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Taking an organisational approach to private sector adaptation – the case of Tata Teleservices in India

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Abstract

A growing paradigm of 'engaging the private sector' is noticeable in all areas of climate risk management and adaptation. However, there is limited empirical investigation into what action companies are taking and what impact this may have on their own resilience as well as on others', particularly in emerging economies and low-income countries. A case study investigation of a large telecommunications company in India aims to address this knowledge gap by offering new insights that further our understanding of the decision-making dynamics of adaptation within this particular business context. Findings show that while awareness of climate change is high, adaptation is primarily reactive and is not systematically undertaken for future climate risks, especially of large magnitude. Results also suggest that a focus on mitigation may hinder business understanding of adaptation. However, there is potential for synergistic solutions combining adaptation and mitigation in the context of energy, both at the firm and government level.

Key words: adaptation, business, India, organisation, organisational adaptation, private sector adaptation, resilience, telecommunications, adaptation-mitigation synergy

1. Introduction

A growing paradigm of 'engaging the private sector' is noticeable in all areas of climate risk management1 – ranging from official United Nations Framework Convention on Climate Change (UNFCCC) documents to national government responses and expert commentaries. Particularly in the face of constrained public budgets and rising adaptation costs policy makers internationally, nationally as well as locally appear to be increasingly interested in the contribution of the private sector to societal resilience through the provision of incentives and services, as well as investment in climate change adaptation. (Surminski 2013) This discourse is based on the recognition that climate change can pose risk and opportunities for companies (PwC 2010), reflecting on possible impacts on operations, supply chain and as well as the regulatory environment. While adaptation is often seen as being driven 'top-down' by government (Tompkins et al. 2010), one can argue that due to limited government resources and the localised nature of adaptation, actual adaptation action is being undertaken to a large extent by private actors, including businesses (Berkhout et al. 2006, Agrawala & Fankhauser 2008, Mendelsohn 2000, Nordhaus 1990).

Although interest in the role of the private sector in adaptation seems to be growing on all sides (e.g. UN Global Compact 2011; PwC 2010; Withey et al., 2009), there is limited empirical investigation into what action companies are taking and what impact this may have on their own resilience as well as on others'. The little we know is based on surveys, case studies and business reports, which are heavily focused on companies domiciled in developed countries, with certain sectors, such as insurance and water, dominating the evidence base (see CDP 2012b, PwC 2010, UNFCCC 2013). In contrast, we have very limited insights to private sector action in emerging economies or low-income countries. This is despite the fact that the need for adaptation action and investment is expected to be much higher in those countries, due to climatic exposures and higher degree of vulnerability (Adger et al. 2007, Akbar et al. 2014), while at the same time the private sector is playing an increasingly key

1 Climate risk management refers to adaptation, the reduction of vulnerability to climate variability and change, rather than mitigation, the reduction of greenhouse gas emissions that cause climate change.

role in the development and growth pathways of these countries. For example, between 2007 and 2012, the private sector invested $225 billion, approximately 12 per cent of GDP, in India's infrastructure (Xu 2014). Thus the private sector is in a position to influence adaptation and resilience through its own actions (Biagini & Miller, 2013).

Our investigation of a large telecommunications company in India aims to address this knowledge gap by offering new insights that further our understanding of private sector adaptation. Rather than a sector-wide analysis, this is an in-depth case study of one particular company, Tata Teleservices (TTL). Using semi-structured interviews, we seek to obtain a greater understanding of the decision-making dynamics of adaptation within this particular business context. Our study asks two questions: 1) what adaptation action is the company undertaking with respect to current and future climate risks? and 2) what factors constrain and enable this activity?

While there are a range of theoretical frameworks through which researchers are looking at private sector adaptation (see section 2), our investigation adopts an organisational approach, widely applied to adaptation case studies, which considers adaptation as the result of adjustments to organisations' routines based on perceptions and shaped by internal and external forces (Berkhout 2012). By applying this approach to TTL in India, we investigate the wider understanding of adaptation within this company, and explore the driving forces as well as constraints for adaptation action. We then discuss the results of the study, as well as the limitations of the approach, before concluding with a reflection on possible policy implications and suggested steps for further investigation.

2. Theoretical approaches to private sector adaptation

To further our understanding of private sector adaptation several methods and approaches are on offer. The analysis and interpretation of the evidence can be traced back to either business management, economics, governance or organisational theory – with overlapping boundaries.

From a management angle, strategic and operational aspects of climate adaptation are of interest, exploring climate adaptation as a risk and opportunity for companies. This approach looks at the 'business case' for adaptation (see IEMA 2013). The benefits for the private sector are framed in two broad categories, closely following the IPCC definition of adaptation: mitigating risk and taking advantage of opportunity (Agrawala et al. 2011, GEF 2012, PwC 2010, UN Global Compact 2011). This is based on the hypothesis that adaptation may not only be necessary for business to protect its operations, assets, employees and supply chains, but also can become a source of "competitive differentiation" (CDP 2012b, p. 6). The decision to undertake adaptation action is considered as part of an overall strategic assessment, based on internal weighing or risks and opportunities. There are a range of assessments and studies being undertaken to further explore the risks and opportunities for various sectors (see for example BSR's Industry Series) and emerging work on identifying a range of specific adaptation investment opportunities for the private sector (IFC & EBRD 2013), but the latter is at a very early stage.

A purely economic perspective sees adaptation as a rational self-interested response to climate change or variability. Upon examining the benefits and costs of adapting, private actors will undertake adaptation when it is in their self-interest, that is, when the private benefits outweigh the private costs. As a result, the efficient level of adaptation occurs automatically (Mendelsohn 2000). Within this approach, most adaptation is seen as reactive (idem), after the effects of climate change have been experienced. There is growing recognition that the theory of rational choice alone does not explain private sector adaptation decisions as empirical evidence suggests that although a majority of companies are aware of the risks of climate change, few actually assess these risks or implement adaptation options (Agrawala et al. 2011, UN

Global Compact 2011). In response to this, some of the economic literature recognizes that adaptation is subject to a wider set of social and environmental influences (see Agrawala & Fankhauser 2008). The economic approach explains barriers to adaptation primarily through market failures. Externalities, information asymmetries, and public goods problems hinder efficient adaptation (Mendelsohn 2000, Stern 2007). In these cases, government intervention is justified to enable actors to make timely, informed, and efficient adaptation decisions (Mendelsohn 2000, Agrawala & Fankhauser 2008).

