate their risk perceptions according to the properties of 'real risk', even though there are several and significant overlaps. Rather, the research shows that elements unrelated to 'real risk' shape risk perceptions. For example, and in line with other research, there is a broad pattern of higher risk perceptions among people with more severe and direct experience with hazards, than people with low risk perceptions who indirectly experience the impacts of hazards (Grothmann and Reusswig 2006, Siegrist and Gutscher 2006, Ruin, Gaillard et al. 2007, Miceli, Sotgiu et al. 2008, Wachinger and Renn 2010, Wachinger, Renn et al. 2013). This finding is particularly critical in light of the problem definition because it provides an explanation of why risk perceptions and 'real risk' are not 'mirror images' of one another. This contrasts with the suggestion that vulnerable groups have a 'bounded rationality', which is often the default argument among studies applying realist approaches for analysing risk perceptions (Douglas 1992, Tobin and Motz 1997).

Literature reviewed in Chapter Two also suggested that research on risk perceptions has tended to stress the influence of previous experience, and largely overlooked the effects of house design and construction features on people's risk perceptions. This helps to frame the significance of a further finding, which shows that the form of the house is one of the most distinctive and strong indicators of residents' risk perceptions. Residents perceive the physical form of the house as the most significant resource for reducing DR, because certain design features such as a deep foundation, brick and a retaining wall are associated with lower 'perceived' physical vulnerability. Accordingly, people with one or more of these design and construction features tend to have lower risk perceptions than people with none. This finding also shows that there is overlap between 'real' and 'perceived' risk as Chapter Four showed that the design and construction of the house is also significant for disaster risk levels.

The thesis identified two principal reasons why the form of the house is particularly influential on risk perceptions. Firstly, persistent, less extreme hazards that incrementally increase DR through an increased intensity and/or frequency of rainfall (Siegele 2012) allows residents to identify and often visually monitor the incremental impacts on the house. Renn et al. (2011) labels this the 'delay effect', and findings are consistent with Blaikie et al (2004) because this time dependent characteristic of slow-onset disasters means that the impacts of rainfall are typically monitored, which provides people with a visual indicator that small effects from rainfall accumulate over time and can be 'tipped' into more serious impacts. Therefore slow-onset risk allows people to identify that the design and construction of the house shapes damage; for example, where rainwater incrementally damages and erodes adobe. As the next section discusses, this 'warning period' encourages residents to take actions to reduce the impacts of hazards by reconstructing the house (Blaikie et al. 2004).

Secondly, Chapter Five also found that people draw heavily on horizontally communicated information, and through this learn about the role of the house for DRR. These sources of information are located in personal networks and are 'disseminated' through story-telling, personal narratives and interactions between people living in the neighbourhood and local construction workers. As such, the thesis finds that people do not rely exclusively on top down and 'expert' led information to comprehend risk. This helps to challenge studies and interventions that suggest that vertical communication of risk information is often the solution if vulnerable groups

are to sufficiently comprehend the process of DR and how to effectively reduce it (e.g. Shklovski et al. 2008, World Bank 2012, United Nations 2013).

Perceived 'personal responsibility'

As hinted at in 7.1, findings suggest that there is a pervasive perception that DRR is largely the responsibility of the household. This largely discourages collaborative DRR strategies between households and the seeking of support from the Municipal House. Findings suggest two particular reasons for this perception of 'personal responsibility', and in doing so this thesis builds on research by Wamsler (2014), who suggests that lower levels of social capital and the urban 'vulnerability gap' are elements that encourage DRR to take place at the household level.

One of the reasons why DRR is perceived as the household's responsibility is because residents identify that the physical form of the house is the most important resource for reducing DR. In addition, interviews with residents and neighbourhood Presidents suggest that people also perceive that designing and constructing the house is the responsibility of the household. This is problematic because residents often perceive that any damage to the house is the result of 'household error'; in other words, they themselves have inappropriately designed and constructed the house for the local context.

In addition to this, the thesis suggests that the perception of 'personal responsibility' is compounded by the risk map and resettlement programme provided by the Municipal House, because local disasters are implicitly represented as biophysical and beyond human control. This research argues that this 'official approach' is a manifestation of the urban 'vulnerability gap', as it illustrates a lack of skills, resources, knowledge and willingness to address DR. Furthermore, and consistent with many top down interventions, this approach of the Municipal House is reinforced by instrumental and technocratic language and techniques, which present results as objective and indisputable (Centno 2010, Hajer and Versteeg 2005, Heller 2001). In line with Felli and Castree's (2012) critique of migration as a form of climate change adaptation, this narrative structure ultimately places the onus of responsibility on residents and implies that the impacts of hazards are the consequence of residents' inappropriate actions by not 'removing' themselves from exposure. The perception that the household is responsible for DRR deeply depoliticises local DR and discourages residents from

engaging in any social or political debate about why they are at risk and who is responsible for reducing their risk, as well as from seeking support from the Municipal House (Felli and Castree 2012). In this way, this thesis has provided another explanation for the 'vulnerability gap' in 'Southern cities'. Previous research has argued that urban authorities have weak institutions to address DR because disasters have been seen as rural phenomena and the responsibility of specialist disaster agencies (IFRC 2010, Pelling 2010, Wamsler 2006); however, this thesis has shown that a lack of pressure from urban dwellers to intervene is also influential.

The timescale and temporality of risk perceptions

Chapter Two suggested that disaster literature has largely framed risk perceptions as static over time, with a small body of research which suggests that levels of stress and apprehension are high in the post disaster stage, but gradually return to pre-impact levels over time (e.g. Weinstein and Nicholls 1993, Weisaeth 2007). Building on this, findings from this thesis show that risk perceptions are not constant over time, but rather that they rise and fall in line with rainfall patterns, with residents' concern with disasters increasing during rainfall. Once more, this is largely because residents identify that risk increases with the consistent impacts of rain, or what Renn et al. (2011) refer to as the 'delay effect'. Therefore, the thesis suggests that risk perceptions are more fluid than current research often suggests, as they may increase and decrease across the seasons, or even during the course of a single day. As 7.3 will discuss, these fluctuations of risk perceptions distinctly influence how and when people respond to DR.

