



# Implementation of environmental management in the Hong Kong construction industry

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## Abstract

The control of environmental impacts from construction has become a major issue to the public. Whilst the implementation of environmental management in construction has a direct contribution to environmental protection, it involves allocating a variety of resources for practicing various environmental management methods such as noise control, treatment of polluted water, waste recycling and reusing, and so on. The application of these methods leads to an increase in labour use, materials handling costs, which can limit their implementation. This paper provides a profile of environmental management in Hong Kong construction by identifying what contractors in Hong Kong consider to be the benefits of and barriers to the practice. The appropriateness of measures for mitigating the barrier effects is investigated. The paper provides empirical evidence of the benefits of and barriers to the process of increasing the implementation of environmental management among contractors in Hong Kong. It should help contractors to adjust their environmental management policy by efficient resources allocation within their companies. © 2002 Elsevier Science Ltd and IPMA. All rights reserved.

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## 1. Introduction

The promotion of environmental management and the mission of sustainable development have resulted in pressure demanding the adoption of proper methods to improve environmental performance across all industries including construction. Construction is not by nature an environmentally friendly activity. Existing research suggests that construction activity is a major contributor to environmental pollution. For example, McDonald's research [1] reports that 14 million t of wastes are put into landfill in Australia each year, and 44% of this waste is attributed to the construction industry. According to Zhang et al. [2], construction-contributed environmental pollution has been increasing in China in line with its fast urban development since the early 1980s. The standards of major environmental indicators such as sulfur dioxide (SO<sub>2</sub>) emissions and total air-suspended particulates (TSP) are far worse than international standards. It has been reported [3]

that 72% of the major Chinese cities, including the municipalities and the provincial capitals, have TSP of over 200 mg/m<sup>3</sup>, whilst the international standard defined by the World Health Organization is 90 mg/m<sup>3</sup> [4]. Construction activity is one of the major contributors to the environmental impacts, which are typically classified as air pollution, waste pollution, noise pollution and water pollution [5]. Poon [6] reported that the waste generated by the building and demolition of construction projects assumes a large proportion of environmental waste in Hong Kong. Uher [7] suggested that construction activities have a significant impact on the environment across a broad spectrum of off-site, on-site and operational activities. Off-site activities concern the mining and manufacturing of materials and components, the transportation of materials and components, land acquisition, and project design. On-site construction activities relate to the construction of a physical facility, resulting in air pollution, water pollution, traffic problems, and the generation of construction wastage. March [8] observed the construction industry's environmental impacts under the categories of ecology, landscape, traffic, water, energy, timber consumption, noise, dust, sewage, and health and safety hazards. Shen et al.

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[9] classified construction environmental impacts as the extraction of environmental resources such as fossil fuels and minerals; extending consumption of generic resources, namely, land, water, air, and energy; the production of waste that require the consumption of land for disposal; and pollution of the living environment with noise, odors, dust, vibrations, chemical and particulate emissions, and solid and sanitary waste. Hendrickson and Horvath [10] considered the five largest toxic air emissions from construction, including sulfur dioxide (SO<sub>2</sub>), nitric dioxide (NO<sub>2</sub>), volatile organic compounds (VOC), toxic releases to air, and hazardous waste generated. They estimated these environmental emissions for the four largest construction sectors in the United States, namely, highway, bridge, and other horizontal construction; industrial facilities and commercial and office buildings; residential one-unit buildings and other construction such as towers, sewer and irrigation systems, and railroads. Nevertheless, their findings suggest that construction in the USA makes a smaller contribution to hazardous waste generation than its share of GDP might suggest. This probably demonstrates that the US Environmental Protection Agency moves to regulate these environmental emissions more closely.

In pursuing the mission of sustainable development, efforts towards practicing environmental management in the construction business have been growing rapidly. The environmental management system (EMS) defined in the standard ISO 14000 is promoted as a vehicle for organizations to develop environmentally friendly practices. The system provides a standard framework that includes environmental policy, planning, implementation and operation, checking and corrective action, and measurement review and improvement [11]. It was developed to assist organizations to improve their environmental performance on a voluntary basis through coherent allocation of resources, assignment of responsibilities, and continuing evaluation of practice. The findings from a recent survey show that the number of firms who have obtained ISO 14000 certification is increasing, mainly in the fields of electrical and optical equipment, basic metal and fabricated metal products, machinery and equipment, construction, and wholesale and retail trade [12]. Improvements in environmental performance in construction are on the increase, particularly in reducing the production of wastes and improving the techniques that could have harmful effects on the environment. This development, however, involves investing resources and thus presents challenges, particularly to contractors' profits-making. It appears that concern related to investment in environmental management has largely overtaken the understanding of the benefits gained by engaging in environmentally friendly construction practice. A recent survey of the Hong Kong construction industry shows that the conception that

environmental management results in many more costs than benefits is prevalent among contractors.

The major objective of this study is to identify what construction practitioners in Hong Kong consider to be the benefits of and barriers to implementing environmental management, and to investigate effective ways of mitigating the barriers. The data used for this study are from a recent survey of the Hong Kong construction industry. The survey was undertaken by sending 382 questionnaires to construction professionals, including 359 contractors and 23 project management consultants. Seventy-seven completed questionnaires were returned but five were not properly completed, thus only 72 were used for analysis. The contractors were chosen from the Hong Kong Construction Association List of Contractors approved by the Hong Kong Government [13]. In total, there are 400 contractors on the list, which is divided into 13 categories, namely, building maintenance, construction materials, consultant services, demolition, earth and geotechnical works, ground investigation, piling and foundation, interior decorations, port and marine works, public housing, roads and bridges, utilities and drainage, and others. There were 41 contractors whose correspondence addresses were not clear, thus questionnaires were only sent to 359 contractors. The respondents were in various positions, including director, senior engineer, site engineer, quality manager, site manager, safety manager, environmental management manager, and contracts manager. To test the readability of the questionnaire, a preliminary questionnaire was sent to three contractors, whose comments were incorporated in the final questionnaire. Following the survey analysis, individual interviews were arranged with five building contractors from among the questionnaire respondents. The five contractors were selected according to their activities at various construction stages: one was in the piling stage, three were engaged in superstructure works, and one was undertaking internal works. The interview discussions were to gather further comments on the questionnaire results.

## **2. Benefits to contractors from environmental management**

There are obvious benefits to the community from implementing environmental management in construction activities, such as reducing the production of wastes, and reducing the use of materials and techniques that could have harmful effects on the environment. The benefits to contractors can be in a number of ways, for example, cost savings due to the reduction of fines associated with convictions as a result of complying with environmental legislation. Existing publications have identified a number of beneficial factors (BF) in

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