

## **Climate Change and Construction Sector SMEs: Vulnerability, Consequences and Resilience**

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### **T1 – Adaptation Strategies and Techniques**

#### **ABSTRACT**

Climate change has become one of the prime challenges the society has to face in the future. As far as businesses are concerned, it also has added one other important issue that they have to consider as part of their business planning. Climate change is of significant importance particularly to the Small and Medium-sized enterprises (SMEs), which are considered as the most vulnerable among the business community to the effects of climate change. This paper presents the findings of a literature review conducted with the aim of identifying the specific importance of climate change to the construction sector SMEs. The objectives of the paper are to identify the vulnerability of construction sector SMEs to the effects of climate change, their consequences and also to identify the importance of improving resilience and implementing adaptive measures to manage these issues. The paper also outlines the directions of a study undertaken to address these issues as part of an EPSRC funded research project titled “Community Resilience to Extreme Weather Events – CREW”. The paper concludes by stressing the importance of improving the resilience of construction sector SMEs to climate change effects and also the importance of collective action in this regard.

#### **KEYWORDS**

Climate change, Construction, Extreme Weather Events, SMEs, Resilience

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## 1 INTRODUCTION

Experiential observations and projections into future increasingly suggest that the global climate is changing and will continue to change in future, largely due to the human interference with the environment over the past few decades. The adverse nature of the effects of climate change has made it one of the prime challenges the society has to face in the future. Given the fact that climate change will continue to happen, even if the mitigation measures are implemented now, has made adaptation to these changes a necessity for the countries around the world.

As far as businesses are concerned, it also has added one other important issue that they have to consider as part of their business planning. Among the business community, climate change is of significant importance particularly to the Small and Medium-sized enterprises (SMEs), which are said to be the most vulnerable to the effects of climate change [Crichton 2006]. As more than 90% of enterprises in construction industry fall to the category of SMEs and as they generate more than one half of employment and turnover in the construction industry, these issues are of special importance to the UK construction industry.

This paper seeks to identify the vulnerability of construction sector SMEs to the effects of climate change and to identify the importance of improving resilience and implementing adaptive measures to manage climate change risk. It briefly discusses an EPSRC funded research study currently underway to address the issue of SME resilience of Extreme Weather Events (EWEs), which are expected to increase in number and severity in future under the changing climatic conditions. The paper concludes by highlighting the importance of SME resilience to climate change effects and also the importance of collective action in achieving resilience.

## 2 CLIMATE CHANGE AND EXTREME WEATHER EVENTS

The Stern Review [2007] predicts that the average global temperatures could rise by 2-3<sup>0</sup>C within the next fifty years leading to many severe impacts such as melting glaciers, rising sea levels, decline of eco-systems etc. In addition to the gradual change of climatic conditions, climate change is expected to increase the intensity and frequency of Extreme Weather Events (EWEs) [Munich Re 2007, Stern 2007, Environment Agency 2005]. EWEs cause significant economic and social costs annually in many parts of the world, and the costs of these events are expected to further increase in future under the changing climatic conditions. It is estimated that the global annual cost of weather damage on average is to be in the range of \$200–330 billion even now [Dlugolecki 2008]. The Pitt Review [2008] discloses that there were about 200 major floods worldwide during 2007 alone, affecting 180 million people, creating 8,000 deaths and over £40 billion worth of damage. These costs are expected to further increase in future due to the increase of intensity and frequency of EWEs. Given this context, it has become a necessity to enhance the resilience of systems; especially which are vulnerable to the climate change and EWEs, in order to counteract the threat of such events and to ensure the continuous operation of those systems.

## 3 VULNERABILITY OF CONSTRUCTION SECTOR SMES

Although the concept of vulnerability has been used in different research traditions, a proper agreement over its meaning is still to be arrived at [Gallopín 2006]. For the purpose of this paper, the definition put forward by the Inter Governmental Panel on Climate Change (IPCC) is applicable. IPCC define vulnerability as “the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes” [IPCC 2007]. It further identify vulnerability as “a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity”. Following sections briefly look at why the construction sector SMEs are specifically vulnerable to climate change and extreme weather.

### 3.1 Vulnerability of construction enterprises

Mills [2003] identify construction sector as “perhaps the most vulnerable” to climate change, “with exposures ranging from damage to physical infrastructure to disruption of business operations to adverse health and safety consequences for building occupants”. Given the fact that a significant portion of construction activities happen in the open environment, the exposure and sensitivity to climate change is considerably high in construction. For an example, it has been predicted that there will be around 2000-3000 additional business failures in UK as a result of the disruptions caused by the recent heavy snowfall, and that businesses in construction and retail industries are the most likely to be affected [BBC News 2009]. In addition, other factors like large investment, long delivery time, long supply chains running across various industries, quite inflexible sequence of production etc participate towards the increased vulnerability of construction sector enterprises to weather extremes.

