Chapter 15
Climate Change and the Offshoring Decision: Risk Evaluation and Management

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Abstract The problem of climate change is becoming increasingly prevalent in the business context. Risks such as increased risk of extreme weather events and the attendant loss of production site facilities, and changes in population density and migration patterns, may seem remote from the business offshoring decision. However, it is in fact highly relevant, as the recent case of flooding in Thailand and its effects on the global hard drive industry shows. The discussion in this chapter focuses on the risk of climate change for the offshoring decision at the firm level. That is, how does the potential for climate change effects occurring in a given locale influence the offshoring decision? This chapter argues for a risk management approach to climate change at the firm level, in which specific locational risks are assessed as a key component in the offshoring decision. The specific problems of climate change, including the potential for coastal flooding, extreme weather events, and hot or cold waves, do not influence all regions in the same way. Similarly, they also do not influence all firms in the same way. Instead, each firm must determine how climate change could affect its offshoring decisions and to what degree this risk should be controlled. In addition to arguing for the use of risk management for climate change at the firm level, this chapter also provides some tools for assessment and evaluation of climate change risk. These tools include a summary of the risk categories required and a risk exposure/vulnerability matrix that can help assess how significant the risk of climate change is for a given location. The tools within this chapter provide a basic guideline for firms to determine the overall climate change risk levels faced by their outsourcing partners and to make a careful decision based on these perceived risks.

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In late 2011 and early 2012, the issue of climate change suddenly inserted itself into the offshoring debate, in the guise of major flooding in Thailand (Connor 2012). These floods which began with the July tropical storm Nock-Ten and continued through the monsoon season were still persistent as of January 2012. Although it might not seem that this would have a great relevance for Western firms, in fact it did, because the region of Thailand that was worst hit was a center of global computer hard drive production (Connor 2012). The floods proved to be severely disruptive to hard drive production by most suppliers around the world, with some plants closing entirely and others working at reduced capacity (Connor 2012). Ultimately, storage firms including Seagate, EMC, NetApp, Hitachi Data Systems, Dell, and Hewlett Packard were forced to raise prices as the supply of storage units became increasingly constrained (Connor 2012). Unable to meet demand, several of these firms estimated that the price of hard drives would rise 5–15 % over the coming year (Connor 2012). Some of the magnetic drive demand also shifted to solid-state drives (SSDs), whose supply remained strong (Connor 2012). Climate change, once a matter of public policy, had suddenly become a matter of firm-level strategic concern.

Risk analysis is one of the well-established practices in the business decision model, with analysis of financial risk, economic risk, and political risk being common assessment practices in making the offshoring decision. However, there are specific issues associated with the offshoring decision that also need to be evaluated from a risk management perspective, such as the risk of miscommunication due to cultural distance (Berry 2006). This author would like to argue that assessment of climate change risk, rather than being a specialized activity only performed in weather-sensitive industries, should be a part of the firm-level offshoring decision process in all cases. Climate change is a global phenomenon, not a local one, and as such this assessment should be performed for every offshoring decision and not only those that are perceived to be in risky areas. As there are no tools that are currently specifically designed for analysis of climate change risk at the firm level, these tools will need to be developed.

This chapter provides a brief introduction to climate change and then discusses the strategy and ethical responsibility perspectives at the firm level toward assessment of this risk. The chapter then provides a framework for assessment of climate change risk for the offshoring decision, including external risks (physical and demographic risks, political risks, and economic risks) and business-specific risks. Finally, it provides a basic matrix-style assessment tool that could be used to determine the overall climate change risk that a firm faces in a given location.

15.1 Introduction to Climate Change

A simple definition of climate change offered by the American National Snow and Ice Data Centre is as follows:

> All forms of climatic inconstancy (that is, any differences between long-term statistics of the meteorological elements calculated for different periods but relating to the same area)… [Resulting] from such factors as changes in solar activity, long-period changes in the Earth's orbital elements (eccentricity, obliquity of the ecliptic, precession of equinoxes), natural internal processes of the climate system, or anthropogenic forcing (for example, increasing atmospheric concentrations of carbon dioxide and other greenhouse gases) (NSIDC).

Of the causes of climate change listed within this definition, the issue of main concern to firms is anthropogenic climate change, as this is the only form of climate change that can be affected directly by firm operations. The main mechanism of anthropogenic climate change, according to the Intergovernmental Panel on Climate Change (IPCC), is the release of greenhouse gases (primarily carbon dioxide) into the atmosphere (Solomon et al. 2007). These gases affect the temperature of the planet because they absorb additional heat from the sun's rays when these rays are reflected from the surface of the planet, thus causing an overall increase in the surface and water temperature (Solomon et al. 2007). The majority of greenhouse gas emissions are associated with the use of fossil fuels for energy production, transport, and other purposes (Solomon et al. 2007).