Findings about the temporal structuring of risk perceptions also illustrate how residents understand DR in more sophisticated ways than disaster literature and policies often propose. Studies of risk perceptions have significantly advanced knowledge of how an individual subjectively gauges their DR based on past and present experiences, and the current research is also testament to this. However, the thesis shows that risk perceptions are also shaped by residents' consideration of the ongoing impacts of hazards and how this influences their level of DR in the future. Residents do not perceive that distant and future disaster scenarios are generally abstracted from their everyday lives; rather, residents recognise that their future DR is connected to the ongoing, subtle and often visually observable impacts of hazards on their house.

Although the projections by 'experts' and residents may not be homogenous or shaped by the same factors, agenda, experiences or knowledge, this finding challenges the idea

that long-term predictions about risk are isolated to the 'skill set' of DR professionals who use technical, professional and sophisticated prediction models. As such, the thesis suggests that residents' perceptions of slow-onset DR are broadly in line with the long-term temporal scale that is often used for understanding and adapting to the impacts of climate change (see Gero et al. 2011, Mercer 2010, Thomalla and Downing 2006, Sperling and Szekely 2005, Thomalla and Downing 2006). This is significant because Chapter Two revealed that the effects of climate change often manifest as incremental and slow onset changes that cause more extreme weather conditions, such as prolonged periods of rainfall (IPCC 2014, Moser et al. 2010). Therefore it is becoming increasingly important for urban actors, including urban dwellers, to recognise and address the impacts of persistent, less extreme natural hazards. Furthermore, as 7.2 will discuss, this long-term temporal structuring of risk perceptions has a direct influence on the anticipatory and preventative strategies that people carry out to reduce DR when designing and constructing the house.

Therefore, this research has shown that widespread understanding of the process of DR is not the result of dissemination of top-down mono-logic risk information that draws on measurements of 'real risk'. Rather, the thesis suggests that residents use alternative mechanisms, experiences and information sources to identify that DR is within their control, and that the house is central to this 'learning process' and the formation of risk perceptions. Therefore, the thesis shows that vulnerable urban dwellers do not necessarily always need 'risk experts', who are often implied in disaster literature and policies to have the 'objective', 'scientific' and 'expert' ability to comprehend and reduce DR (Hajer and Versteeg 2005). Neither does the research suggest people have a 'bounded rationality', because 'real' and perceived risk do not perfectly mirror one another. In order to fully address the research aim, this thesis explored how these perceptions shape responses, which is synthesised below in light of relevant theoretical debates.

7.3 Risk perceptions and responses

I have suggested that residents are aware and understand DR in ways that significantly, yet not wholly, mirror 'real risk'. Further, residents have heterogeneous perceptions of risk, which often differ over timescales and which are structured by understandings of past, present and future risk and the form of the house in particular. However, there is a widespread perception that DRR is the responsibility of the household, which is

particularly encouraged by the de-politicised character of local DR. The thesis set out to explore the relationship between these risk perceptions and responses, and the way that people design and construct their houses in particular. Chapter Two revealed that the literature largely focuses on the influence of risk perceptions on response and recovery, whereas anticipatory measures are often overlooked. This is not inconsequential, but helps to frame the significance of another research finding, which shows that residents' risk perceptions play an important role in shaping short and long-term strategies to reduce disaster risk. In particular, this research shows that the effect of risk perceptions on ad hoc responses that require less investment of resources is particularly clear; however, influence on how people design and construct self-build houses is important, though not as conspicuous, because of the diverse and overlapping factors that people negotiate when self-building in disaster prone contexts.

An agency-oriented approach to analyse DRR was chosen in order to move beyond an exclusive focus on the role of urban actors located above the neighbourhood, which is often adopted by biophysical, structural and integrative approaches to DRR. As well as often obscuring the activities at scales such as the household and neighbourhood levels, these approaches often gloss over the local social context including intra-household power dynamics, residents' experiences and demographics. These may seem inconsequential, but play an important part in how people are differently at risk of disasters and how they therefore address DR (Dow 1992, Adger 2006). In applying this approach this thesis builds on recent disaster and climate change research that focuses on the skills, abilities and knowledge of vulnerable groups for reducing the impacts of hazards (see Wamsler 2007, Baumwoll 2008, Sabates-Wheeler, Devereux et al. 2008, Simatele, Binns et al. 2012, Dodman and Mitlin 2013, Gaillard and Mercer 2013, Shaw 2014, Wamsler 2014).

In spite of residents' perceptions of disaster risk, which was discussed above and throughout this thesis, Chapter Six revealed that many residents 'stay put' in the Cerro. The thesis showed that a lack of resources to migrate is one explanation, which is in line with Kothari (2003). This was significant for residents living in 'high risk' zones, where the indirect effects of the resettlement programme trap them in a vulnerable state of 'limbo', in which they are unwilling to leave, but simultaneously unable and unwilling to reconstruct the house. However, for most household informants that were interviewed, this research argues that it is useful to draw on Starr's (1969) idea of

'voluntariness', whereby people are willing to remain living with DR if it is associated with benefits and an ability to control risk to some degree. Reflecting studies in 'Southern cities', the research finds that benefits are associated with "residential satisfaction" (Weidemann and Anderson 1985: 155) because of the services and employment opportunities available in the Cerro and Cochabamba city more broadly. However, the thesis suggests that the idea of 'place attachment', which reflects notions of identity and belonging, is particularly useful for explaining why residents with high and low risk perceptions do not leave the Cerro. The effects of 'place attachment' in disaster risk settings has been largely overlooked and has only very recently received attention in climate change adaptation research that investigates the effects of place identity on people's decisions to migrate or remain in areas that they know to be at risk from the future impacts of climate change (Adger et al. 2011, Novaczek et al. 2011, Baxter and Armitage 2012, Graham et al. 2013).