### 3.2 Vulnerability of SMEs

Vulnerability of SMEs arises virtually by definition from the small scale of their human and financial resources [Bannock 2005]. Thus, predictably, SMEs are considered as the most vulnerable section of the UK economy to the impacts of climate change [Crichton 2006]. In addition, previous research reveals that small businesses are not adequately prepared to cope up with the risk of EWEs and other natural hazards and to recover following an event [Tierney & Dahlhamer 1996, Crichton 2006, Yoshida & Deyle 2005, Alesch *et al.* 2001, Dlugolecki 2008]. Further, since a majority of SMEs are local in their operations and rooted in local communities [Bannock 2005], their owners are often hit twice by EWEs; as local citizens and as business owners [Runyan 2006], increasing the vulnerability to failure following an adverse event.

### 3.3 Vulnerability of construction sector SMEs and consequences

Being the vulnerable segment operating in a vulnerable industry sector has made construction SMEs at high risk of climate change and weather extremes. Climate change and extreme weather can create a variety of effects on construction sector SMEs including disruption to site works directly and indirectly by disrupting site deliveries and utility supplies. Hot weather conditions may increase the risk of heat exposure for workers in the construction sector, increasing health costs and reducing productivity [Burnham 2006]. Insurance may become more expensive or difficult to obtain during the construction process [Sussman & Freed 2008]. In addition to the construction sites being affected, the business premises may also get affected giving rise to costs, loss of data/information etc. Implications like ignoring climate change issues, over-reacting, being unplanned for regulations and standards may also give rise to unforeseen costs and would ultimately lead to business failure [Metcalf & Jenkinson 2005]. Although the list of consequences identified here is not comprehensive, it still gives an idea about the range of negative consequences that EWEs can create on construction sector SMEs and the need for improving their resilience to minimise these consequences.

## 4 IMPORTANCE OF RESILIENCE

Resilience is defined by the IPCC as the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change [IPCC 2007]. In simple terms, it seems to denote the ability of a system to function as usual in the event of a disturbance and the ability to adapt to such disturbances. Being resilient will allow businesses to minimise the risk of a weather extreme affecting their business, to withstand the event if it still affects and also to recover quickly following the event. Particularly, this will allow them not only to minimise the risks, but also to capture the business opportunities arising from such an event.

Given that a significant portion of the construction activities are carried out by SMEs; more than 65% of turnover in the construction industry is generated by SMEs [BERR 2008], a resilient SME network is required specially to carry out the refurbishment, maintenance activities of the existing building stock and for reconstruction following an adverse weather event in order to allow other systems to

function properly. Especially it is important that premises of other business sectors are repaired quickly for the economy to function properly following an event like flooding etc. Further, inherent advantages of flexibility and innovation associated with construction sector SMEs will allow them to exploit market opportunities for new products, construction methods which address climate change, EWEs. A recent pilot study conducted by DEFRA has found that local households increasingly prefer local contractors; which are more likely to be SMEs, to install flood defences for them. Thus, it seems that climate change and EWEs present significant business opportunities for SMEs. For them to utilise those opportunities however, they have to survive such an event successfully first. Thus, a resilient SME sector in construction is required for the economy to function as usual and to bounce back following a weather extreme.

#### **4.1 Importance of Integrated Response**

Achieving resilience in SMEs however is not an easy task given their resource constraints, perceptions/attitudes and other barriers involved in implementing such measures. Adaptation to climate change is not a high priority for SMEs currently, especially considering the current economic downturn. Further, their perception that the actions of an individual SME will not make a difference is a barrier for them implementing adaptation measures [Norrington & Underwood 2008]. If they are involved in an integrated response to climate change, it will eliminate this perception, resulting in better adaptation. Further, the pressure coming from other community partners involving their customers and competitors, authorities etc will also positively affect the uptake of adaptive measures by the SMEs. More importantly, the solutions reached in collaboration with all the major stakeholders of a community will lead to better and concentrated response, leading to enhanced resilience at the community level.

### **5 SME RESILIENCE TO EXTREME WEATHER EVENTS**

As part of the Engineering and Physical Sciences Research Council (EPSRC) funded “Community Resilience to Extreme Weather – CREW” research project, we investigate how the SMEs respond to EWEs, and how their individual and collective actions along with other community groups (households and local authorities) can achieve community resilience to EWEs. The study is undertaken via a participatory approach involving SMEs and business organisations representing SMEs, to obtain a broader understanding on how to improve their resilience to EWEs. Although the focus of the research is not specifically on construction sector SMEs but on SMEs in general, SMEs in construction will be paid special attention due to the increased vulnerability of their activities to EWEs, and the significant effect that their activities have on adaptation agenda.

### **6 CONCLUSIONS**

Changing climatic conditions are expected to further increase the intensity and frequency of EWEs, which are capable of creating a variety of adverse effects on a community affected. SMEs, which are not adequately prepared to cope up with the risk of EWEs and to recover following an event, are highly vulnerable to failure in the event of EWEs. Due to the nature of its operations, construction industry SMEs are significantly vulnerable for climate change and EWEs. EWEs can create a number of negative effects on construction sector SMEs and some positive consequences as well. Being resilient will allow the SMEs not only to minimise the vulnerability to negative impacts but also to capitalise the positive impacts successfully. Thus, improving their resilience is important in order for them to prevent EWEs from affecting them, withstand the effects and also to recover from the aftermath. This is of particular importance as the activities of the construction sector have a diffusing effect on the activities of other industries, especially in case of climate change and extreme weather.

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