There are a number of observable effects on the environment and climate that can be seen from the increase in greenhouse gases. These observable effects have been studied over a long period of time by the IPCC, who has issued ongoing reports that have routinely updated estimates and effects (Solomon et al. 2007). These effects to date include the following:

- An acceleration of the linear global warming trend from 0.74 °C over the 100 years from 1906 to 2005 to an average of 0.2° per decade from 2005 to 2020, resulting in an increase of 0.126 °C per decade more rapid acceleration in climate change;
- Observed and projected changes in snow cover (expected to be reduced overall, especially including reduction in depth of permafrost), increasing extremes of heat and cold, particularly heat waves and high precipitation events;
- Changes in precipitation patterns and a shift in precipitation locations from subtropical and tropical regions to high-altitude drier regions;
- Increases in sea level resulting from melting of polar sea ice, ice caps, and glaciers;
- Changes in water resource availability due to glacial melt, particularly affecting high-mountain regions that are dependent on glacial water supplies;
- An increase in severity and frequency of adverse weather events, such as heat waves, hurricanes and cyclones, severe storms, monsoons, and blizzards, and changes in patterns of adverse weather events from historic patterns (Trenberth and Jones 2007).

While all regions experience some degree of climate change, not all regions are affected equally. The IPCC has determined that the Asia Pacific region will experience increased intensity of typhoon and monsoon seasonal weather patterns (as the Thailand flooding clearly shows) (Trenberth and Jones 2007). Other expected effects include intensification of strength and frequency of hurricanes in North and South America, rain forest damage, increased temperatures in temperate climates such as North America and Europe, and ongoing desertification and extreme weather events in Africa (Trenberth and Jones 2007). In other words, *all* locations that are likely to be candidates for offshoring are also likely to experience climate change, but the specific type of change that will be seen will vary widely.

15.2 Offshoring

The core business process considered within this research is offshoring, which is a common business activity for firms of all sizes. Offshoring can be defined as "a strategy of relocating business processes, services, and work to overseas locations, where it makes most business sense, by capitalizing on the global skill pool, advances in communication technologies, and the benefits of cost arbitrage (Babu 2005)." Offshoring can be seen as a form of foreign direct investment (FDI), in which firms seek out specific advantages that are associated with a given geographic location (Lewin et al. 2009).

While offshoring and outsourcing are commonly conflated, there is a subtle difference in meaning between the two processes; while offshoring refers to a company's internal operations in a location outside the home country, outsourcing implies a contractual vendor relationship with another firm that provides services outside the home country (Bunyaratavej et al. 2011). Offshoring and outsourcing are commonly discussed under principles including the eclectic theory, the competence-based view of the firm, network theory, the Uppsala model of internationalization, and a number of other theories that address specific elements of the outsourcing transaction (Hätönen and Eriksson 2009).

Offshoring is commonly seen by firms as a way to reduce costs, increase manufacturing flexibility and open up new markets (Farrell 2005). The ability to increase the number of workers and to acquire cheaper capital investment means that firms can rapidly increase capacity and lower the cost of manufacture; at the same time, providing industrial employment in developing regions also provides an increased consumer base, at least for some companies (Farrell 2005). As such, firms have powerful incentives to offshore their manufacturing or services, and they have taken advantage of this. Outsourcing, a specialized form of offshoring, began during the 1950s, but did not become a common business strategy until the early 1990s (Hätönen and Eriksson 2009). Within 10 years, outsourcing no longer provided competitive advantage, but was instead a common business strategy (Hätönen and Eriksson 2009). Today, strategic use of both offshoring and outsourcing is driven by increasing competition to cut costs, both in unskilled and in

skilled labor (Contractor et al. 2010). Standardization of business processes has also played a role in increasing the use of offshoring services; this is true both for routine business processes and for high-value and specialized processes such as research and development (R&D) and engineering (Contractor et al. 2010). However, whether these returns can be supported on an ongoing basis is dependent on several factors, including the ability to continue to standardize production and business processes and the ability to customize business processes in an efficient manner (Sako 2006). As such, even though offshoring and outsourcing are often effective, it should not be taken for granted that they will continue to be effective in future.