For residents who remain, findings indicate that responses to address DR are not situated in the post disaster phase, but are highly anticipatory and preventative. Further, the relationship between risk perceptions and responses is not constant, but can be more conspicuous during certain times and when residents carry out certain DRR strategies. In particular, Chapter Six showed that residents carry out a number of ad-hoc strategies, such as sweeping rainwater out of the house, or moving to spaces in the house that they perceive as less vulnerable during rainfall. Critically, the likelihood that residents will carry out these DRR actions is not dependent on whether risk perceptions are high or low, but rather on the temporary increase of individual concern with the impacts of hazards during rainfall, which occurs because people understand that risk incrementally increases with the impacts of rainfall. However, the influence of risk perceptions on DRR is less discernible when exploring the way that people design and construct their houses.

Risk perceptions and self-build houses

Exploration of the way people design and construct their houses represents a particularly novel approach to explore the relationship between risk perceptions and responses, which have shown that risk perceptions also shape long-term DRR strategies that require significant investments of resources. It is not surprising that the thesis finds that many residents design and construct their houses in ways they perceive reduce DR, given that Chapter Five revealed that the form of the house heavily determines risk

perceptions, and the literature review highlighted that the house is often used as a resource to reduce DR in 'Southern cities' (see Wamsler 2007, Green 2008a).

Design and construction features that residents associate with DRR are brick and concrete, reinforced concrete, a deep foundation and a retaining wall, which are increasingly incorporated into self-build houses across Cerro Lourdes. However, residents do not perceive that these design and construction features can eradicate DR; rather that it can significantly make the house "last longer" against the inevitable impacts of hazards and delay the onset of a disaster. Residents' perception that construction of the house can delay the impact of hazards into the future suggests that the long-term temporal structuring of risk perceptions is not disengaged from people's behaviour in the present. On the contrary, residents carry out significant and long-term investments in the house to address their future DR because they do not perceive it as entirely abstracted from their present behaviour. Accordingly, the research suggests that reconstruction of the house to reduce DR is broadly in line with the long-term temporal scale that is often used for understanding climate change adaptation, which the thesis recognises as significant and important, given the current and forecast impacts of climate change (see Gero et al. 2011, Mercer 2010, Thomalla and Downing 2006, Sperling and Szekely 2005, Thomalla and Downing 2006).

People with high and low risk perceptions equally build, plan to build or aspire to build their house in ways that they perceive reduce DR. Interviews with construction workers, architects and residents indicate that this is because features such as a retaining wall, a deep foundation and materials such as brick and concrete now represent local 'architectural norms' that are desirable and viewed as 'good practice' because of their association with DRR. This moves beyond research that has focused on understanding how people with 'high' or 'low' risk perceptions differently respond to disaster risk. As such, this research shows that is the fact that an individual has perceived they are at risk (regardless of their perception being 'high' or 'low') and they understand the house can be built in ways to reduce DR that encourages people to self-build their house to reduce their disaster risk. Accordingly, features such as a retaining wall and a deep foundation are now largely incorporated, or 'mainstreamed', to take from Wamsler (2006), into the design and construction features of the house when people decide to build and have the resources to build. These architectural features are not simply an 'add on' that is considered after construction, but form an integral part of the local architectural norm

across the Cerro. However, the way that residents design and construct the house is not exclusively determined by DRR. Here, exploration of the different influences on how people design and construct their house, which are not directly related to DRR was especially useful. This helped to untangle how and to what extent residents' concern with DR shapes the particular design and construction features of the house.

The house as more than a physical resource to address disaster risk

Exploration of how the design and construction features of the house shape social and economic processes within and beyond the household is a particularly novel approach in disaster studies. Chapter Two showed that disaster studies and policies often conceptualise the house as a resource to reduce physical vulnerability and to access and consolidate social, economic, human and political capital that may also reduce DR (e.g. Bosher 2008, Lorch 2005, Wamsler 2007). Therefore design and construction features of the house are largely discussed and understood according to the language and process of DR, which largely glosses over the other functions and effects of self-build houses that do not necessarily relate to DRR, but which may significantly shape how people design and construct their house (see Kellet 2005, Kellet and Napier 1995).

Through this wider conceptualisation of the house, Chapter Six revealed residents' deep tacit knowledge about how they understand and relate to the physical form of the house (Stevenson 2008). The transformation and consolidation of economic and social processes also largely determine the way people design and construct their house (Kellett 2005). Therefore, the research argues that dimensions located beyond issues of DRR must also be considered when exploring the relationship between risk perceptions and responses, because the form of the house cannot be wholly understood according to the analytical lens of DRR. For example, residents increasingly build brick houses because they perceive that it reduces their risk of a disaster. However, discursive analysis of interviews and closer scrutiny of participatory drawings revealed that residents also associate brick with many social functions such as health benefits, efficient domesticity, privacy, comfort, security, higher income and personal taste. Therefore, this thesis argues that concern with DR is not the most determinant factor of house design and construction features, or the primary catalyst for reconstruction. Rather, risk perceptions are one of many influences, because residents attempt to articulate and consolidate many social functions besides DRR when self-building.

Building on the suggestion that the form of the house is determined by many and overlapping social functions and not merely DRR, the research finds that residents associate other construction features with multiple benefits. This buttresses the argument that the catalyst and determining factor of the design and construction features of a house cannot be reduced to DRR exclusively. Examples include the use of a tiled roof because of personal taste and because tile is not as loud as tin when it rains, or opaque windows, which conceal household activities and help to regulate the internal temperature of the house. In contrast, there is a clearer link with design features, such as a retaining wall and a deep foundation, as residents exclusively associate these with DRR. However, as discussed above, it is important to consider these construction features as being 'mainstreamed' into the physical form of the house when people decide and have the resources to reconstruct the house.