A more normative perspective considers private sector adaptation in a governance context, investigating the role of private companies in the overall quest to increase society's resilience (Berkhout 2012, Biagini & Miller 2013, Weinhofer & Busch 2012). Climate change policy discussions have increasingly focused on the key role of the private sector in the governance of adaptation. The discourse calls upon the private sector's expertise, technology, finance, efficiency, and entrepreneurship to help both business and society adapt (Biagini & Miller 2013, PwC 2010, Terpstra & Ofstedahl 2013). Some of the literature also illustrates potential synergies between corporate adaptation and developing country communities in which they operate, showing win-win opportunities where business interests align with those of the poor (WRI 2009). This involves providing services that help vulnerable communities cope with climate change; for example, mining company China Minmetals Co. has developed a technology to treat and recycle wastewater, which decreases the use of new freshwater and provides clean water to the surrounding community (UN Global Compact 2011). Despite the prescriptive stance of current policy discourse, involvement of companies in adaptation is only beginning to receive academic attention and analysis in the wider debate of environmental governance. Fisher and Surminski (2012) have made a recent contribution, analysing private governance of adaptation as "the management of climate risks through an entirely private and voluntary enterprise" (17). Using the example of agricultural insurance in India, they argue that while there might be potential for companies to engage in adaptation for strategic reasons including supply chain security, corporate social responsibility, or the desire to build expertise in new markets, a key barrier is commercial viability. This means there is still a role for government alongside the private sector. Indeed, the role of public-private partnerships in adaptation is beginning to be explored

(Fankhauser & Soare 2013, Tompkins & Eakin 2012) but is beyond the scope of this paper. Also within a governance context, Biagini and Miller (2013) identify several examples of private sector engagement in adaptation in developing countries, supported by international development organisations' climate funds. In analysing the barriers and opportunities for private sector engagement, the authors argue that in order for companies to undertake adaptation initiatives that build resilience in their countries of operation, further public policy incentives are needed.

Taking into account the conclusions, but also the limitations of the management, economic and governance approaches, a more holistic account of the internal and external factors influencing adaptation has emerged, based on behavioural economics and institutional theories, focusing on the 'organisational' dimension of adaptation (Berkhout 2012). The organisational approach takes the perspective of the organisation (primarily business) (Berkhout et al. 2006). It considers adaptation as the result of adjustments to organisations' existing routines, based on perceptions and shaped by internal and external forces, rather than rational optimising behaviour. Thus the adaptive response of a firm is determined by the "perceptions and capabilities of the organisation, with the strategy chosen depending less on an objective assessment of costs and benefits, and more on a messy process of sensemaking, learning, and organisational adjustment" (Berkhout 2012). Furthermore, the organisational approach views climate change as one of many stimuli that drives action within an organisation (Berkhout et al. 2006), supporting the idea that that adaptation rarely takes place as a response to climate change alone (Kandiklar & Risbey 2000, Smit & Wandel 2006). Within a business context, climate change may compete with other strategic considerations such as new technology, new competitors, and changing consumer expectations and regulations (Berkhout et al. 2006, Hertin et al. 2003).

Existing case study literature has supported these theoretical considerations and has advanced our understanding of the dynamics of adaptation. Examples of sectoral assessment are found in construction (Hertin et al. 2003), water (Arnell & Delaney 2006), winter tourism (Hoffmann et al. 2009), electric utilities (Weinhofer & Busch, 2012), and food production (Beermann 2011), among others. Despite the significant differences across those sectors, the case study literature tends to agree on the general process of adaptation, which includes three main elements: perception of risk, evaluation, and enactment (Agrawala et al. 2011, Arnell & Delaney 2006, Berkhout

2012, Kandiklar & Risbey 2000, Weinhofer & Busch 2012). The literature also points towards four main determinants of private sector adaptation:

- Perception of risk;
- Uncertainty, which can function either as an encouragement or a constraint for adaptation action;
- External forces such as market, technology and regulatory pressures and;
- Internal firm characteristics, including organisational culture (Berkhout et al. 2006), external relationships (Arnell & Delaney 2006), access to information and financial resources, as well as leadership (Berkhout 2012).

These four determinants of private sector adaptation provide the main pillars of our investigation of Tata, but this does not come without challenges and limitations.

The various factors that influence adaptation are often interrelated, making them difficult to isolate or measure. Because of the underlying assumption that climate change is just one factor affecting decisions, it can be analytically challenging to attribute an adaptive decision to climate change. The organisational approach assumes that adaptation is planned, whereas it is often more aptly described as being ad hoc (Gasbarro 2012) or driven by reaction to surprise (Haigh & Griffiths 2012). Still others argue that the organisational approach is limited because it focuses on gradual adjustments (Linnenluecke & Griffiths 2010) based on prior experience of climate impacts and the assumption that future environmental states will be stable, allowing the organisation to adapt its routines (Winn et al. 2011). This may not always be the case, especially for extreme weather events. Terminology is also a concern – companies may not label their actions as adaptation, but consider them in a more short-term perspective as part of risk management, health and safety or operational resilience (Agrawala et al. 2011; Pauw and Pegels 2013).

3. Case Study of Tata Teleservices: background and methodology

The telecommunications sector has a multi-dimensional relationship to climate change. First, through its network operations, particularly energy consumption, the sector contributes to greenhouse gas (GHG) emissions that cause climate change, though its emissions are relatively small when compared with other industries. Global

telecommunications systems are estimated to account for about 0.7% of global carbon emissions (Kelly & Adolph 2008). However, due to the proliferation of telecommunications devices, as well as the need for more processing power for the growing transmission capacity of new generation technologies, emissions are predicted to increase more than twofold (idem). Second, the telecommunications sector is vulnerable to impacts of higher temperatures, increased flooding and severe weather events that are likely to increase with climate change. Higher temperatures may lead to increased energy demand and thus higher expenditure, while extreme weather events may damage network infrastructure and equipment, posing a risk of service disruption (Wong & Schuchard 2011). Third, telecommunications can assist other sectors and society in mitigation by reducing the need for travel, as well as in adaptation, by monitoring and communicating climatic changes and providing information during crises (Kelly & Adolph 2008). Therefore, the telecommunications sector merits attention not only to adapt its own operations to climate change, but also to facilitate adaptation for society.