Typically, firms outsource what they consider to be core (or essential) and non-core operations and outsource those that are considered to be non-core (Contractor et al. 2010). However, the perception of core or non-core is changing over time as well, as firms make increasing use of offshoring to perform core functions. Of particular interest is the increasing rate of offshoring associated with innovation and research and development, which has largely been driven by increasing demands for scientific and engineering human resources that are not being met by the work force in the developed countries (Lewin et al. 2009).

There are a number of issues that are associated with offshoring, including performance management, innovation, organizational governance, and external contextual factors (Bunyaratavej et al. 2011). One of the contextual issues that the firm must deal with is climate change. Offshoring, as well as other forms of international trade, is implicated in the intensification of climate change over the past few decades. From 1990 to 2008, there was an estimated increase in emissions associated with exported production between 20 and 26 % (Peters et al. 2011). Notably, this growth in emissions is faster than the average GDP, population, or overall carbon emissions, although lower than the growth in dollar value of international trade (Peters et al. 2011). This growth in emissions can be attributed to increasing transportation of people and goods, increasing distance from food sources and other transport-related factors, and increasing energy consumption and resource usage among all nations (Solomon et al. 2007).

Offshoring is expected to continue to grow over the next several years, as it becomes an entrenched practice and may eventually result in a fundamental transformation of the firm structure and function (Lewin and Peeters 2006). However, embedded in the cost savings achieved by the firm are various forms of hidden costs, such as costs associated with perceptions of ineffectiveness by consumers and costs associated with inefficiencies caused by geographic, cultural, or interaction distance (Stringfellow et al. 2008). This chapter's main argument regarding offshoring and climate change is that climate change is one of these potential hidden costs, and the cost of climate change needs to be taken into account in order to effectively determine the savings (or potential savings) from offshoring.

15.3 Risk Management

The framework used to analyze the problem of determining the cost of climate change for firm-level offshoring practices is the risk management framework. A simple definition of risk is "the chance that harm will occur (Chicken and Posner 1998)," which is nominally calculated by a combination of hazard (or the potential for harm) and exposure (or the chance of the hazard occurring). Acceptance of risk may be based on judgment of its appropriateness, given a number of factors including knowledge, judgment, trust, regulation, bias, the nature of the risk, funding, political beliefs, aims, and supply and demand (Chicken and Posner 1998). (These are general factors in risk acceptance and may not always apply for a given project or development).

Following on from this definition of risk, *risk management* can be defined as an attempt to reduce downside loss or volatility from risks that are encountered in the operating environment (Andersen and Schrøder 2010). The history of risk management can be seen in the operations of insurance companies and other industries, such as shipping and trade that have traditionally seen increased levels of risk associated with their activities (Andersen and Schrøder 2010). However, the modern practice of corporate risk management, in which corporate strategy is specifically focused on identifying and eliminating (or at least mitigating) risk from its activities, is a relatively new development (Andersen and Schrøder 2010). Risk management is not limited only to the specific issues that are directly within the firm's control, however. Instead, Andersen (2008) argues strongly that the firm can use risk management to reduce the threat of lost earnings even from risks that are outside its own control. There is a positive statistical relationship between risk management strategies and stabilization of corporate earnings, according to one empirical study of 1,369 companies, indicating that this practice has the ability to improve corporate earnings (Andersen 2008). Thus, there is a strong rationale for the use of risk management as a framework for making decisions related to offshoring, as well as those related to other issues the firm may face.

Currently, climate change is classified as an uncertain risk, indicating that although it is highly likely there will be some degree of risk involved in the business operation, the extent or impact of this risk is not yet fully understood (Andersen and Schrøder 2010). This makes climate change risk more difficult to use a risk management approach with than other risks that are more certainly known, such as interest rate risk. However, given that much of climate change that firms need to be concerned about involve extreme adverse weather events and their after effects, this can be approached under a catastrophic event planning approach, in which a proactive approach is used (Narasimhan and Talluri 2009).

In terms of the existing literature on risk, the most appropriate positioning for climate change risk in offshoring is under supply chain risk, as the offshoring process is used by many firms as a link in the supply chain. Making the offshoring or outsourcing decision is commonly known to be problematic in terms of risk management, as the decision to use the practice is often undertaken without any

