

FOSTERING AN ENVIRONMENTALLY RESPONSIVE INDUSTRY – A PUBLIC SECTOR CASE STUDY FROM HONG KONG

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Abstract

Well meaning high-level construction industry reviews, and recommendations from those reviews, usually lead to many industry development initiatives. Promoting a safer work place and environmentally responsible industry was one of the seven themes under which recommendations were made in Construction Industry Review Committee (CIRC) Report of 2001 of Hong Kong. These were followed with many related initiatives for industry development by industry stakeholders. The findings reported here are part (limited in focus to environmental responsiveness of construction industry) of a wider research project titled 'Construction Industry Development Comparison and Acceleration' (CIDCA) designed to track implementation programmes against the original objectives in the CIRC report and some changing priorities thereafter, actual achievements, drivers, enablers and barriers, residual issues and concerns; in comparison with UK and Singapore scenarios in interlocking studies.

The original CIRC recommendations laid the responsibility of promoting an environmentally responsible industry on public sector agencies with an assumption that the private sector would follow suit. In this regard, a case study of a proactive public sector client was conducted. The data from the case study was supplemented with interviews with key personnel from other stakeholder organisations. The findings reported here identify environmentally responsive initiatives from the case study and isolate high impact initiatives among them. Their implementation is tracked and their impact on the rest of the industry is analysed. Also, key challenges and enablers/ barriers are identified in terms of achieving (i) desired results within the organisation and (ii) desired impact on the industry. Lessons learnt are then discussed with an emphasis on transforming innovative initiatives into acceptable industry norms. The reported findings though specific to the Hong Kong Construction Industry should provide pointers on implementing public sector led initiatives for other countries.

Keywords: Environmentally Responsible Construction Industry, Industry Development Initiatives, Public Sector

BACKGROUND

Despite the recent surge in international focus and universal aspirations, 'reduced environmental impact' and 'sustainability' are phrases that still trigger apprehensions in many construction contractors, as these are still associated with added and non-reimbursable costs. This is especially true in the private sector where project schedule acceleration and profit generation remain the primary drivers. An effective solution to this problem, as well as a way to gradually change the mindset and culture of the industry, is to have a sufficiently influential public client leading the new initiatives, as a catalyst and test-bed.

Triggered by some ethical and quality control related issues in the Hong Kong construction industry in the late 1990's, a government directed, comprehensive industry review was conducted by Construction Industry Review Committee (CIRC). The review report (CIRC, 2001) made 109 recommendations under seven themes, one of which was promoting a 'safer workplace and an environmentally responsible industry'. Under this theme, many recommendations advocated a more environmentally responsible industry, with specific recommendations tailored for public sector clients, whom it was expected would become a leading example and catalyze the industry in general.

In this regard, this paper presents interim findings from a case study which targeted one of the leading public sector clients entrusted with championing environmental initiatives in Hong Kong for the construction industry. This case study was part (being limited to environmental responsiveness of construction industry) of a wider research project titled 'Construction Industry Development Comparison and Acceleration' (CIDCA) designed to track implementation programmes against the original objectives in the CIRC report and some changing priorities thereafter, actual achievements, drivers, enablers and barriers, residual issues and concerns; in comparison with UK and Singapore scenarios in interlocking studies.

INTRODUCTION TO CASE STUDY

The CIRC report advocated championing of select themes by select public sector clients as mentioned earlier. The case study presented here is of one such public sector client (termed as PSC hereafter). The strategies suggested in the report for championing the themes were to incentivise the adoption of initiatives as well as to link the procurement (tendering opportunities) to adoption and performance of these initiatives by contractors. It has to be noted here that environmental responsiveness initiatives are long term objectives and hence need to be championed for a longer term to demonstrate their impact. Also, they are often not in the commercial interests of the contractor if they are cost intensive and non-reimbursable. From partnering experiences in construction industry (Bennet & Jayes 1995, 1998; Barlow et al. 1997), it has been demonstrated that in aligning long term adversarial goals, sustainable workload (continuity of work) is the key, along with economy of scale. In this regard, the selected PSC appropriately fits the bill as it is mandated to provide housing for the economically weaker sections of the society, hence a continuous and steady work flow in their domain.