To date, little has been written about adaptation and the telecommunications industry, and the limited discourse has been prescriptive. Agrawala & Fankhauser (2008) suggest that telecommunications will play a key role in monitoring hazards and communicating risk. Others suggest that there is potential for harnessing opportunity within current mobile phone markets, especially in developing countries, for real-time communication of extreme weather events that may increase with climate change (GEF 2012). The grey literature makes some mention of company initiatives that could be labelled both as corporate social responsibility (CSR) and adaptation. For example, Nokia has developed a mobile phone application providing information to farmers in developing countries about weather conditions and market prices (UN Global Compact 2011). While some focus has been given to the potential for new telecommunications products, climate risk to network service provision remains underexplored. Ofcom, the British telecommunications regulator, has conducted an assessment of the impact of climate change on its functions and outlined its own adaptation strategy, but has not examined the sector as a whole (Ofcom 2010). Perhaps one of the reasons telecommunications has not been analysed is the perception that the sector is less affected by climate change as other more obviously

climate-sensitive sectors such as winter tourism, water, and construction (CDP 2012b).

3.1. Telecommunications in India

Telecommunications has been one of the main drivers of socioeconomic development in India. India has the second largest and the fastest growing mobile phone market in the world, with the lowest tariffs, which has enabled mobile connectivity for much of the poorer population (Deloitte India 2014). India has approximately 900 million mobile phone subscribers, but teledensity (telecommunications penetration as a percentage of population) is less than 40% in rural areas, compared to roughly 140% in urban areas (TRAI 2012). Rural areas represent a huge potential market, which, combined with privatisation and deregulation of the industry, has attracted a large number of operators, including foreign companies.

While there is a huge untapped rural market in India, telecommunications penetration has been constrained by unavailable and unreliable grid power. On average, grid power is unavailable for ten hours per day in rural areas, and two to four hours per day in urban areas (GSMA 2012). As a result of the lack of availability and reliability of grid power, telecommunications operators rely on diesel generators for back up. Diesel costs up to three times more per unit of grid electricity and, while subsidised, it is becoming more expensive (idem). The projected growth of the industry along with continued diesel use will lead to higher operating costs, a heavy financial burden on the government, and increased GHG emissions.

The Department of Telecommunications (DoT), part of the Ministry of Communications and Information Technology, is responsible for policy and regulation in the telecommunications industry. Initially DoT was the government-run provider of all telecommunications services in the country, but in the 1990s the government opened up the industry to private investment. Privatisation brought the need for independent regulation, and in 1997 the Telecommunications Regulatory Authority of India (TRAI) was set up. The regulatory framework of the industry has encouraged a high level of competition. There are currently 15 telecommunications companies in India, compared to the norm of four or five major players in most other countries. This has resulted in low tariffs but also low margins. Furthermore, the

industry is highly regulated; under license, telecommunications operators are required to maintain continuous, uninterrupted service 99.95% of the time.

Due to the high level of energy consumption, especially from diesel, there is strong regulatory pressure for climate change mitigation in the telecommunications sector. In January 2012, the DoT accepted TRAI's recommendations for "Green Telecommunications," aimed at reducing telecommunications emissions using a combination of policy instruments including mandatory emission reduction targets, renewable energy technology quotas, and bi-annual carbon footprint reporting. Aside from TRAI, NGOs are putting pressure on operators to reduce their emissions (see Greenpeace 2012). In response to this pressure, as well as their own need to reduce costs, telecommunications operators have been implementing renewable energy pilot projects as well as energy efficiency measures such as tower sharing, removal of air-conditioning units and better network planning. However, further deployment of renewable energy is constrained by high up-front capital costs; operators have recently approached the DoT for financial assistance.

3.2. Tata Teleservices

Incorporated in 1996, TTL is ranked fifth among Indian telecommunications operators in terms of its number of active subscribers, around 64 million. The company provides integrated telecommunications services using both Global System for Mobile Communications (GSM) and Code-Division Multiple Access (CDMA) technologies. In 2008 it entered a strategic partnership with Japanese telecommunications company NTT DOCOMO, which owns a 26% stake in the company. TTL is a privately held subsidiary of Tata Group, one of the largest conglomerates in India with over 100 companies and 450,000 employees. Tata Group is held by a trust and is known for its corporate social responsibility and commitment to the communities within which it operates. Based on these values, TTL was the first telecommunications operator in India to introduce the per-second tariff option, replacing the previous minimum one-minute tariff, making phone calls more affordable. Climate change is also part of the Tata Group code of conduct and the Tata Business Excellence Model (TBEM), frameworks adopted by all subsidiaries. It is also part of the focus of the recently established Tata Sustainability Group, which guides all Tata companies in embedding sustainability in their business strategies. While some Tata companies have established themselves as leaders on climate change

(CDP 2012a), TTL has only recently embarked upon a formal sustainability program, primarily focusing on energy, waste, and electromagnetic field safety.

3.3. Adaptation in India

India's First and Second National Communications to the UNFCCC recognize the country's vulnerability and the need to plan for adaptation (MOEF 2004, MOEF 2012). In 2008, India introduced its National Action Plan for Climate Change (NAPCC), which outlines current and future policies and programmes for mitigation and adaptation, while maintaining the country's economic growth. The NAPCC is operationalised through eight missions, which represent an integration of climate change considerations into various government policies, by specific ministries. Given countrywide concerns about energy access and security, the NAPCC's focus is primarily on mitigation: energy efficiency and renewable energy, particularly through the highly publicised National Solar Mission. The NAPCC has been criticised for not adequately supporting and budgeting for adaptation activities (Ganguly & Ranjan Panda 2010). However, State National Action Plans for Climate Change (SAPCCs), intended to ensure implementation of the NAPCC at state level, are meant to elaborate on adaptation measures (Nachmany et al. 2014). To date, nine states have had their SAPCCs endorsed by the central government. International development organisations are providing assistance in the development of SAPCCs (ie. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), UK Department for International Development (DFID) and United Nations Development Programme (UNDP)) and many non-governmental organisations run adaptation programmes, particularly related to water and agriculture.

The private sector does not yet have a formal role in adaptation policy in India. The National Advisory Panel on climate change, which produced the NAPCC, is made up of a wide range of members, including industry. However, there is little mention of the private sector in India's climate change policy in relation to adaptation. The National Mission on Strategic Knowledge for Climate Change is meant to encourage private sector initiatives for developing new technologies for adaptation and mitigation, but it is unclear how this is to be done.

