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Organisational obstacles to reducing carbon emissions in Hong Kong

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A B S T R A C T

An emerging theme for a nation transiting into a sustainable future is the provision of a low carbon (dioxide) environment. Carbon emission reduction is therefore important for the industry and community as a whole. Buildings contribute immensely to total greenhouse gas emissions, so pragmatic actions need to be taken to cut the amount of carbon emitted by the construction industry. These typically involve strategies such as energy-saving features in the design, construction and operation of building projects. However, a variety of characteristics of the markets and stakeholders involved are suppressing their development.

This paper reports on a series of interviews with a variety of Hong Kong construction project participants aimed at identifying the drivers of, and obstacles to, the construction industry's attempts to reduce carbon emissions. The results confirm the main actions currently undertaken are energy efficiency enhancement, green procurement, research and development activities, waste/water management and other technical measures such as the provision of thermal insulation. The majority of the drivers are economical in nature, suggesting that financial aids, and particularly government incentives, are likely to be useful motivators. Also suggested is the increased promotion of the benefits of environmental sustainability to the wider community, in order to alert the general public to the need for reducing the amount of carbon originating from building usage.

Introduction

There is a world-wide move towards a low carbon (dioxide) environment in recent years, with many governments being determined revert climate change. Of the various sectors affected, the construction industry is a prime target for emission reduction, as one-third of greenhouse gas (GHG) emissions in the world is related to buildings (UNEP, 2009). Also of note, is that GHG generated by the construction and use of building facilities is even higher in major cities due to their high urban densities and populace's pursuit of better living standards. For instance, Hong Kong's buildings contribute approximately 60% of the city's total annual GHG emissions (EPD, 2010). By limiting the emission levels of the construction industry, it is possible to significantly reduce the total environmental damage of a country or city (Zhang, Shen, Love, & Treloar, 2000) and thus help in moving towards a low carbon economy.

Acknowledging the impacts caused by rapid urbanisation (Dulal & Akbar, 2013), planners in advanced economies (Hamin & Gurran, 2009; Saavedra & Budd, 2009) and developing countries (Ho, Matsuoka, Simson, & Gomi, 2013; Kocabas, 2013) are striving to transform urban areas into low carbon cities (Lehmann, 2013), communities (Zhang, Shen, Feng, & Wu, 2013) or neighbourhoods (Qin & Han, 2013). Through the development and use of suitable sustainability indicators (Shen, Jorge Ochoa, Shah, & Zhang, 2011) or carbon indicators (Price et al., 2013), the environmental performance of a city can be carefully monitored. However, analysis of the environmental burden associated with a building project must take into account its entire life cycle, process or activity (encompassing extracting and processing materials); manufacturing, transportation and distribution; use, reuse, maintenance; recycling and final disposal (Consoli et al., 1993). For instance, GHG is released as a result of fuel consumed or a by-product of the process of manufacturing building materials (Buchanan & Honey, 1994) and in the construction of buildings (Yan, Shen, Fan, Wang, & Zhang, 2009).

Researchers have identified six major sources of emissions relevant to a construction project in the: (i) manufacture of building materials (Gonzalez & Navarro, 2006; Nassen, Holmberg, Wadeskog, & Nyman, 2007; Seo & Hwang, 2001); (ii) transport of building materials (Cole, 1998; Nassen et al., 2007; Upton, Miner, Spinney, & Heath, 2008); (iii) transport of construction plant and

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equipment (Cole, 1998; Guggemos & Horvath, 2005; Nassen et al., 2007); (iv) energy consumed by construction equipment (Gonzalez & Navarro, 2006; Guggemos & Horvath, 2005; Seo et al., 2001; Upton et al., 2008); (v) transport of workers (Cole, 1998); and (vi) disposal of construction waste (Guggemos & Horvath, 2005; Upton et al., 2008). Apart from the emissions related to the construction process, the operational emissions due to the use of construction facilities also contribute a substantial proportion of the total GHG emitted.

Achieving the desired emission reduction targets set by a government, therefore, requires the cooperation of the various construction project stakeholders involved as any low carbon policies might increase the initial cost (cf: Liu, Tao, & Tam, 2013) and affect the way in which an organisation operates. Without understanding the obstacles hindering client/owners and/or contractors in selecting low carbon building materials (Zuo, Read, Pullen, & Shi, 2012) or construction techniques (Hamilton-MacLaren, Loveday, & Mourshed, 2013), it is difficult to introduce appropriate policies to promote emission reduction. The purpose of this paper, therefore, is to identify the main current practices of the different construction industry participants in relation to carbon reduction measures. Through a series of interviews conducted in Hong Kong, the obstacles faced by each participant in improving these practices are then identified. The paper concludes by outlining the various potential means by which the obstacles may be overcome.