Therefore, this research argues that the influence of risk perceptions on the form of the house is nuanced, which indicates that human behaviour in disaster prone contexts is not a zero sum game. In other words, it is not a matter of reducing DR and subsequently neglecting other aspects, such as social and economic processes that people value. Rather, by exploring the way people self-build their houses, the research shows that the factors which shape how people design and construct self-build houses in disaster prone contexts is a multidimensional process, because people negotiate and satisfy their risk perceptions alongside their other values, risks, objectives and aspirations. Accordingly, the research has moved beyond the oft cited suggestion that the relationship between risk perceptions and responses is weak or unclear. In contrast, I suggest that risk perceptions certainly shape responses, but that this relationship is subtle and nuanced, which is why a more holistic conceptualisation of the house that looks beyond the process of DRR has been of such importance.

Despite this subtlety, the relationship between risk perceptions and the way residents design and construct the house is not always this nuanced. Four of the residents participating in this research have high risk perceptions after experiencing more extreme impacts, and therefore placed greater emphasis on the house as a resource to reduce DR when discussing their ideal house. The four informants would prefer to live in a one or two storeys house in contrast to other informants who build, plan to build or aspire to build a house of three or four storeys. Nevertheless, this group is not representative of residents with high risk perceptions, as other residents with severe

experience and high risk perceptions did not place as much emphasis on DRR when discussing the design and construction features of their current house and their 'ideal' house. As discussed above, this is because people associate the physical form and materials of the house with many functions that are no less important than DRR.

Re-visiting findings about vulnerability levels, results show that residents are differently able to self-build their houses because of heterogeneous levels of capital. For example, political capital in the form of house-ownership is not universal, and so tenants are unable to self-build. Access to and levels of economic capital needed to self-build also vary significantly. Household composition can also shape the investment of income in distinct ways, as some household members way wish to invest in the house, whereas others may not prioritise housing construction. Findings also show that household composition and social capital can determine a household's access to skills necessary for reconstruction. As such, households are differently able to use the house to reduce DR. This is by no means inconsequential; however, in light of the research aim, it is significant that interviews and participatory drawings suggest that residents build, plan to build or aspire to build their house in highly similar forms when disaggregated by vulnerability levels. In other words, no matter what levels of capital residents have access to they have distinctly similar ideals of how they would like to design and construct their house. The research discovered that this 'architectural' norm is often labelled the 'casa bonita', and findings show that 'risk reduction features' such as a retaining wall, brick and deep foundation form an integral part of it. As such, the research finds that even where residents are less able to reconstruct the house, they still aspire to mainstream DRR.

7.3.1 Limitations of the research

As with any research, there are limitations. Firstly, this research would have benefitted from a more gender balanced sample of household informants. Although results showed that there were no significant gender differences with regards to the houses that men and women wanted to design and construct, results do show that there were gendered reasons behind these choices. For example, whereas both women and men cited the design of the house as a way to increase domestic efficiency, women placed much greater emphasis on this reason than men. Therefore, a larger sample of male informants may have uncovered other reasons for certain design and construction features being chosen. In relation to interviews with residents, it would have been

beneficial to conduct an equal amount of interviews during the rainy season as during the dry season. More interviews during the dry season would have likely highlighted how people's risk perceptions attenuate when it is not raining, which may have strengthened the argument that risk perceptions rise and fall broadly in line with rainfall patterns.

Secondly, and as Chapter Two outlined, DRR includes strategies to facilitate recovery from disasters. However, this research was not able to give significant attention to the effects that housing reconstruction has had on residents' ability to recover, following the impacts of hazards. This was given some attention in Chapter Six, which highlighted that it may be more difficult to reconstruct brick houses because it is a more expensive material than adobe. Although the focus of this research is not to establish exactly how much risk is reduced through the DRR strategies of urban dwellers, but rather what strategies urban dwellers carry out and why, greater attention to the effects of housing construction on recovery from a disaster would have allowed this research to discuss the effect of housing reconstruction for the process of DRR more holistically and whether or not residents consider this when acting to reduce DR.

Thirdly, as this research paid attention to housing reconstruction, the DRR strategies of people who do not own their house were largely overlooked. Attention was given to the ad-hoc strategies and the 'ideal house' of non-house-owners; however, the research somewhat overlooked the DRR strategies that people carry out which may not be related to the physical form of the house. This was beyond the aim of this research; however it would have potentially shown the many non-housing construction related strategies that non-house-owners (and house-owners) carry out to address DR, some of which have been identified in previous studies (e.g. Wamsler 2007) and which may also shape people's risk perceptions. Related to this, this research looked at the relationship between physical damage to the house and risk perceptions. However, as Chapter Two showed, property damage has indirect and hidden impacts on people's social, economic and human capital. These 'non-physical' impacts may shape people's risk perceptions in particular ways which this research was not able to verify. Therefore, this represents another exciting potential for further research.

7.4 Risk perceptions in disaster prone 'Southern cities'

The aim of this thesis has been to answer how perceptions of risk shape the responses of people living in disaster prone contexts in cities of the Global South. Using the design and construction features of the house to explore this relationship has offered a novel approach. Furthermore, a focus on slow-onset risk of small-scale disasters is also important in light of the large focus on rapid onset large-scale disasters in disaster studies. Findings indicate that more nuanced understandings and investigations of the relationship between risk perceptions and responses are needed. Focus on the form of the house, which adopts a more holistic conceptualisation of the social functions of the house has provided this. In particular, this approach showed that risk perceptions, alongside other social and economic processes, shape the way that people design and construct their house. This has allowed this research to argue that the relationship between risk perceptions is subtle and nuanced, rather than weak or unclear (Haynes, Barclay et al. 2008, Wachinger et al 2013), or that people have a 'bounded rationality' (Tobin and Montz 1997).