CASE STUDY METHODOLOGY

The methodology followed for this case study was the same as for the other case studies for the wider research project mentioned above. The target institution for the case was identified first, following which the case study was conducted in three stages as described below:

Stage 1: Setting up the Case Study Agenda - This stage consisted of an initial meeting with a few key representatives of the target institution. For this meeting, a list of initiatives that the research team was aware of as having been implemented and were directly/ indirectly linked to the HK construction industry self improvement initiatives was sent in advance. Target institutions representatives were asked to supplement the items on our list if required, and help us identify a few (3 or 4) initiatives that were perceived as having achieved high degrees of positive impact. In addition, other key personnel from the institution who were involved in implementing these high impact initiatives were identified as possible interviewees for the next stage.

Stage 2: Series of individual interviews on identified high impact initiatives - This was to delve deeper into these initiatives. A series of interviews with personnel identified in the first meeting were set up at convenient times for them, to track how the initiatives were implemented, identify barriers to implementing them and strategies used to overcome these etc. In this stage, access to relevant data in the form of documents, statistics etc was also requested.

Stage 3: Case Study Report Preparation - In this stage data collected from above was analyzed and a report prepared.

The following sections describe the key initiatives identified in the case study, their implementation process and impact on the general industry and discuss the key challenges and drivers in implementing them.

KEY INITIATIVES IMPLEMENTED

Life Cycle Strategies

The CIRC report recommends that PSC's are to take a lead in practicing life-cycle costing strategies. Following the CIRC report, the PSC published its very own Environmental Procurement Policies in the same year, seeking to minimize the use of natural resources in main building components and materials. A consultancy study on life cycle costing (LCC) and life cycle analysis (LCA) of various building materials (as well as their respective alternative materials) frequently used in housing projects was completed in 2004. As a result, an in-house database and technical guidelines of the major building materials for the PSC's projects was established. A procurement strategy and specifications for more environmentally friendly materials, which are technically and economically viable was also developed (HKHA 2010a).

Based on the study, a software tool for selecting construction materials in terms of LCC/LCA, waste generation, energy consumption as well as environmental impact was made available free of charge to the industry in 2005. Several other public sector bodies have made use of this tool in the design stages of four pilot projects to examine its effectiveness and practicality,

which are currently being reviewed by the industry. The adoption of the LCC/LCA scheme not only aids the designers in project planning stage, but will also offer value for occupants especially in the Hong Kong housing market. The PSC is also responsible for maintenance of its assets. Thus the long term economical values and durability are decisive factors from its perspective. The finished products which utilized LCC/LCA material selection tool have also played an educational role in advising the general public about the environmental and economical benefits from adopting selected building materials. It was hoped that this demonstrated the advantages of adopting this approach to the private sector developers and that they would follow similar LCC/LCA strategies to attract buyer's who are concerned with quality products, and long term value for money.

However, the existing database does not fully address the long term strategic directives of the PSC in terms of having a comprehensive performance and economic appraisal/ assessment for many alternative building materials. Such a database requires a full life cycle monitoring and assessment (both financially and environmentally) of the material performance, in which case it must span long periods of time before the result can be obtained. As construction materials vary greatly in substance, function, sophistication and method of construction, an universal LCA assessment methodology has been difficult to establish. Internationally, although countries have developed their own LCA tools, very few of them have linked LCC module (with updated cost information). The highly fluctuating construction material costs require any particular LCC software tool to be updated actively at least monthly to the most current market prices of materials, which again can be difficult (HKHA, 2005).

Recycling and Waste Minimisation

The CIRC report recommends the public sector clients to take a lead in promoting wider use of recycled materials for new construction projects. In recent years, a greater amount of building waste from redevelopment projects is being recycled in construction. The specifications for public works and public housing projects have also been updated accordingly to facilitate the use of recycled materials in building foundation, sub-base in road construction and in concrete that requires less structural strength such as concrete paving blocks (CIC, 2009).