Reducing carbon emissions from buildings

A major theme towards the adoption of sustainable practices has been a call for radical change – *"we need a revolution in the way we build, design and power our homes"* (DCLG, 2007). This can also be heard in Hong Kong too, where calls range from the need for industry leaders, *"sustainable design … is still in its infancy and visionary pioneers are needed to facilitate knowledge exchange, set standards and establish best practice locally"* (Chen et al., 2011), to a wider insistence that *"every actor in the building industry … has the ability to make a difference in mitigating the effects of climate change"* (Siew, 2007).

The major thrust, and increasing trend, is for the government to intervene. The government is urged to push industry into more low carbon building practices by using policy, regulation or even legislative specifications, as avoiding fines is always a strong incentive in any industry (cf: Ball, 2002). Similarly, Li and Colombier (2009) argue that the most urgent issue is for enforcing instruments such as taxes and charges, tradable permits and the distribution of information and subsidies to encourage climate change mitigation and sustainable and bioclimatic building designs. This is being implemented in many countries. In the United Kingdom, for example, the Greater London Authority uses the energy policies contained in the London Plan to ensure specific targets relating to energy efficiency and renewable energy are met by the building sector (Day, Ogumka, Jones, & Dunsdon, 2009).

In China, there are increasing demands from policy makers for a more sustainable society (Li, Zhu, & Zhang, 2010). This is demonstrated in its Twelfth Five-Year Plan, which outlines various energy efficiency and low carbon development strategies. Buchanan and Honey (1994) postulated that maximising energy saving and improving energy efficiency are two other feasible short-to-medium term solutions to the problem, with the latter being the most effective way to reduce carbon emissions when full consideration is given to opportunities that can passively reduce building energy usage (IEA, 2007; Levine et al., 2007). Apart from legislated specifications related to energy issues, energy saving and reduction in carbon emissions is also being encouraged by China government policy (Jiang & Tovey, 2010).

A substantial reduction in building energy consumption can be obtained by sustainable urban planning, optimised site planning and design, natural ventilation and suitable orientation, integration of renewable energy sources, and/or bioclimatic architectural design (Harvey, 2006; Salat, 2006). Other alternative proposals include a change in certain key areas of practice, such as the inclusion of environmental parameters in tender evaluations (Sterner, 2002) or using energy performance contracting (Xu & Chan, 2013). On the other hand, energy-efficient refurbishment is also an important means of reducing energy consumption in the building sector (Hong, Oreszczyn, Ridley, & The Warm Front Study Group, 2006; Papadopoulos, Theodosiou, & Karatzas, 2002; Yung & Chan, 2012) by improving the insulation of the external envelope of a building, use of environmental-friendly materials, adopting renewable energy sources (Sitar, Dean, & Kristja, 2006) and installing energy-efficient devices (Ürge-Vorsatz & Novikova, 2008). This, together with good post-occupancy management, can significantly reduce the energy consumption of buildings (Choy, Ho, & Mak, 2013; Tovey & Turner, 2006).

Another way to encourage the adoption of low carbon building practices is to promote the use of green building assessment systems, such as the most widely recognised green building rating system in the United States, the Leadership in Energy and Environmental Design (LEED) model, the Building Research Establishment's Environmental Assessment Method (BREEAM) in the United Kingdom, the Green Star in Australia and the Hong Kong Building Environmental Assessment Method (HK-BEAM). Since the value of energy-efficient projects is currently insufficiently recognised (Cheng, 2005), a single well-developed product-based carbon labelling scheme for construction materials is recommended for the future. Preferably, to be instigated (or at least acknowledged) by the Government (Ng, Wong, & Skitmore, 2012) as this could facilitate the client/owners, design team members and contractors to distinguish between the carbon footprint levels of different construction products.

Possible barriers

However, some characteristics of the markets and end-users involved are actually suppressing the incorporation of carbon reduction and energy-saving features into the design, construction and operation of building projects (Levine et al., 2007). According to Carbon Trust (2005), these can be classified as:

a) *Financial cost/benefits*: This concerns the higher initial costs involved. Although there is some understanding of the extra benefits associated with the green measures and that costs may reduce over time, the benefits are generally long term while costs are immediate (Yudelson, 2008). Hence, client/owners still find the higher investment costs involved hard to accept (Sterner, 2002).
b) *Hidden risks*: The additional technological risks, regulatory uncertainties and other hidden problems make the cost of low carbon building projects more uncertain and therefore less predictable over the medium to long term (Wellington, Bradley, Childs, Rigdon, & Pershing, 2007). For example, renewable energy systems or energy-efficient equipment may not reach their predicted performance standards due to local environmental factors (Jiang & Tovey, 2010).
c) *Real market failures*: Hidden costs/benefits also exist in the form of misplaced incentives (real market failures) and landlords that are unlikely to invest in energy-efficient design and equipment or low carbon materials as they feel that they will probably not be sufficiently well rewarded (Schleich & Gruber, 2008; Scott, 1997).