3.4. Methodology

Building upon the qualitative approach of previous similar studies, using in-depth interviews (Arnell & Delaney 2006, Berkhout et al. 2006, Hertin et al. 2003, Weinhofer & Busch 2012) this study seeks to obtain further insight into the processes, barriers and drivers of adaptation at the firm level. A qualitative approach can help "make sense of new phenomena when very little information exists" (McKeown 2004). Through semi-structured interviews with key decision-makers in one Indian telecommunications company, we seek 1) to determine what adaptation activity is actually occurring and 2) what factors constrain and enable this activity.

This analysis employs an exploratory case study method. Adaptation is highly localised and context-dependent, which poses an analytical challenge (Berkhout 2012). A case study method of analysis can help to overcome this challenge. Case studies are useful for conducting exploratory research, focusing on "understanding the dynamics present within single settings" (Eisenhardt 1989), and answering the "how" and "why" questions (Yin 2003), which clearly need further examination in the adaptation literature. Although findings will be restricted to one company within the industry, the selection of a particular case can maximise insights within a limited time frame, with subjects that are easily available and willing (Stake 1995).

Several data collection methods were used at each stage of the research process. In the first stage, a review of responses to the 2011 Carbon Disclosure Project (CDP) questionnaire by the telecommunications industry was conducted to determine possible climate risks for the telecommunications industry, which would then inform the interviews. Next, secondary data was collected about the organisational structure at TTL, in order to understand who would have a view to the risks facing the company. In the third stage, data was collected using in-depth, semi-structured interviews. As interviewing allows investigation into *perception* of climate risk, an important component of our chosen conceptual model, it was deemed an appropriate method.

In-depth interviews were conducted between July and August 2013, during which time the researcher worked in TTL's Navi Mumbai office. Interview subjects were selected from those in senior positions, with a high-level view of risks facing the

company, and across all functions, to capture where adaptation might sit within the organisation. Over the course of two months, eight formal in-depth interviews were conducted. The researcher also participated in sustainability-themed meetings and held informal conversations with staff from various business functions, including sustainability, technology, sales, legal and accounting, which provided further insight and helped highlight business priorities and attitudes toward climate change. Being present in the office for this time gave the researcher a better understanding of the industry and context within which the participants worked, as well as the opportunity to develop trust with participants, which facilitated the interview process.

4. Results and discussion

The findings of our case study suggest that there is a gap between the company's awareness of climate change and its adaptation activity, in line with much of the literature. Similarly to previous studies (see Agrawala et al. 2011, Arnell & Delaney 2006), climatic and non-climatic drivers and barriers highlight the difficulty in attributing a corporate activity to climate change. This difficulty in attribution is exacerbated in the Indian telecom environment, where the focus on mitigation, driven by India's power deficiency, constrains awareness of adaptation. Finally, the study highlights a limitation of the organisational framework in explaining the process of adaptation, which at TTL is more ad hoc than planned. As a result, the approach is useful to conceptualise adaptation to observed climate impacts, but cannot adequately explain how organisations might adapt to future climate risks, especially those of high magnitude.

4.1. Overview of findings

In terms of the first research question, what adaptation activity is actually occurring at TTL, main findings of the interviews are summarised in Table 1 below, according to the organisational framework of adaptation: perception, evaluation and enactment. Perceived impacts are elaborated in Table 2.

Table 1: Adaptation process at TTL

Organisational adaptation process →		
Perception	**Evaluation**	**Enactment**
• High level of awareness of climate change among senior managers. • Repeated reference to June 2013 Uttarakhand disaster and sense of India's unpreparedness. • More reference to climate-related risks than opportunities. • Increased temperatures, changes in precipitation and isolated extreme events (continuous changes in climate means) are observed and anticipated. • Climate impacts of high magnitude such as the Uttarakhand event (low probability but high impact) are not perceived as an urgent concern. But there is a sense that TTL would be unprepared to deal with them. • Climate change is happening slowly enough to be managed; extreme weather events are not an urgent concern because they are not happening much in India (T2), have not significantly impacted the business (F1), or only occur in specific parts of the country (T1). • Respondents in the technology function had more awareness of climate impacts than those in regulatory and sustainability functions. • Participants were unfamiliar with the word "adaptation," and actions intended to manage climate impacts were not labelled as such.	• Informal, ad hoc risk assessment process is employed, in response to physically observed climatic impacts, as and when they affect the network. • The gradual nature of climate change and the uncertainty of future affect the evaluation of climate risks. Business decision-making time frames are maximum 5 years. Climate change impacts are perceived to be too far off in the future to merit serious evaluation. • Highlighting the reactive nature of adaptation: "[people] don't take something very seriously until something seriously happens so that's why probably we haven't yet provided that to our processes" (T4).	• Primarily reactive adaptation measures are implemented. For example, unexpected heavy rain in Rajasthan several years ago prompted the raising of base transreceiver station (BTS) platforms in that area to avoid flood impact (T1). • There was little mention of incorporating climate change into business continuity and disaster recovery planning. • Anticipatory adaptation measures are implemented for events anticipated with a high level of certainty. For example, for regular climatic events like the monsoon, active measures are taken in the months leading up to the rainy season to prevent damage to the network (T3). • Most adaptation measures implemented are technical – involving investment in readily available options such as the installation of air purifiers, changing tower locations and enhancing existing technology to withstand greater heat.

4.1.1. Perception

All interviewees demonstrated a high level of awareness of climate variability and change, citing noticeable changes over the last few years, including temperature rise, increased rains and flooding, and extended winters in some parts of the country, both through direct observation and the media. All respondents independently made reference to the June 2013 Uttarakhand disaster, where abnormal rainfall caused landslides and flooding, burying villages, washing away homes and roads, resulting in in 6,000 missing people (Reuters India 2013). Respondents highlighted the extreme magnitude of the event and the country's failure to properly anticipate it. They spoke of predominantly negative perceived climate impacts and risks to the business, both direct and indirect, with fewer opportunities (Table 2).