In an attempt to maximize recycled content in new construction, recycled steel from demolished hoardings and recycled concrete are put together to produce furniture for its new projects. In the new Kai Tak development where the old Hong Kong airport was situated, marine mud is being used, after strengthening and stabilizing conditionings, for backfilling at the project site itself. Being one of the largest consumers for concrete and related materials, there is huge potential for the PSC to use recycled aggregate concrete (RAC) in its projects. The PSC, therefore proactively invested in numerous studies before RAC was used in real projects. These studies unveiled RAC's structural and chemical properties as well as its suitability in various building applications (HKHA 2010b). With local experiences apparently lacking in the long term properties of RAC in new construction, the PSC explored international experiences and found that RAC, when used appropriately, is comparable in quality to ordinary concrete. With the confidence gained from the review, the PSC is examining the possibility of extending the use of RA in structural concrete as a sustainable building material.

On specific projects, according to the PSC statistics, 1700 tonnes of RA from the demolition of Wong Chuk Hang Estate were used as backfill at Tung Tau Estate Phase 9, and 180 cubic meters of rock core was used in the outdoor areas of Choi Wan Estate (HKHA 2010a). In

total, until 2009, about 3,100 tonnes of RA have been used in the PSC's projects in Hong Kong (CIC 2009). Cement replacement materials such as pulverised fuel ash and ground granulated blast furnace slag are also put into the concrete mix to partially substitute cement content in pre-fabricated façades (HKHA 2010b). From the cost perspective, contrary to common public perceptions, the cost of preparing RAC such as setting up and operating crushing facilities to produce RA is in fact comparable with that of transporting and disposing demolition wastes to landfill facilities (HKHA 2010b), while limited landfill capacities pose a related problem.

This demonstration coupled with the rapidly increasing construction material cost, maximizing use of recycled content has become a popular practice in the construction industry in Hong Kong. The apparent and significant cost saving gained, drives its usage to increasingly higher levels. In addition, the levy of landfill charge scheme implemented by the HKSAR government will further incentivize developers and contractors to turn construction and demolition wastes to their respective recycled usages. However, the perceived high cost of crushing RA and the limited sources (government is the only supplier of RA for the time being) of purchasing RA are two main obstacles in its propagated implementation. Due to the latter, contractors may be exposed to higher liability as they are unable to control the source of RA and subsequently the performance of RAC. Therefore, a fully commercialized and regulated supplier of RA is needed.

Prefabrication

Prefabrication in construction has a number of advantages in terms of environmental responsiveness such as reduce (i) noise, (ii) construction waste and (iv) pollution. Greater use of pre-fabricated components was also called for in the CIRC report. In response to that and in addition to the conventional precast elements that were already in use, the PSC piloted the use of other non-conventional building elements such as volumetric precast bathrooms, and precast lift core as a holistic unit in such a way that things like waterproofing, M&E semi-fittings are all completed off-site. Aside from its sustainability benefits, volumetric precasting offers easy and fast assembly procedure, better quality control, and cost saving in the long term if implemented in large quantities. In addition, prefabricated facades are already used extensively in the PSC's projects.

However, the initial investment in product development has hindered the popularity of prefabrication. In addition, the absence of a local manufacturing industry adds additional transportation costs for the precast elements to be transported from factories in Mainland China. Therefore, unless proven long term cost saving is observed which requires economy of scale, it may be difficult for many private clients and contractors to adopt more prefabrication. In this case, having an influential public sector client to take a pioneering role becomes especially critical, while a long term and strategic commitment from such client for its promotion, testing and use is essential.

Green Design

The CIRC report specifically called for wider use of green designs in the PSC's projects. The PSC introduced its first departmental environmental objectives in 1999, and subsequently updated it to reflect rapidly developing environmental perspectives as soon as the needs arose. These objectives are the guidelines and also drivers of many initiatives implemented by the PSC. Some of these are described below.

Micro-climate study has been introduced since 2001 on all the PSC's projects to refine design to ensure optimized use of natural features at that particular location, and to implement appropriate sustainability measures. The design initiatives are then measured at the completion of the project to check against its projected effectiveness. These have hitherto shown positive results.