The 'official approach' of the Municipal House to issues of DR largely reflects the 'vulnerability gap' identified in disaster studies literature (IFRC 2010, Wamsler 2006). This can significantly increase the vulnerability of urban dwellers and deeply depoliticises DR, which can marginalise vulnerable urban dwellers from engaging in social and political debates about DR. Weak institutional structures to address urban DR is an ongoing problem in 'Southern cities', and one that certainly requires further research. However, for this research it provided a useful context to explore how urban dwellers understand and attempt to reduce their DR in a context of negligibly coordinated institutional support. This is insightful because disaster studies literature and policies largely frame urban dwellers as unable to comprehend and address DR without the aid of top-down expert led solutions that are largely imposed on populations (see Mileti and Darlington 1997, Sandman and Lanard 2003, Eisenman, Cordasco et al. 2007, Shklovski, Palen et al. 2008, World Bank 2012, United Nations 2013). Meanwhile, this research argues that residents understand this risk in sophisticated ways that largely, although not wholly, reflect elements of 'real risk'.

Although risk perceptions and 'real risk' are not based on the same factors, agenda, experiences or knowledge, the findings of this research indicate that DR professionals

who use technical, professional and sophisticated prediction models are not the only ones to understand the process of DR and how to address it. Furthermore, through a social constructivist approach, this research has been able to explain why 'real' and 'perceived' risks do not perfectly match. This enabled this thesis to steer away from the conclusion that people have misunderstood 'real risk', which is often the default argument of studies that adopt realist approaches to explore risk perceptions. Many studies also conclude that the influence of risk perceptions on responses is weak and unclear. However, through exploration of how risk perceptions shape responses, the thesis suggests that risk perceptions importantly influence how people respond, which is particularly conspicuous during rainfall, when concern with slow-onset risk increases. However, this relationship is more subtle when investigating the influence on how people design and construct self-build houses. As people give significant importance to local natural hazards and their impacts, this research contradicts studies that suggest there is a 'risk hierarchy', whereby people are less concerned with natural hazards linked to disasters, and are typically more concerned with 'everyday' problems like food on their plate, paying school fees, getting water, crime, road accidents and so on (Barberi 2008, Blaikie et al. 2004, IFRC 2014, Lavigne et al. 2008). In contrast, this thesis shows that because local natural hazards and their impacts are frequent (albeit principally during the rainy season) and observable, they are considered important and 'everyday' local problems.

Adopting the house as a methodological tool is a novel way of exploring the relationship between risk perceptions and responses. This approach also allowed this thesis to conduct a more nuanced analysis of this relationship by drawing on a more holistic conceptualisation of the house and how people relate to it. Through this, the research shows that people with high and low risk perceptions equally build, plan to build or aspire to build their house in ways that they perceive reduce DR. Interviews with construction workers, architects and residents indicate that this is because features such as a retaining wall, a deep foundation and materials such as brick and concrete now represent local 'architectural norms' that are desirable and viewed as 'good practice' because of their association with DRR. This moves beyond research that has focused on understanding how people with 'high' or 'low' risk perceptions differently respond to disaster risk. As such, this research shows that is the fact that an individual has perceived they are at risk (regardless of their perception being 'high' or 'low') and they understand the house can be built in ways to reduce DR that encourages people to

self-build their house to reduce their disaster risk. Accordingly, a retaining wall and a deep foundation are now 'mainstreamed' into the design and construction features of the house when people decide to build and have the resources to build. Despite this, risk perceptions are not the catalyst for reconstruction, or the principal factor shaping the design and construction features of the house. Risk perceptions represent one of a multitude of factors that shape the decisions people make about the design and construction features of the house. As such, this research has shown that DRR is much broader than dealing with DR, as people negotiate many objectives. In this way risk perceptions become embedded into their strategies for social progress.

Analysis of vulnerability revealed that households are differently able to reconstruct the house, and so a focus on capabilities is paramount for any study about housing construction or addressing DR more broadly. However, the focus on the reasons why people design and construct their houses in particular ways in order to facilitate certain social, physical or economic functions of the house allowed this research to show that people are not 'rational environmental actors'. In other words, behaviour in disaster prone settings cannot be understood by exclusively looking to people's perceptions of risk. In particular, this approach provided a rethinking of what the house means to the people who live in it, in terms of social, economic and physical processes, and how they attempt to negotiate and articulate aspirations, values, beliefs and other risks. As such, the thesis argues that research which describes the relationship between risk perceptions and responses as 'weak' forecloses the nuances of human behaviour in disaster prone contexts and does not apply an analytical approach that is equipped to capture the subtle, yet important ways that perceptions shape responses.

As this research has shown that people negotiate and articulate their risk perceptions alongside other objectives, aspirations and social, cultural, economic and political processes when they design and construct their house, it seems evident that any interventions or research focusing on the reduction of DR in disaster prone urban contexts must remain critical of marginalising debates about urban dwellers' ability to comprehend DR and how they respond. Simultaneously, they must remain sensitive to the multiple factors that include and fall outside the 'disaster box', which shape human behaviour. Actions to reduce DR that fail to account for people's cultural perspectives, local priorities and 'voluntariness' to live with risk are unlikely to be effective. For example, in light of the important, yet subtle ways that risk perceptions shape house

design and construction, international organisations or academics may wish to review how they contextualise a particular neighbourhood or case site by looking to the (often hidden) aspirations and broader objectives of people, instead of limiting themselves to the methodological and analytical tools of disaster studies.