specific risk assessment or even specific goals in mind (Lonsdale 1999). Lonsdale has suggested that the use of a risk management framework is appropriate for making supply chain decisions, a suggestion that this research expands upon. The risk management process for supply chains involves identifying objectives and performance goals and then determining what risks will be seen in the process of achieving these performance goals (Narasimhan and Talluri 2009). Identification of risks is then followed by an attempt to determine what strategies could be used to eliminate or mitigate them (Narasimhan and Talluri 2009). The offshoring firm will particularly need to plan for catastrophic events to occur within the supply chain, given that these events are likely to impose higher and more sudden cost burdens than slow change processes (Knemeyer et al. 2009). For example, the catastrophic effects of Thailand's flooding, discussed at the beginning of this chapter, had the ultimate effect of constraining the supply flow for major makers of computer hardware systems, including both consumer-level PC systems and enterprise-level storage systems (Connor 2012). This type of effect should have priority in the catastrophic events planning process. Unfortunately, many companies only come to an awareness that they need to use risk management in their supply chain practices after a major disaster or occurrence. One example of such a company is Swedish cellular phone maker Ericsson, who did not implement risk management practices in their supply chain until after a sub-supplier that manufactured radio frequency chips experienced a fire in their production facility (Norrman and Jansson 2004). This was an exceptionally expensive oversight for Ericsson, which reported a loss of $400 million in 2001, primarily attributed to this incident. Thus, the use of risk management in the supply chain is well supported as a means of avoiding potential losses from unforeseen risks in the supply chain.

15.4 Climate Change Risk Management in the Offshoring Decision

The discussion of climate change above clearly highlights reasons why it might be vital to understanding the firm's offshoring decision. However, it does not clearly indicate how the decision regarding offshoring can be made. This section of the chapter discusses the firm's responsibility toward climate change and the importance of risk management as an approach. It then provides a risk management framework derived from climate change and risk management literature that highlights the basic issues the firm needs to take into account.

15.4.1 What is the Firm's Responsibility?

There are a number of reasons why the firm has the responsibility to engage in climate change risk management. First, there is the potential for financial loss or market share loss for the firm; since the manager of the firm has the fiduciary duty

to shareholders to identify and mitigate material risks (Lorenz 2008), the risk of loss means that climate change must be considered in the risk management process. A framework of decision making that integrates consensus versus uncertainty, uncertainty versus probability, and short-term versus long-term concerns can help determine the overall weight of climate change in the decision (Lorenz 2008). Climate change research has reached a state of general consensus, and there is a high probability of effects being seen (although the specific effects to be seen are as yet uncertain). Furthermore, this is a long-term concern. Thus, climate change is a part of the analysis required to enact the firm manager's fiduciary duty.

An additional reason for the firm to take climate change into account is an ethical dimension of the offshoring decision. Carbon emissions are not localized, but are global, and firms that engage in offshoring without taking care to control carbon emissions cause global damage (Eckersley 2010). The transfer of carbon emissions from richer countries to poorer ones through offshoring is also a negative externality (Eckersley 2010). Thus, in order to discharge overall ethical requirements to not take advantage of negative externalities, firms need to make a conscious effort to evaluate climate change impacts and effects of their offshoring decision. This can be seen as an extension of the corporate social responsibility practice, in which the firm takes into account a stakeholder perspective and integrates the interests of stakeholder groups beyond the owners of the firm into its practices (Kytle and Ruggie 2005). Thus, in a sense, the consideration of climate change is oriented not just toward the specific risks of climate change itself, but also toward controlling and mitigating social risk, which can affect consumer demand, regulatory oversight, and employee satisfaction (Kytle and Ruggie 2005).

Of course, the question should be asked as to whether environmental concerns should play a role in firm decision making. Traditional thinking has been that consideration and mitigation of environmental risks are the unnecessary cost and that it decreases the firm's earnings and profits (Ambec and Lanoie 2008). However, Ambec and Lanoie's analysis shows that under current operating conditions, taking into account environmental risk has a number of advantages for the firm, including improved market access, product differentiation, and consumer preference, and other advantages including reduced cost of labor, capital, and inputs. This chapter, which focuses on the development of climate change as an area of environmental concern (even though it is outside the direct control of the firm), is based on research such as Ambec and Lanoie's, positing that taking climate change into account can provide financial benefits for the firm.

15.4.2 Risk Management for Climate Change

There are a number of potential risk areas identified for climate change, although many of these risk areas are more oriented toward the country level than the firm level (as this is where most of the research has occurred). However, some of the elements of this high-level risk analysis can be examined at the firm level. In

general, the vulnerability of a region can be understood as a combination of its risk exposure and its ability to cope with or mitigate the risks it is exposed to (Bogardi 2004). The separation of these components of risk is required to understand the differences in various regions that may nominally be exposed to the same level of risk (Bogardi 2004).