Table 2: Perceived climate impacts observed at TTL using a framework based on Hertin et al. (2003)

Direct impacts		**Indirect impacts**		
Extreme events	*Gradual change*	*Through market*	*Through regulation*	*Through supply chain*
Equipment failure	Equipment failure due to higher temperature	Opportunity to provide climate information to farmers and fishermen	Mandate to reduce carbon footprint	Delayed delivery of equipment due to roads washed out, planes delayed
Base transreceiver station (BTS) site flooded	Signal fading due to higher temperature	Customers may switch to a more resilient operator if service is disrupted due to climate impact	Mandate to use renewable energy sources	Procured goods may become more expensive
Towers uprooted	Increased power cost due to higher temperatures and increased cooling demands	Opportunity to provide communication services in times of climate disasters		

While awareness of climate change was generally high, concern about impact on the business varied according to the pace and magnitude of climate change. Two types of perceived impacts emerged: the first related to continuous changes in climate means such as increased temperatures, changes in precipitation, and including isolated extreme events, and the second to climate impacts of high magnitude, characterised by low probability but high impact. TTL has observed and anticipates impacts of the first type, but has less knowledge and certainty about the second type.

4.1.2. Evaluation

Evaluation of climate risks depends on a firm's adaptation strategy. Adaptation strategy, as defined by Arnell and Delaney (2006), "defines *what* the organisation is seeking to achieve by adaptation and *how* it intends to achieve it" (229). For TTL, the implicit aim of adaptation that emerged from interviews is to maintain the level of service provision to customers driven both by the regulatory mandate of 99.95% uptime and a highly competitive market. In this context, findings show that TTL follows an informal, ad hoc risk assessment process and a primarily reactive adaptation strategy, implementing technical measures to reduce risk.

4.1.3. Enactment

Accordingly, the adaptation measures identified by respondents tend to be reactive and technical in nature. Adaptation may involve both building adaptive capacity, thus increasing the ability to adapt to changing conditions, or implementing adaptation options, thereby putting adaptive capacity into action (Adger et al., 2005). TTL builds adaptive capacity incrementally by incorporating climate change risk into business continuity planning and disaster recovery programs. However, only two participants mentioned business continuity planning, so it may be that climate change is not yet well integrated into these processes. Adaptation measures at TTL are normally implemented when a climate impact has been experienced or is anticipated with a high level of certainty.

4.1.4. Adaptation drivers and barriers

Awareness of climate change is high among senior managers at TTL, though concern about business impact varies, according to business function and type of risk. It was found that rigorous risk assessment is generally not carried out. Interviews uncovered a number of factors that enable and constrain adaptation, and help explain this gap. These factors can be grouped into two broad themes: non-climate and climate factors, shown in Table 3 below. Non-climate factors are further grouped into external and internal factors. External factors include regulation, technological pressure, and market forces; internal factors include financial resources and CSR. Climate factors include uncertainty and a focus on mitigation.

Table 3: Adaptation drivers and barriers at TTL

Adaptation drivers and barriers				
			Drivers	*Barriers*
Climate factors		Uncertainty		-Too much uncertainty in future climate impacts to justify proactive measures -Lack of confidence in government's ability to provide accurate climate information/predictions
		Mitigation focus	-TTL's energy efficiency and renewable energy initiatives, aimed at reducing emissions, also constitute adaptation, ie. heat-resilient equipment increases resilience to rising temperatures, and reduces energy consumption (and emissions) from air conditioning	-Primary association with climate change is mitigation, possibly constraining awareness and action on adaptation
Non-climate factors	External	Regulation	-DoT's licensing regulation for 99.5% uptime – encourages adaptation to reduce service disruption	-Green Telecommunications directive's mandate that operators reduce and report carbon footprints, representing the government's mitigation focus
		Technological pressure		-Dependence on long-lasting infrastructure, which is inflexible and costly to adapt
		Market forces	-Competitive pressure incentivises adaptation in order to retain customers -Untapped rural poor markets; climate change creates opportunity to serve needs through telecommunications technology, for example: Tata's pilot project to provide weather and market information to fishermen through mobile phone technology	-Competitive pressure in Indian telecommunications industry has constrained profit margins and resources available for adaptation
	Internal	Financial resources		-Substantial investment required for adaptation actions -Financial trade-off with other priorities ie. social/economic needs of communities
		CSR	-Managing climate change relates to Tata Group's commitment to serving the needs of the community	-Primary focus of CSR is on reducing emissions

4.1.4.1. Regulation

Government regulation emerged as a key influence on climate change awareness and action, albeit an indirect driver of adaptation. On one hand, the DoT's mandate that all operators maintain 99.95% network uptime encourages adaptation to adverse and changing climatic conditions to avoid disrupting customer service (T1). Conversely, the Green Telecommunications directive's mandate that operators reduce and report their carbon footprints represents the government's focus on mitigation. For example, one respondent commented that "in terms of protecting the business from the environment, that is not there. Rather protecting the environment from the business is the actual strand" (S1). Therefore climate-specific regulation does not explicitly encourage adaptation, though licensing regulation does.

4.1.4.2. Market forces

Market forces emerged as another factor, with two subthemes: competitive pressure and untapped markets. First, because the industry is highly competitive, the customer can easily switch operators if he does not perceive his current operator as providing reliable service (T4). This represents an incentive to adapt to changing climatic conditions to avoid service disruption. On the other hand, heavy competition has driven down tariffs to the point where revenue and profit margins are low, constraining the resources available for adaptation measures. Secondly, the large poor and rural population of India represents market potential for telecommunications operators in general (T2, T3, T4, F1) and climate change may create further opportunity to serve their needs. One participant described a new pilot project that provides weather and market information to fishermen through mobile phone technology (T3). He expressed that this initiative is driven by climate change, corporate responsibility and a revenue generation opportunity.

4.1.4.3. Technological change

Technological change emerged as an important factor shaping adaptation, primarily as a barrier. As one respondent noted, because the telecommunications industry depends on long-lasting infrastructure, the rapid pace of technological evolution can make it costly to "keep the network covered in such a way that we are flexible enough to adopt those changes on the way" (T3). Climate change is seen as compounding this already existing pressure on the business. Indeed, most of the infrastructure was built

over a period of time when awareness of climate change was not very high (F1). Adaptation could be hindered by the incremental pace of technological change at TTL, based on the significant cost required to shift its legacy technology (T3).