Policy implications

The thesis began by setting out the problem of increasing DR and disasters in 'Southern cities'. Certainly, the increasing number of vulnerable people moving to hazardous urban land indicates that the problems of urban disasters are not going away, and that there is a need to better understand the cause of DR, how people perceive DR and how they respond to it. Although the research suggests that it is people's awareness and understanding of risk which encourages and shapes long-term investments in DRR, and not whether a risk perception is high or low, it would be inappropriate were DRR policies not to attempt to better understand and capture the risk perceptions and responses of vulnerable urban dwellers. On the contrary, the thesis has painted a picture of heterogeneity and complexity, whereby people are differently at risk between and within households, risk perceptions differ between and within households, and people's behaviour is by no means exclusively shaped by DRR. This complexity suggests the need to untangle how and why people differently experience, perceive and respond to DR. Therefore the thesis suggests disaster policies should incorporate the skills, knowledge and capabilities of vulnerable groups into multi-scalar disaster approaches to DRR.

The thesis ultimately indicates that notions of 'rational' and 'non rational' behaviour in disaster settings are unhelpful, as they suggest a normative standard of how people ought to behave in disaster contexts, and imply that any behaviour to the contrary is misinformed or foolish. As such, I argue that disaster literature and policies need to maintain a sense of complexity of human behaviour in disaster contexts, which ultimately requires more nuanced understandings of how risk perceptions subtly, yet importantly, influence the responses of people living in disaster contexts. A more holistic understanding of the social functions of the house has revealed that often, people understand that the house signifies more than a physical resource to reduce DR. Rather, they see it as a resource that allows people to address DR while simultaneously transforming and consolidating other social functions which also have an effect on DRR, albeit an indirect one. This indicates that any disaster policies that focus on DRR,

and on houses in particular, ought to critically understand and capture the multiple aspirations, values and priorities of vulnerable groups, so that policies are not entirely bound by the issue of DR, but are simultaneously able to transform and consolidate other social, economic and cultural processes that people may value.

This thesis is not taking a romanticised view of urban dwellers in disaster contexts; it is instead arguing that their perceptions, knowledge and skills ought to be adequately inserted into academic and policy discourses. The thesis also argues that there needs to be awareness that human behaviour in disaster prone contexts is complex and not mono-causal, because people do not make 'rational' or 'non-rational' choices about their DR. Rather, human behaviour is influenced by, and negotiates, many elements including DRR and beyond. The task then for disaster studies and policies is to uncover people's 'imagined future' and the many things that people value, so that any attempt to deal with natural hazards can incorporate these, rather than treating them as largely irrelevant, or as an illogical or obstructive 'extra' to DRR interventions. John Clammer (2012: 57) suggests this when discussing development studies more broadly, "development studies is the art and science of conceiving and bringing into being that future, the one we want, not the one imposed on us."

Future research

This research investigated the relationship between perceptions of DR and responses in disaster prone contexts. The particular case was composed of three adjacent neighbourhoods in Cochabamba, Bolivia. However, the characteristics of DR, perceptions of risk and responses are extremely context specific. This is why analysis was conducted at the micro-level, in order to capture the different experiences, capabilities and knowledge of people within and across households. This approach has advanced knowledge on the role and abilities of vulnerable groups in DRR, particularly in Cochabamba. However, there is still scope to expand this research to other cities of the South. There are many vulnerable populations that live in marginal and hazardous land, and important factors such as urbanisation and climate change exacerbate their DR. As such, research in other geographical, political, social and cultural contexts would greatly advance knowledge.

In addition, this research has explored incrementally increasing DR that is linked to persistent and less severe natural hazards. This runs against the tendency of disaster

studies and research to focus on less frequent, extreme hazards that quickly overwhelm people's capabilities. As such, there is still room for investigation of different timescales of DR which may incrementally increase over long periods of time. Further, it would be beneficial and insightful to build on the present research and to explore how slow-onset risk shapes the temporality of people's risk perceptions.

On the basis of the discussions in this chapter, future disaster research ought to take into account the values, beliefs, identities and aspirations of urban dwellers living in disaster prone contexts. In particular, there is a negligible amount of qualitative research that captures the particular life that people aspire to have and how DRR may be 'mainstreamed', so that people do not have to prioritise DRR whilst neglecting other priorities, or vice versa. This would ultimately require research to adopt a more holistic analytical approach that is not bound by the methodological and analytical tools of disaster studies. The present research has made an initial step by exploring the non-DRR factors and how they affect the way people design and construct self-build houses. However, there is exciting potential to take this even further and for research to apply an analytical lens such as 'materiality', whereby the focus is on the social driving forces of the material world and concern with the "notion that humans engage with the things of the world as conscious agents and are themselves shaped by those experiences" (DeMarrais et al 2004: 2). Other useful analytical approaches may include ideas such as 'place-making' (Marcus 2006) or the concept of 'home' (Blunt 2005). The aim of conducting this type of research would be to ensure that, as argued in the thesis, when trying to plan or execute DRR interventions in cities – wherever they may be located – it is important to fully understand the local social contexts, including the skills, knowledge, experiences, values, identities and aspirations of the population, through a critical, but empirically driven approach.