One category of risk is location and demographic risk. Some potential risks in this category that could affect a firm's offshoring decision include the simultaneous increase in flood risk and reduction in water supply availability associated with melting glaciers; the risk of declining crop yields due to increasing temperatures, an increase in vector-borne disease and heat and cold-related deaths, and increased coastal flooding and loss of coastal areas (Stern 2006). These risks could potentially affect capital plant and equipment, human resources, and raw materials availability as well as transportation and communication links. However, these risks are not distributed evenly around the world; the highest risk *and* highest vulnerability are borne by developing regions including South America, Asia, and Africa, which are characterized by higher agricultural dependence, poorer institutions, and fewer resources to combat these results (Stern 2006). This has serious implications for offshoring in popular locations such as China, India, and Indonesia. The cost of this type of risk is expected to be high, for example, a risk analysis for rising sea levels in Copenhagen, Denmark suggests total private and public losses of between one and six billion euros, mostly concentrated in transportation, post, and communication services (Hallegatte et al. 2011).

The second major risk category to be considered is political risk. Political risk from climate change includes effects on vulnerable occupations (such as agriculture and fisheries), increasing poverty, migration, and weak states (Barnett and Adger 2007). These risks both deplete regions undergoing climate-related stress of valuable human resources (one of the main reasons many firms choose to use offshoring in the first place) and increase threats to human security and increase the potential for armed conflict (Barnett and Adger 2007). Given that political risk, particularly the strength of the state and the potential for armed conflict, is already of concern in the offshoring decision, this element of risk is simply an extension of existing risk management approaches.

The third major risk category applicable to climate change is economic risk. To some extent, there is limited control that a firm can exercise over economic risk associated with climate change, but this does not mean that firms will not feel the effects. With an estimated loss of 20 % per capita decrease in GDP worldwide (Stern 2006), there is likely to be a significant fall in demand due to reduced personal income. Additionally, government regulations are likely to require increase efficiency on the part of producers by as much as 25 % in order to achieve environmental targets (Stern 2006). As such, while economic risk is not directly controlled by the firm or necessarily dependent on the location choice, this is still an issue for long-range strategic planning.

The final category of risks that needs to be taken into account for the climate change risk assessment is business-specific risks. Unlike the previous risks, business-specific risks can be (at least to some extent) controlled or mitigated by the firm through choice of location, operational mode, or mitigation strategy. Table 15.1 summarizes key business-specific risks that could be affected by climate change conditions, although this summary should not be presumed to be exhaustive.

Table 15.1 Business risk categories for climate change

Risk category	Brief description
Insurance risk	Insurance risks arise from the potential for physical damage to property, plant, equipment, and human life that some of the effects of climate change, such as sea level changes or adverse weather events (Dawson and Spannagle 2009). The insurance industry is highly aware of the potential for negative effects of climate change and as such has engaged in substantial risk assessment and planning (Dawson and Spannagle 2009). As such, the firm may face the risk of increased premiums and assessments if choosing to locate in a high-risk area, which cannot be easily avoided through such means as requiring vendors to carry insurance
Finance risk	Finance costs associated with a perceived risky operation based on the potential for force majeure (extreme and unpredictable events) resulting from climate change may be higher than costs that are not associated with this type of operation (Choucri et al. 2007). Firm-level risk assessments do not commonly take into account the problems of climate change (Choucri et al. 2007), which could make finance planning inaccurate
Supply risk	Firms that are dependent on suppliers in regions vulnerable to climate change, or that rely on inputs (such as lumber) that are themselves vulnerable to climate change, may face significant supply risk (Choucri et al. 2007). As the case of Thailand's flooding shows, firms themselves may create supply risks through concentration in vulnerable areas
Infrastructure risk	Offshoring success depends on available transportation, communications, and electricity infrastructure, but this type of infrastructure can be strained or even broken by extreme adverse weather events (Hallegatte 2009). This risk is generally beyond a firm's ability to mitigate, but examining the government strategy for dealing with infrastructure risk (such as overbuilding or changing planning models) will help determine how much vulnerability the firm faces (Hallegatte 2009)
Human resource risk	Climate change risks such as increased in vector-borne illness, desertification, crop failure, or destruction of settlements by extreme adverse weather effects carry with it the potential for significant out-migration from an area, though the level of out-migration can be difficult to assess due to multiple causes (Mearns and Norton 2010). Regions in vulnerable economic areas may not have sufficient resources to deal with migration flows or prevent them through assurance of water quality, housing, or health care (Mearns and Norton 2010). This poses a significant risk at the firm level because regions that do not have an ample supply of human resources are generally unsuitable for economically efficient offshoring operations