The PSC places strong focus on maximizing the comfort level and well-being of residents. In achieving it, new standards of greening have been put in place. The current guideline specifies that for every 15 domestic housing units built, at least one tree has to be planted; and for every housing development project, a greening ratio of no less than 20% to 30% is to be followed (HKHA 2010a). In addition to greened rooftop planted with self-maintainable vegetations in newly built low-rise estates, vertical green panels are also being installed to increase the greening areas. Vertical green panels not only provide increased areas of greening, but also help to reduce the heat of the concrete wall behind it by up to 16 degrees Celsius and thus lower the interior temperature (HKHA 2010a). These greening initiatives reduce heat island effect and energy consumption, and also enhance noise absorption to abate noise pollution in the estates.

Other green measures that the PSC has adopted in pilot projects include installation of photovoltaic systems, solar water heating systems, wind and solar hybrid powered street lighting. As these initiatives are still in their early testing stage, the high initial investment as well as the intangible and uncertain ROI (Return on Investment) is a key challenge for them to be extensively adopted.

Procurement

A large part in the above mentioned relevant section of the CIRC report was devoted to the suggestion to give weight to environmental performance in assessing tenders and performance of contractors. In response, the PSC has incorporated environmental aspects into its procurement process starting right from the tender stage. An 'Environmental Management Plan' from contractors is now mandatory for demolition, piling, building and civil contracts. In the tendering process, additional credits are given to those with environmental proposal that exceed the basic contractual requirements. More weights are inserted into the Performance Assessment Scoring System (PASS) which was developed by the PSC to maintain the standard of works for its new building works projects in 1990. Its main functions are for work performance monitoring, registered contractor list management, and for streamlining tender process (Tao 2009).

Of the eight assessment categories in the PASS criteria, section F measures contractor's performance in terms of environmental, health and other related provisions. Assessed on a quarterly basis, the scores of a particular contractor performing work in a project are then totalled and calculated (Tao 2009). The score, together with other past performance scores, will then become part of the assessment criteria in subsequent project tenders submitted by this particular contractor. The PASS system is updated and improved from time to time to reflect the concurrent needs and focus areas of the industry. With the implementation of "pay for environment" scheme mentioned in the next section, the PASS score is more of a reflection of the contractor's obligated efforts in optimizing the environmental performance of the their respective construction discipline. In the private sector, some clients, although may not be as aggressive, are following the public sector in terms of placing a strong focus in environmental aspect of the construction in the tendering and contractor assessment processes.

A new procurement method which may potentially place more focus on sustainable design and construction was developed and implemented by the PSC in a pilot project. The PSC calls this new approach the “three envelope system”. This is distinct from the now common “two envelopes system” by adding a third envelope which proposes innovative ideas and technologies with the associated costs (Fung 2010). The new system opens the door for more environmentally innovative designs and building technologies. The majority of the accepted innovations in the pilot project contributed towards improved sustainability. However, concerns have been expressed over this new approach by designers and contractors that they may lose a competitive edge by disclosing their technologies in this system, especially in the case of a losing tender.

Construction Nuisance Mitigation

A number of initiatives derived from construction nuisance mitigation objective outlined in the CIRC report were implemented by the PSC in recent years with an encouraging response from the industry. One of these is the integrated “pay for safety, environment and hygiene” scheme introduced in 2003. Aside from encouraging better safety and site hygiene initiatives, the program incentivized contractors to translate adequate measures under the project’s Environmental Management Plan into responsible actions without having to sacrifice profits. Such Environmental Management Plans address various issues such as noise control, water pollution control, dust control and protection of existing facilities, depending on the nature and location of the particular project. While meeting these main objectives, the scheme indirectly promotes a healthy tender process in a way that contractors bidding for the project would not need to cut corners to meet environmental requirements during the construction process, as may be later set by the clients.

With positive responses from the industry, particularly contractors, similar schemes have also been adapted by some progressive private sector clients. The Construction Industry Council (CIC) of Hong Kong has published guidelines in this regard (CIC 2008), hoping that the rest of private sector clients will soon catch up and thus transform it to become a norm in the industry.