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APPENDICES

Appendix 1: List of semi-structured interviews

Household informants							
No	***Pseudonym***	***Type of interview***	***Age***	***Sex***	***Religion***	***House-ownership***	***Previous experience with hazards***
1	Gemita	Resident – Vinateros	44	F	Evangelical	House-owner	Moderate damage - rainwater
2	Faya	Resident – Vinateros	61	F	Evangelical	Tenant	Total collapse - landslide
3	Gracia	Resident – Simancas	26	F	Catholic	House-owner	No damage
4	Fabiola	Resident – Simancas	43	F	Evangelical	Tenant	Total collapse - landslide
5	Teresa	Resident – Simancas	35	F	Evangelical	House-owner	Very serious damage - landslide
6	Juanita	Resident – Amposta	31	F	Evangelical	House-owner	Partial or total collapse of walls - rainwater
7	Rosa	Resident – Amposta	61	F	No religion	House-owner	Partial or total collapse of walls - rainwater
8	Norma	Resident – Vinateros	30	F	Evangelical	House-owner	Total collapse - landslide
9	Federico	Resident – Vinateros	31	M	No religion	House-owner	Total collapse - landslide
10	Javier	Resident – Amposta	32	M	No religion	House-owner	No damage
11	Rebeca	Resident – Amposta	28	F	Evangelical	House-owner	Very serious damage – landslide; Partial or total collapse of walls - rainwater
12	Alejandra	Resident – Vinateros	22	F	Evangelical	House-owner	Very serious damage - rainwater
13	Jaime	Resident – Vinateros	24	M	Catholic	House-owner	Very serious damage - landslide
14	Monica	Resident – Amposta	59	F	Evangelical	House-owner	Total collapse - landslide
15	Paulo-Jaime	Resident – Amposta	58	M	Evangelical	House-owner	Total collapse - landslide
16	Lucia	Resident – Vinateros	32	F	Mormon	House-owner	Moderate damage - rainwater
17	Rafael	Resident – Vinateros	25	M	Catholic	House-owner	Moderate damage - rainwater
18	Carla	Resident – Amposta	24	F	Catholic	House-owner	Partial or total collapse of walls - rainwater
19	Felix	Resident – Amposta	58	M	Evangelical	Tenant	Partial collapse - landslide
20	Nadimo	Resident – Amposta	56	M	Catholic	House-owner	Partial collapse - landslide
21	Gloria	Resident – Amposta	45	F	Evangelical	House-owner	Serious damage - rainwater
22	Marcela	Resident – Simancas	33	F	No religion	House-owner	Serious damage - rainwater
23	Eliza	Resident – Vinateros	39	F	Catholic	Tenant	No damage

24	Silvia	Resident – Vinateros	35	F	Catholic	House-owner	Very serious damage - landslide
25	Consuela	Resident – Simancas	34	F	Catholic	House-owner	Very serious damage - rainwater
26	Juan	Resident – Amposta	35	M	Catholic	House-owner	Partial or total collapse of walls - rainwater
27	Maria	Resident – Amposta	52	F	Catholic	House-owner	No damage
28	Valeria	Resident – Vinateros	62	F	Evangelical	House-owner	Total collapse – landslide; Negligible damage - rainwater
29	Camila	Resident – Amposta	39	F	Catholic	House-owner	Moderate damage – landslide; Partial or total collapse of walls - rainwater
30	Maria Jose	Resident – Simancas	42	F	No religion	House-owner	Moderate damage - Landslide
31	Victoria	Resident – Simancas	48	F	Evangelical	House-owner	No damage
32	Daniela	Resident – Simancas	56	F	Catholic	House-owner	No damage
33	Samantha	Resident – Simancas	34	F	Evangelical	House-owner	Partial or total collapse of walls - rainwater
34	Vicente	Resident – Amposta	54	M	Catholic	House-owner	No damage
35	Ana	Resident – Vinateros	50	F	Catholic	House-owner	Partial or total collapse of walls - rainwater
36	Olivia	Resident – Simancas	46	F	Catholic	House-owner	Very serious damage - rainwater
37	Jazmin	Resident – Simancas	33	F	Evangelical	House-owner	No damage
38	Romina	Resident – Amposta	44	F	Evangelical	House-owner	Partial or total collapse of walls - rainwater
39	Luna	Resident – Amposta	36	F	No religion	Tenant	Very serious damage - rainwater
40	Bianca	Resident – Amposta	47	F	No religion	House-owner	No damage
41	Luis	Resident – Amposta	37	M	Catholic	House-owner	No damage
42	Josefina	Resident – Vinateros	58	F	Catholic	House-owner	Very serious damage - landslide
43	Cristiana	Resident – Vinateros	60	F	Catholic	House-owner	Light damage - landslide
44	Isabel	Resident – Simancas	37	F	No religion	House-owner	No damage
45	Amalia	Resident – Vinateros	55	F	Catholic	House-owner	Moderate damage – landslide; Partial or total collapse of walls - rainwater
46	Sofia	Resident – Vinateros	39	F	Catholic	House-owner	Very serious damage - landslide
47	Valentina	Resident – Vinateros	54	F	No religion	House-owner	No damage
48	Jimena	Resident – Simancas	47	F	Catholic	House-owner	Partial or total collapse of walls - rainwater
49	Felipina	Resident – Simancas	41	F	Evangelical	House-owner	No damage
50	Harry	Resident – Simancas	22	M	Catholic	House-owner	No damage
51	Enrique	Resident – Simancas	24	M	Catholic	House-owner	No damage

52	Alfonso	Resident – Simancas	25	M	Evangelical	House-owner	No damage
53	Pepe	Resident – Simancas	35	M	Catholic	House-owner	Partial or total collapse of walls - rainwater

Other interviewees

No	***Pseudonym***	***Age***	***Sex***	***Position***	***Institution***
54	President of Simancas	37	M	President of Simancas	Territorial Base Organisaton (TBO)
55	President of Amposta	62	M	President of Amposta	Territorial Base Organisaton (TBO)
56	President of Vinateros	49	M	President of Vinateros	Territorial Base Organisaton (TBO)
57	Pastor	48	M	Pastor	Local Evangelical church
58	Mauge	42	F	Director of COMPASSION	COMPASSION and local Evangelical church
59	Builder 1	23	M	Local construction worker	Informal construction industry
60	Builder 2	59	M	Local construction worker	Informal construction industry
61	Builder 3	44	M	Local construction worker	Informal construction industry
62	Builder 4	46	M	Local construction worker	Informal construction industry
63	Builder 5	21	M	Local construction worker	Informal construction industry
64	Builder 6	26	M	Local construction worker	Informal construction industry
65	Builder 7		M	Local construction worker	Informal construction industry
66	Builder 8		M	Local construction worker	Informal construction industry
67	Arcenio		M	Architect	Valle Hermoso Municipal House
68	Echavarri-Valdez	38	M	Senior engineer	Office for Urban Development, Valle Hermoso Municipal House
69	Aponte-Gonzalez	34	M	Head of infrastructure	Office for Urban Development, Valle Hermoso Municipal House
70	Shamelo	44	M	Senior housing officer	Office for Urban Development, Valle Hermoso Municipal House
71	Sanchez		M	Head of urbanism and administrative processes	Office for Urban Development, Valle Hermoso Municipal House