15.4.3 Proposed Risk Management Framework

There are no identified general-purpose risk management frameworks for use in assessing climate change risk currently available. Because of this gap in the literature, a modified version of the Roadmap to Assess the Economic Cost of Climate Change, a large-scale assessment tool (Hallegatte 2009) has been prepared as a preliminary assessment tool. However, this assessment tool should not be used casually, because there is a significant knowledge gap in the general-purpose knowledge regarding climate change and its true effects (Sandblad et al. 2007). Although general awareness of climate change is growing, there is still a consistent underestimation of its severity and effects, as well as confusion between climate change and separate (though related) environmental issues like ozone depletion (Reynolds et al. 2010). This suggests that either substantial research or expert knowledge should be used in order to supplement layperson knowledge regarding climate change for this analysis.

The framework that has been created is based on a matrix of risk exposure and risk vulnerability, in order to take into account both aspects of risk that are discussed in the literature (see discussion above). Figure 15.1 shows the assessment matrix that is used to determine threat levels for each of the risks identified. The use of this assessment matrix is similar to the use of other matrix-based assessment tools, which should be familiar to the strategy analyst. Following consideration of each of the risks involved in the specific offshoring location, the overall risk is assessed based on weighting of the risk involvement. This provides a rapid assessment tool for the determination of which risks pose a significant threat and whether the site is simply too risky to be considered. Each risk that is included is a *location/risk pairing*, that is, the risk level is specific to the location considered for offshoring, rather than being a generalized level of risk associated with the offshoring activity itself.

A summary of each of these factors is as follows:

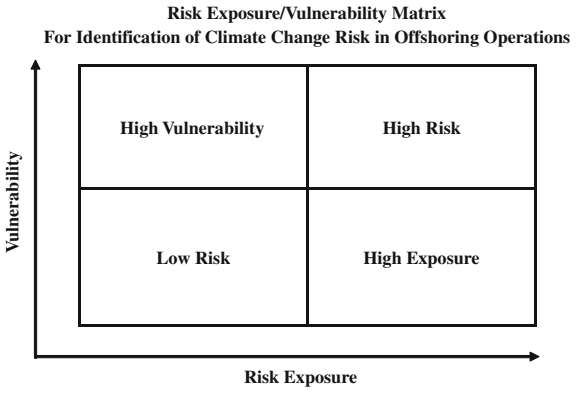

Fig. 15.1 Risk exposure/vulnerability matrix for assessment of climate change risk to offshoring operations

- A low-risk location/risk pairing is found in a location that has an absolutely low risk of exposure to a specific climate change challenge; it has both low-risk exposure and low vulnerability to the risk involved. An example of a low-risk location/risk pairing would be the risk of flooding due to sea level change in an inland location.
- A high-exposure location/risk pairing is found in a location that has high exposure to a specific risk, but which has existing adaptations in place in order to reduce vulnerability to the risk. An example of this type of location/risk pairing would be flood risk in a port city with a sophisticated flood control system that is well maintained and supported by the government. This risk is most likely to be of concern for short-run business risks, including finance risk and insurance risk, since these areas will be subject to very conservative models.
- A high-vulnerability location/risk pairing is found in a location that has high vulnerability to a given risk, although the risk itself may be relatively low. An example of this type of risk is the potential for vector-borne illness in a region that is adjacent to an area where this disease is endemic and which does not have mechanisms in place to reduce its spread. The high vulnerability poses two main categories of risk, including the potential for catastrophic effects from an unanticipated event and long-run risk that a slow-growing risk may not be appropriately met.
- A high-risk location/risk pairing is absolutely high risk—it has both high-risk exposure and high vulnerability to a given risk. An example of a high-risk location/risk pairing is the risk of coastal flooding in a Pacific Rim coastal city in a developing country, which will have both increased exposure to the risk and increased vulnerability. These risks should be treated as both short-run and long-run threats to viability of an offshoring strategy and should be targeted with risk mitigation strategies before moving forward.

In addition to a risk analysis matrix, this framework includes a number of identified risks that should be considered (Table 15.2). These identified risks should be considered to be neither generalized nor comprehensive, but serve as a starting point for location risk assessment. Geographically specific risks and risks associated with political structures should also be considered. This risk assessment process should be performed in unison with other strategic planning exercises.

The suggested stages of use of this framework are to first identify the risk levels involved (with verbal description of the risks, in order to provide more information and a basis for assessment) and then to graph the resulting matrix in order to provide a visual representation of the overall climate change risk involved in a given location. This approach will help to identify the overall level of risk involvement in a way that can be contextualized and understood in decision-making practices. The provision of additional qualitative information will help understand the overall types of risks involved as well as provide opportunities to assess risk mitigation strategies that could be used. However, it should be kept in mind when using the matrix representation that not all risks are equal; thus, the verbal description must remain the main decision-making tool.