4.1.4.4. Financial resources

Almost all respondents mentioned the substantial investment of financial resources required to manage the impacts of climate change. Interviewees mentioned instances when TTL had made investments in managing predictable climate risk, like the monsoon (T3) or when there is a revenue or CSR opportunity, for example in the pilot project for fishermen (T2, T3, F1). However, for high magnitude climate events of low probability, the cost is perceived as too great to implement anticipatory adaptation actions: "Now we are not anticipating these situations to happen and trying to take some action.... Because…you know that, cost, it is all capital. So we have to see what is the gain of investing and return on investment has to be there" (T1). Another respondent emphasised that any activity related to climate change represents a financial trade-off with activities that may be perceived as more urgent, for example social and economic needs of the community (F1).

4.1.4.5. CSR

All respondents made reference to Tata Group's sense of responsibility to the community within which its companies operate. One respondent noted, "we have a responsibility and we have a mandate and we have an opportunity to be part of the climate change area so I strongly believe that we have a role as a business in managing climate change in the days to come" (T4). This CSR discourse emerged primarily in the context of mitigation, reducing emissions as a social responsibility. However, CSR was also linked to adaptation in comments about telecommunications' ability to connect people in times of climate disaster, which presented both an opportunity and a responsibility for the company (T1, T4).

4.1.4.6. Uncertainty

Uncertainty emerged as a climate-related constraint to adaptation. As mentioned with respect to financial resources, TTL implements measures to manage observed climate impacts, but does not invest in proactive measures to anticipate more uncertain climate events. Compounding this uncertainty is the perception that neither telecommunications operators nor the government possess the expertise to properly assess and attribute variability to climate change. There is also a lack of confidence in

the government's ability to provide accurate climate information and predict changes. As one participant observed, any initiative to capitalise on the opportunity to use mobile phone technology to disseminate climatic conditions would strongly depend on the government's ability to provide accurate information in the first place:

> "…given the current infrastructure and the accuracy and the systems that we have in place for forecasting the weather [laughs], and correctly in the current situation itself, has a long way to go. You have so much of a huge disaster recently in Uttarakhand and it's of such a huge magnitude. It's not a slight variation compared to the normal, but even that kind of huge variation we were not able to predict. Our…forecasting systems were not able to capture such…a magnitude of the weather that's going to come down on us and we could have saved at least some lives." (T4)

4.1.4.7. Mitigation focus

As previously mentioned, respondents tend to associate climate change with mitigation rather than adaptation. According to most, the main climate risk facing the company is related to energy and the country's power deficiency. As temperatures increase, cooling demands increase, as does energy demand and thus operating cost. Increased energy demand leads to higher fuel consumption, which makes it difficult for the firm to reduce carbon emissions especially in the face of unreliable grid power and operators' dependence on diesel. While participants' association of the topic of climate change with mitigation and CSR discourse made it difficult to direct the focus toward adaptation during interviews, it became apparent that there was a connection between the two strategies, consistent with Smit et al.'s (2000) suggestion that "some adaptations may have implications for mitigation, such as those that relate to energy use" (245). The energy efficiency and renewable energy options that the firm is exploring to reduce emissions also constitute adaptation. For example, one respondent mentioned an initiative to upgrade to more heat-resilient equipment that could be kept outside rather than inside an air-conditioned shelter (F1). While making the network more resilient in the face of rising temperatures, it also reduced energy consumption from air conditioning and thus carbon emissions. The respondent also mentioned the financial benefit of the initiative, illustrating the multiple drivers of adaptation responses.

4.1.5. Discussion

One of the aims of this study was to conduct an exploratory investigation of private sector adaptation within the telecommunications environment in India. What are the implications of these findings for the governance of adaptation, in terms of public policy and business engagement? Furthermore, what are the implications for the emergent theoretical approaches to private sector adaptation?

4.1.5.1. Building societal resilience

The results of this case study support the view that business, as an important part of society, will have a role to play in successful overall societal adaptation (Berkhout 2012, Weinhofer & Busch 2012). This was strongly underpinned by all participants' reference to Tata Group's CSR values in helping communities cope with the impacts of climate change. From this one might infer that a strong culture of corporate responsibility might encourage business leadership in climate change adaptation as outlined in the grey literature. However, as seen at TTL, this cultural driver conflicts with a substantial financial barrier. While social and environmental responsibilities were clearly emphasised by all participants, they were usually in combination with business opportunity. This supports Fisher & Surminski's (2012) finding that commercial viability is an important factor for greater engagement of the private sector in adaptation. Where commercial viability is lacking, there is a role for government. Furthermore, managers do not feel the company is prepared for future climatic impacts of great magnitude, like the Uttarakhand disaster, yet there is a low sense of urgency with regard to addressing these types of impacts, seen as too uncertain. Managers at TTL expressed the view that ultimately, government must drive adaptation for societal good, noting its responsibility to improve forecasting systems (T4), conduct research on climate change impacts and probabilities (T4) and raise awareness (F1). This corresponds to Stern's (2007) argument that the government is responsible for providing public goods that constitute adaptation. In particular, provision of climate information in the form of better forecasting was viewed by TTL as crucial for the business to be able to make adaptation-related decisions. At this point in time, this case study suggests that private governance of adaptation for greater societal resilience may not be as feasible as some suggest.

4.1.5.2. Dominance of mitigation

A further point relates to the dominance of mitigation within international and Indian policy discourse. This is reflected in corporate adaptation strategy at TTL, and sheds light on the adaptation deficit as reported in the existing literature. It has been suggested that this deficit exists because less adaptation is reported than is actually occurring (Berrang-Ford et al. 2011), which holds true at TTL. Consistent with the literature, findings show that a multitude of factors influence adaptation, making it difficult to attribute any one initiative to climate change (Berkhout 2012, Smit et al. 2000). This illustrates the difficulty in defining an initiative as adaptation, and therefore in communicating it. For example, the multiple drivers behind TTL's energy efficiency initiatives, including cost saving, carbon footprint reduction, and energy security, make it difficult to attribute decisions to climate change or label them "adaptation". Furthermore, Agrawala et al. (2011) suggest that adaptation may not be reported by a company to the same extent as mitigation, because it does not easily fit into CSR narratives. For TTL and the wider Tata Group, such CSR narratives are deeply embedded, reflected in the fact that every participant referred to the company's strong sense of corporate citizenship. In the context of climate change, participants often steered the conversation toward TTL's commitment to reducing environmental impact as part of its responsibility to society, highlighting the efforts of the newly created sustainability working group. To this extent, the focus on mitigation may be seen as constraining an understanding of adaptation by TTL.