Promotion of Public Awareness

New initiatives need to be accepted and appreciated by the people who are using and benefiting from them. The CIRC report recommended promoting public awareness of energy efficiency and wider adoption of energy efficient designs a priority. In this regard, the PSC works closely with other government departments, district councils and institutions to facilitate exchanges with the communities. Forums and workshops are also conducted at the design stage of its projects to encourage public engagements. Also, post completion review workshops are held with the residents and contractors, as a way of understanding the performance of green technologies and materials – and assessing whether they have achieved design objectives and expectations (HKHA 2010a).

Tenant’s involvement in greening their own estates not only can contribute to fostering a better environmental community, but also plays an effective role in promoting environmental concepts in the community at large. Launched in 2007, the Action Seedling program provides tenants the opportunities to nurture and raise plants until they are mature enough to be transplanted as part of the greening in the estates. In the past year, over 15,000 seedlings have been nourished and eventually moved to community gardens in various estates (HKHA 2010a).

KEY CHALLENGES AND DRIVERS

The impact of championing the above initiatives on the industry as a whole has been mixed, as described under individual initiatives. Cost intensive initiatives have been slow to be cross pollinated to the private sector. This is probably because many of these initiatives involve new technologies which require investments and the fact that the benefits of some of these initiatives are yet to be demonstrated as they can only be proven in the long run. Therefore, the initial costs are considered as a barrier. Suggested remedies include subsidies to the industry until the initiatives are widely propagated and become the norm.

Within the public sector, it was felt that commitment to environmental initiatives is the key driver to promote them. The PSC is ready to bear additional costs in demonstrating them in pilot projects but foresees that it can only sustain them if they can show cost advantages in the longer run. It was also felt that the contribution of these initiatives to the society has to be clear and acceptable to the general public if they are to be sustained. The success of many of the initiatives has been attributed to linking procurement (tender opportunities) to performance scores. Another key driver that is important to the extensive implementation of environmental initiatives adopted by the PSC is the support from CIC, the industry's coordinating body, which needs to effectively educate the industry by disseminating information about the initiatives, their advantages and successes.

CONCLUDING OBSERVATIONS

This case study analysis indicates that in general, it is observed that industry wide implementation of many environmental friendly initiatives in the construction industry is step-by-step "work in progress". Most of the initiatives are at the initial stage, with benefits of some being still to be demonstrated. Initiatives such as "pay for safety, environment and hygiene" experience less obstacles to be employed by contractors, because costs are borne by committed clients and have been highly successful. Since nearly all the public projects are now exercising this scheme where applicable, it is hopeful that with the catalyst of CIC's published guidelines, it is likely to be transformed into an industry norm in the near future.

The PSC has taken an important step forward by pioneering and investing in practicing LCC/LCA exercises which provide a solid foundation and material database for future use. Fostering an environmentally responsible culture is further enhanced by periodically updating procurement and tender systems in such a way that environmental requirements reflect the needs of the developing market. Objectives, inputs and outputs of the most current R&D programs should be geared accordingly. However, the barriers and challenges in driving environmentally responsible industry forward need to be noted and addressed. Although due to the inherent characteristics of each environmental initiative, the challenges are different, what they share in common is that it requires a persistently long term commitment from the investing client. Therefore the industry needs such proactive clients with a responsible vision of the future and a willingness to "test the water" and invest money and efforts to foster an environmentally conscious industry.

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ABBREVIATIONS

CIC	The Construction Industry Council
CIDCA	Construction Industry Development: Comparison and Acceleration
CIRC	Construction Industry Review Committee
LCA	Life Cycle Analysis
LCC	Life Cycle Costing
HKHA	The Hong Kong Housing Authority
HKSAR	The Hong Kong Special Administrative Region
M&E	Mechanical and Electrical
PASS	Performance Assessment Scoring System
PSC	Public Sector Client
RA	Recycled Aggregates
RAC	Recycled Aggregate Concrete