Table 15.2 Risk assessment framework for climate change in proposed offshoring operations

Risk area	Risk level (low/high)	Risk vulnerability (low/high)	Risk quadrant (low risk, high exposure, high vulnerability, high risk)
Location and demographic risk			
(1) What is the potential for coastal flooding or inland flooding due to sea level change?			
(2) What is the potential for reduced water resources due to glacier melt?			
(3) What is the potential for increased transmission or severity of vector-borne illness?			
(4) What is the likelihood of increased cold or heat-related deaths?			
(5) What is the likelihood of increased severity or frequency of the following extreme adverse weather effects?			
(a) Hurricane or cyclone			
(b) Tornado			
(c) Snow or blizzards			
(d) Increased rains or monsoons			
(e) Changes in seasonal weather patterns			
(f) Other extreme adverse weather effects			
Political risk			
(6) What is the overall political vulnerability to climate change due to weak institutional frameworks or other factors?			
(7) How high is the involvement of region in vulnerable professions (coastal, agriculture, water dependent)?			
(8) What is the likelihood of changes in migration patterns or changes in human resource availability due to climate change?			
(9) What is the overall weakness or strength of the state in terms of climate change assessment?			
Economic risk			
(10) Infrastructure maintenance: does the region have effective long-term planning strategies in place to help ensure infrastructure viability?			
Business-specific risk			
Note the company, rather than the location, is the target of the business-specific risk considerations			
These risks should be assessed qualitatively and mitigation strategies identified			

(continued)

Table 15.2 (continued)

Risk area	Risk level (low/high)	Risk vulnerability (low/high)	Risk quadrant (low risk, high exposure, high vulnerability, high risk)
Insurance risk		Will the company face increased insurance costs due to vulnerability of the area to climate change risks as assessed by insurance providers?	
Finance risk		Will the company face increased cost of capital due to increased perception of risk by investors, particularly due to force majeure or potential for gradual financial loss or degradation?	
		What is the company's risk exposure to equipment loss from sea level change or extreme adverse weather events, resulting in increased demand for finance?	
Supply risk		Is the company dependent on suppliers or natural resources that would be affected by climate change outside the offshoring area?	
Infrastructure risk		Does the company have specific infrastructure needs that would be threatened by climate change and if so is the provision for infrastructure development used in the region sufficient?	
Human resource risk		Will the company be able to continue to maintain required staffing levels from the offshoring vendor given the potential human capital risk factors such as vector-borne illness and migration? Does the region have, or can the company provide, risk mitigating factors such as sanitary living conditions and health care?	
Regulatory risk		Does the firm's activity (particularly manufacturing activity) place it at increased risk of regulation, such as through restriction of carbon emissions, increased taxation, or uncertain or developing regulation?	
Corporate governance risk		Does the overall risk profile of the region meet the fiduciary and ethical duties of the corporation to protect the investment given the climate change risk involved?	

15.5 Conclusion and Future Directions

The increasing intensity of weather and climate issues that can be attributed to climate change makes it clear that this must be a consideration in the firm-level offshoring decision. The need to make strategic decisions that minimize supply constraints or damage to firm capital equipment and personnel means that offshoring in regions that are likely to undergo significant climate change effects should be considered carefully. Furthermore, there is an ethical element to this offshoring decision as well, as firm decision makers must consider whether they are taking advantage of negative externalities gained by offshoring and relocating production to poorer regions. A risk management approach can be used to take these issues into account, consistent with risk management in various other areas.

This chapter has provided a basic framework for evaluation of risk associated with climate change. However, substantially more work remains to be done, including identification of specific risks and quantification of these risks as well as determination of how climate change risk can be mitigated. More fundamentally, the risks of climate change clearly show how the firm's risk management process must be tied to regional and even global environments in order to be effective at identifying and mitigating risks. At the present time, it is not clear how to determine what effects climate change may have on pricing or supply of goods or on the overall use of offshoring in the long term. Thus, although this basic framework offers a starting point for consideration of this issue, there is substantially more research and issues that need to be explored.