4.1.5.3. Potential drivers of adaptation

One of the main drivers at TTL for climate change activities are Tata Group's values, reflected in the code of conduct and business excellence model that is disseminated to all Tata companies. As suggested by Arnell & Delaney (2006), decisions made by the holding company may affect individual companies' ability to adapt. At the moment, the climate change focus of Tata Group is mitigation, bound up in the discourse of reducing emissions as an environmental and social responsibility. Increasing awareness of adaptation may thus be effectively initiated by the holding company, Tata Group. Another important driver of climate change activity is regulation, which is currently heavily focused on mitigation, as evidenced by the recent Green Telecommunications directive. A look at climate change policy from a broader

national perspective, in the NAPCC, also shows a focus on mitigation. Current policy and regulation may act as a barrier to adaptation if the focus remains primarily on mitigation. SAPCCs devote more attention to adaptation, and rightly so, given its context-specific nature. In the design of future SAPCCs, it may be effective to promote adaptation-mitigation synergies and to consider formally assigning a role to the private sector.

4.1.5.4. Organisational framework

The organisational framework, while useful to explain adaptation to observed climatic variability, falls short of being able to explain response to future climate risks, especially events of high magnitude. The approach is useful to analyse the process of adaptation in various conceptual stages, but it may not accurately reflect the decision-making process, which consists more of a set of ad hoc and reactive measures rather than a planned learning process (Gasbarro 2012, Smit et al., 2000). Results correspond to Berrang-Ford et al. (2011)'s finding that climate variability and isolated extreme events play a greater role in stimulating adaptation than gradual long-term changes in climatic conditions. However, results counter the same authors' findings that most reported adaptation is proactive in anticipation of future changes, although their results were primarily from developed countries. This points to a potential difference between developed and developing countries' approaches to adaptation.

Furthermore, in explaining firms' management of climate risks, the power of the organisational approach is limited. It is best suited to analysing responses to experienced impacts that allow the firm to return to a previously stable state, which for TTL is providing a minimum level of service uptime. Because the approach is based on past experience and stable routines (Winn et al. 2011), it may not explain response to future climate risks, such as weather events of extreme magnitude, or "ecological discontinuities" beyond the firm's range of experience (Linnenluecke et al. 2010). Recent evidence of extreme weather in Uttarakhand brings to light this type of risk, perceived by participants as of such huge magnitude that the business would not be prepared to deal with it.

While this paper has helped create a more comprehensive picture of how adaptation occurs within a business by broadening the analysis to a previously underexplored

sector in a developing country context, it has also inspired questions for further research. The study was limited to one company, which prevents generalisation. A study of other Indian telecommunications firms would give a broader sector-wide view, and a closer investigation of the sector in other countries would be interesting for comparison, especially where a nation-wide power deficiency does not exist.

5. Conclusion and outlook

The aim of this study was to explore the dynamics of private sector adaptation in a previously under-explored sector, telecommunications. The study's importance relates to its developing country context and its implications for both business and policymakers, in India and globally. First, the study is important because it is one of the first to examine adaptation by a private sector company in a developing country. Some of the biggest climate risks exist in developing countries, as well as potentially the greatest opportunities for delivering adaptation (Surminski 2013), yet not much is known about how companies are adapting. Given India's importance as an emerging economy and its vulnerability to climate change, adaptation is an important consideration for any company wishing to do business in India now and in the future.

This study is also important from a more general business perspective. Companies' adaptation actions both affect and are affected by other stakeholders' actions. A company's resilience to climate change is dependent not only on its own initiatives, but also on the resilience of its clients, suppliers, employees, and supporting infrastructure (Amado et al. 2012, Surminski 2013). Conversely, companies' actions may lead to higher exposure and vulnerability elsewhere. These interactions have not yet been examined in detail, although this case study suggests they are important considerations. For example, the resilience of TTL in terms of its ability to provide uninterrupted service in the face of climatic variability and change contributes to the resilience of its clients during times of natural disasters, or in allowing farmers or fishermen to receive real-time weather updates.

In the specific case of TTL, while awareness of climate change is high, action on adaptation to future climate change is low. If TTL is to increase resilience to future

climate change, awareness of climate risk and adaptation measures must be built across the company, particularly in the sustainability function, which currently has low awareness of physical climate risk. Working alongside members of the technology function, who are more knowledgeable about actual and potential impacts on the network, could help build awareness and capacity. Second, policies that combine mitigation and adaptation will be beneficial. Weinhofer & Busch (2012) suggest a holistic risk management approach that integrates risks arising from physical climate change alongside emission risks arising from market, social, and institutional pressures to reduce GHG emissions. Such an approach might be appropriate at TTL, and other similar companies, especially with respect to energy use. This is evidenced by TTL's exploration of renewable energy technology, which both decreases exposure to risk from higher temperatures and rising fuel costs as well as reduces emissions. Further research is needed to explore the link between mitigation and adaptation in order to inform policies and corporate strategies that incorporate both.

This study also has important implications for policymaking in India and globally. Findings suggest there is potential for private governance of adaptation for greater societal resilience, yet incentives are needed. An understanding of the drivers and barriers of adaptation within companies may help policymakers understand how they can support the adaptation process (Hoffmann et al. 2009), especially where adaptation will benefit society, and where there is an expectation that the private sector will share the cost of adaptation in times of increasingly constrained public resources. In India, telecommunications is a key industry, not only for socioeconomic development, but also to ensure connectivity in times of extreme climatic events, which are projected to increase. As telecommunications is a key service for society, with the potential to greatly reduce emissions from other sectors, policymakers will be interested in efforts to increase the industry's resilience to climate change.

Finally, in more general terms, companies can be delivering agents for public adaptation measures, for example, investing in flood defenses or building resilient homes. Companies can also drive and influence government policy, through lobbying, at the global, national or local level. Due to companies' potential to influence

adaptation policy and implement actions driven by those policies, policymakers have an interest in understanding the dynamics of adaptation within the private sector.

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Appendix 1: Interview Guide

INTRODUCTION

- Introduction of interviewer
- Briefly explain the purpose of the research and interview
    - I am researching the impact of climate change on business. I would like to discuss the risks and opportunities associated with the impacts of climate change, and if/how they form part of the business strategy.
- Explain confidentiality and anonymity
- Ask for permission to record interview

BACKGROUND

- What is your position at TTL?