Appendix 2: Survey questionnaire

Neighbourhood						**Block Number**			
BACKGROUND AND VULNERABILITY									
1	**House-ownership status**					Owner			
						Renting			
						Anticrético			
2	**Legal land title? ('derechos reales')**					Yes		No	
	Minuta de compraventa?					Yes		No	
3	**Access to basic services**					Legal			
						Illegal			
4	**Household composition**								

	Sex	**Age**	**Religion**	**Years of study**	**Relation to Hh**	**Occupation**	**Monthly income**	
							Work	**Other**
Hh								
2								
3								
4								
5								
6								
7								
8								
9								
10								

5	**Total Monthly Hhold income**		
6	**How many Hholds live in the house**		
7	**How many people rent in this house normally?**		Adults (18+)
			Children

8	**Where did the household live before living in this house?**	
		Year of arrival
	Other Bolivian Department _____	
	Other province of Cochabamba	
	Other part of the city	
	Other part of the hill	
	Other country _____	
MOBILITY		
9	**¿Does the household have any member living in another country or another part of Bolivia, now or in the past?**	
	1 Destination	
	2 Destination	
	3 Destination	

10		Age	Sex	Years of study	Civil state when there	Religion	Relation to Hh head
	1						
	2						
	3						
11	**What year did they go?**						
	1						
	2						
	3						

12	**Did they return/will they return to live in this house?**						
	1		Yes		No		Don't know

	2		Yes		No		Don't know
	3		Yes		No		Don't know
13	**What year did they return/will they return to permanently live in the house?**						
	1						Don't know
	2						Don't know
	3						Don't know
14	**Did they live independently before they left?** *(spend money separately from the household?)*						
	1		Yes		No		
	2		Yes		No		
	3		Yes		No		

15	**Does/Did this person send money to the house?**			
		Amount	Frequency	No, Why?
	1			
	2			
	3			
16	**Has/Did the amount of money change over time?**			
		Increased	Decreased	Stopped	The same
	1				
	2				
	3				

17	**Why did the amount change?**						
		Less work	Currency change	Wanted to save	Other partner	Separation	More work	Other
	1							
	2							
	3							

18	**What does/Did the household spend this money on? *(number of priority 1-5)***		Housing Changes	Buy another plot/house
			Food	Buy their own plot/house
			Education	Construction of own house
			Health	Other

19	**If the migrant is/was saving, how will they/did they spend the money?**						
		Changes to our house	Education	Food	Buy own plot/house	Construction of own house	Other _____
	1						
	2						
	3						

CONSTRUCTION AND VULNERABILITY

20	**What materials *are* the walls of your house made of?**		Adobe		Brick, cement and adobe
			Brick and cement		Other
21	**What materials *were* the walls of your house made of?**		Adobe		Brick, cement and adobe
			Brick and cement		Other
22	**House damage from landslip and/or rain?**		Landslip		
			Rain		

23	**Has the family made any structural changes to the house?**	
		Destroy all old adobe rooms and built ***multiple*** single structures of brick and/or cement
		Destroy the old adobe rooms and built ***one single structure*** of brick and/or cement
		Built brick and/or cement rooms (but maintain the adobe rooms)
		Built adobe rooms
		More floors
		Retaining wall
		Reboque
		Fill cracks and holes with cement
		Deep foundation

		New roof				Material
		New floor				Material
		Other _____				
24	**Why did you build the house with these materials? *(number of priority 1-5)***		Lasts longer against the rain		Prettier	
			Lasts longer against the unstable ground		It's how we build houses here now	
			No vinchucas		Builder told us	
			Its cleaner/easier to clean		Cheaper	
			Architect told us		Other _____	
25	**How did you pay for changes? *(number of priority 1-5)***		Work wages		Bank loan	
			International remittances		Other _____	
			Domestic remittances		Don't know	
26	**How long did you have to save money for these changes?**					
27	**In what time did you complete the construction?**					
28	**Who made the changes?**		Builders			
			Family			
			Family with Builders			
			Friends			
29	**How do household members feel about the problems with the ground and rain after these changes?**		More secure			
			Less secure			
			The same			
			Don't know			
ASPIRATIONS						
30	**If the household had more money, what would it be spent on? *(number of priority 1-5)***		Housing changes		Health	
			Food		Buy another plot/house	
			Education		Other _____	
31	**Have household members thought about migration to make more money?**		No			
			Yes		A member will go	Affects the children
					Too expensive to go	No work there
					Affects the couple	Other ___

Appendix 3: Glossary of foreign terms

Adobe	Sun dried bricks made of mud, water and straw. Often used to make 'medias aguas' houses
Anticretico	Long-term contract where a large amount is paid upfront to the house-owner, which is returned to the tenant when they leave
Bono Escolar - Juancito Pinto	Cash benefit to Bolivian primary school children aged six to twelve years, to increase school enrolment, completion, and levels of human capital that can be used to break intergenerational poverty
Campesinos	Peasant communities
Casa bonita	Pretty house
Cerro	Hill
Chicheria	An informal and often illegal bar that is built inside of houses
Derechos reales	Legal land title
Hacendado	Single landowners that ruled under the 'hacienda' land system
Manzana	Block (of houses)
Medias aguas	Houses based on rural vernacular architecture and which are predominantly made of adobe
Minuta de compraventa	Proof that the house has been bought
Renta Dignidad	Universal Bolivian benefit for all people aged 60 years and older