References

Ambec S, Lanoie P (2008) Does it pay to be green? a systematic overview. Acad Manag Perspect 22(4):45–62

Andersen TJ (2008) The performance relationship of effective risk management: exploring the firm-specific investment rationale. Long Range Plan 41:155–176

Andersen TJ, Schrøder PW (2010) Strategic risk management practice: how to deal effectively with major corporate exposures. Cambridge University Press, Cambridge

Babu M (2005) Offshoring IT services: a framework for managing outsourced projects. Tata McGraw-Hill, Mumbai

Barnett J, Adger WN (2007) Climate change, human security and violent conflict. Polit Geogr 26:639–655

Berry J (2006) Offshoring opportunities: strategies and tactics for global competitiveness. Wiley, London

Bogardi J (2004) Hazards, risks and vulnerabilities in a changing environment: the unexpected onslaught on human security? Glob Environ Change 14:361–365

Bunyaratavej K, Doh J, Hahn DE, Lewin AY, Massini S (2011) Conceptual issues in services offshoring research: a multidisciplinary review. Group Organ Manage 36(1):70–102

Chicken JC, Posner T (1998) The philosophy of risk. Thomas Telford, London

Choucri N, Mistree D, Haghseta F (2007) Mapping sustainability: knowledge, e-networking and the value chain. Springer, London

Connor D (2012) Hard drive prices rise due to thai floods. http://www.informationweek.com/news/storage/data_protection/232301534
Contractor FJ et al (2010) Reconceptualizing the firm in a world of outsourcing and offshoring: the organizational and geographical relocation of high-value company functions. J Manage Stud 47(8):1417–1433
Dawson B, Spannagle M (2009) The complete guide to climate change. Taylor & Francis, London
Eckersley R (2010) The politics of carbon leakage and the fairness of border measures. Ethics Int Aff 24(4):367–393
Farrell D (2005) Offshoring: value creation through economic change. J Manage Stud 42(3):676–683
Hallegatte S (2009) Strategies to adapt to an uncertain climate change. Global Environ Change 19:240–247
Hallegatte S et al (2011) Assessing climate change impacts, sea level rise and storm surge risk in port cities: a case study on Copenhagen. Climatic Change 104:113–137
Hätönen J, Eriksson T (2009) 30 + years of research and practice of outsourcing—exploring the past and anticipating the future. J Int Manageme 15:142–154
Knemeyer AM, Zinn W, Eroglu C (2009) Proactive planning for catastrophic events in supply chains. J Oper Manageme 27:141–153
Kytle B, Ruggie JG (2005) Corporate social responsibility as risk management: a model for multinationals. Working paper. Harvard University J.F. Kennedy School of Government, Cambridge (MA)
Lewin AY, Peeters C (2006) Offshoring work: business hype or the onset of fundamental transformation? Long Range Plan 39:221–239
Lewin AY, Massini S, Peeters C (2009) Why are companies offshoring innovation? The emerging global race for talent. J Int Bus Stud 40:901–925
Lonsdale C (1999) Effectively managing vertical supply relationships: a risk management model for outsourcing. Supply Chain Manage 4(4):176–183
Lorenz D (2008) Prudence, profit and the perfect storm: climate change risk and fiduciary duty of directors. In: Hansjürgens B, Antes R (ed) Economics and management of climate change. Springer, New York
Mearns R, Norton A (2010) Social dimensions of climate change. World Bank Publications, Washington
Narasimhan R, Talluri D (2009) Perspectives on risk management in supply chains. J Oper Manage 27:114–118
Norrman A, Jansson U (2004) Ericsson's proactive supply chain risk management approach after a serious sub-supplier accident. Int J Phys Distrib Logistics Manage 34(5):434–456. NSIDC (2011) Climate change (definition). http://nsidc.org/arcticmet/glossary/climate_change.html
Peters G et al. (2011) Growth in emission transfers via international trade from 1990 to 2008. In: Proceedings of the national academy of sciences, (in print)
Reynolds TW et al (2010) Now what do people know about global climate change? survey studies of educated laypeople. Risk Anal 30(10):1520–1538
Sako M (2006) Outsourcing and offshoring: implications for productivity of business services. Oxford Rev Econ Policy 22(4):499–512
Sandblad EL, Biel A, Gärling T (2007) Cognitive and affective risk judgements related to climate change. J Environ Psychol 27:97–106
Solomon S et al. (2007) http://www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html
Stern N (2006) The stern review: the economics of climate change (executive summary). The World Bank. http://siteresources.worldbank.org/INTINDONESIA/Resources/226271-1170911056314/3428109-1174614780539/SternReviewEng.pdf
Stringfellow A, Teagarden MB, Nie W (2008) Invisible costs in offshoring services work. J Oper Manage 26:164–179
Trenberth KE, Jones PD (2007) Climate change. Working group I: the physical science basis. http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch3.html