ADAPTATION PROCESS

PERCEPTION

- Are you aware of changing weather patterns or climate variability? How?
- Has extreme weather ever impacted TTL in the past? Have you had to make any changes to infrastructure or operations because of climate-related concerns?
- Do you anticipate that climate change or extreme weather will have (negative or positive) impacts on TTL in the future? Could you tell me more about these impacts?
- Where do you obtain information on climate change?
- Do you anticipate any opportunities arising from climate change, for example in terms of new products or services?

RISK ASSESSMENT

- How do you evaluate climate risk?
- How great a risk do you think climate change poses to business?
- Who is responsible for evaluating risk?

RISK MANAGEMENT

- If there were an increase in extreme weather events of high magnitude, what adaptation measures would TTL put in place?
- Are there any active plans or strategies in place to manage climate risks or assess current risk losses and/or opportunities due to climate?

DRIVERS/BARRIERS

- What are the factors that enable and constrain TTL's response to climate risks?

TERMINOLOGY

- Where do these activities to manage climate change risks sit within the business?
- Have you heard the term "adaptation" or "mitigation"?

RESPONSIBILITY

- What is the role of government in dealing with climate change risk?
- Do you think business has a role in helping society adapt to climate change?

Citation no.	Position with TTL	Length of service	Date
T1	Vice President, Head of Network Operations	10 years	6 Aug, 2013
T2	Vice President, Head of Network Infrastructure	10 years	8 Aug, 2013
T3	Chief Network Planning & Implementation	15 years	24 July, 2013
T4	Vice President, Contracts and Commercial	10 years	25 July, 2013
S1	Additional Vice President, Business Excellence and Transformation	8 months	26 July, 2013
R1	Additional Vice President, Legal, Secretary, and Regulatory Affairs	8 years	23 July, 2013
F1	Chief Financial Officer	17 years	13 August, 2013

Appendix 2: Interview Participants

All interviews were conducted in TTL's offices in Mumbai, India.

Appendix 3: Sample Interview Transcription

Do you anticipate that there might be impacts from climate change on the business in the future?

It is going to continue because while the intent is good, if the implementation is delayed, we continue to do everything against nature. The Uttarakhand – we have been very irresponsible in managing the environment and we have seen the flooding which has happened with such a large damage.

Did that have an impact on TTL?

It had an impact. More than the business, it had an impact on the overall economy of the country, of the particular state. For us there was an impact but not a significant impact. The size of our operation was small. So we didn't get…temporary

If events like that continued to happen would it impact the business?

It would impact. Nationwide, the population. Anything like this will have impact, seriously. Any climate changes will have impact either more flooding, less monsoon, more monsoon, less summer, more summer.

And how would you be prepared to deal with that?

One is you have business as usual disaster recovery systems which are in place to run the business. Business continuity programs are there. There is enough and more which has been done in ensuring that business does not suffer. So your ability to actually recover your network, recover your systems, get back to operations, is fairly well tested across the country in various areas, whether it is infra, IT, running your operations, it is being tested repeatedly. Most of these have been tested for events which are still not of a scale like if there is a tsunami or if there is a cloudburst like in Uttarakhand. Those I think are still difficult to handle. Anything which happens on a different, smaller scale we can manage. But if anything like a tsunami, if anything like a cloudburst happens, then I think we are not fully geared to handle it. There is still a long way.

And is that something that the business is looking at?

We continue to work to say that even in those situations, how can you improve? That requires investment. So we keep making investments, but it's a continuing journey. These are things which you should anticipate and keep preparing yourself. Which we are continuously doing. There are more and more investments which are happening in these initiatives.

Do these processes take climate change into account?

Yes yes definitely they are taking climate change into consideration and they have been built to handle those situations. Whether we are fully equipped to handle a massive disaster, no. That's still a long way away.

Where does that responsibility for handling climate risks sit?

It is across. There is a very systematic process which is there. This basically comes out of your business continuity study. Risk management study which we do. We engage consultants who bring in knowledge from various places where they have done this. So based on the combined work of the consultants and the people in house. Every year we keep revisiting to see incrementally what is the investment which is required, how prepared are we, how can we improve this further. It is a continuous process and various teams contribute to this. Especially all the people dealing with infrastructure whether it is network, IT, facilities management, all of these guys contribute. And we have our role to play to say what is the money required, can I afford this, what is it in terms of the overall spend? Can I afford the entire thing this year or should I do it over a three year period?

How do you take uncertainty into account in decision making?

I don't think we have a very scientific way, taking it into the business today. While we all, what we do is, incrementally, every year we look at it to say that I have reached a certain level, I need to improve by 5%, 10%, 20%, depending the affordability to continuously work on it. Are we prepared to meet an exigency, which is a worst case. I don't think that today, at this point in time, we don't have a scientific way of evaluating and saying yes I will reach this. Doing incrementally. It is not completely to fill the void between where we are and where we will be. There is some distance to go.

Do you foresee that there might be any opportunities arising from climate change?

There are enough and more opportunities. Everywhere there is a problem there is an opportunity. So even for our business there is an opportunity. So whenever these exigencies happen it actually pushes the customer to become protective about himself and his business and his environment. So one of the critical needs for him is communication. So he invests in communication equipment, connectivity. Businesses for example, they look at these exigencies; they can't be self-sufficient on a single source of connectivity. So they build in redundancies. So that's my opportunity. In any exigency there is also an opportunity for the business, it's part of the game. There are various applications which are being developed to address these things. For example, fishermen they used to go into the sea, but they don't have connectivity. So in case they run into a problem how do they communicate? Today we are running projects with Qualcomm for fishermen, to say that if you get into these locations, you get connectivity up to a certain distance.

What are the main drivers for a project like this with the fishermen?

Driver for us, it's an incremental business opportunity and second is, it's also a way to contribute to society. Because it is not completely self-funding, it's an opportunity for me to establish a brand, opportunity to establish a connectivity. But it may not be

profitable in all the cases. So somewhere we say that even if it doesn't make money today, it doesn't matter, because at least I'm actually able to fill a need in the place. So somewhere we take it as brand-building, somewhere we take it as a social responsibility. Somewhere it is actually a profitable opportunity…it's a combination of all these.