BENCHMARKING DEVELOPMENT OF THE SUSTAINABILITY OF HONG KONG BUILDINGS – HKQAA SBI SUSTAINABLE BUILDING INDEX

Connie Sham[1] and Caroline Ma

Hong Kong Quality Assurance Agency, Hong Kong

[1] Corresponding Author E-mail: connie.sham@hkqaa.org , Tel: (852) 2202 9559

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ABSTRACT

This study presents the overview, development process and uniqueness of the benchmarking tool – HKQAA Sustainable Building Index (HKQAA SBI), aiming to encourage the users of buildings, such as building owners or property managers to periodically evaluate buildings' sustainability performance in terms of the triple bottom line principle, i.e. the environmental, social and economic aspects such that improvement opportunities can be identified for subsequent enhancement.

Over the past decade, various green building rating systems or certification schemes were promoted across the globe. Notwithstanding the fact that the environmental performance of buildings becomes the core issue, however, the social and economic performance also plays an important role in measuring the sustainability performance of buildings. In addition, incidents related to ageing, maintenance, safety, security, quality and environmental issues of buildings in recent years has clearly signified the need of durable and sustainable buildings. In view of this, the Hong Kong Quality Assurance Agency (HKQAA) endeavours to develop a territory-wide benchmarking tool – HKQAA SBI, which made reference to the latest international standards and best practices of the sustainability in building construction together with several key ISO standards.

The HKQAA SBI is developed as a composite index of current sustainability performance along with the building life cycle; the index encompasses 20 performance indicators (P.I.) for evaluating the performance of 10 core issues of the social, economic and environmental aspects of the building. Factual based measurement approach is adopted to reflect the status of the respective performance indicators. Building sustainability performance data were gathered by conducting a territory-wide benchmarking survey. The survey inputs were analysed via a statistical model, as such ranking for each sustainability performance indicator was generated, as a result the benchmarking tool to measure buildings' sustainability performance in Hong Kong is formulated and made known to the public.

Keywords: *Buildings Benchmarking; Building Life Cycle; Sustainability; Sustainability Performance Indicators; Sustainable Building Index.*

1. INTRODUCTION

Over the past decade, various green building rating systems or certification schemes were promoted across the globe. For instance, BREEAM is the BRE Environmental Assessment Method owned and operated in the UK by BRE Global (BREEAM, Accessed 31 May 2013); CASBEE is the Comprehensive Assessment System for Building Environmental Efficiency owned and operated in Japan by the Japan Sustainable Building Consortium (CASBEE, Accessed 31 May 2013); GREEN STAR is the environmental rating system to evaluates the environmental design and construction of buildings and communities, owned and operated in Australia by the Australian Green Building Council (GREEN STAR, Accessed 31 May 2013); LEED is Leadership in Energy and Environmental Design, which is a green building rating system owned and operated in the USA by US Green Building Council (LEED,

Accessed 31 May 2013); and BEAM Plus is the environmental assessment scheme for new buildings and existing buildings, which is owned by BEAM Society Limited, recognised by the Hong Kong Green Building Council and operated in Hong Kong (HKGBC *et al.*, Accessed 31 May 2013). This phenomenon shows that the environmental performance of buildings becomes the international core issue.

However, the social and economic performance also plays an important role in measuring the sustainability performance of buildings (Clare Lowe *et al.*, 2009). In addition, incidents related to ageing, maintenance, safety, security, quality and environmental issues of buildings in recent years has clearly signified the need of durable and sustainable buildings. In view of this, the Hong Kong Quality Assurance Agency (HKQAA) endeavours to develop a territory-wide benchmarking tool – HKQAA Sustainable Building Index (HKQAA SBI).

2. BACKGROUND OF HKQAA SBI

HKQAA SBI (The index) aims to encourage the users of buildings, such as building owners or property managers to periodically evaluate buildings' sustainability performance along with the building life cycle in terms of the triple bottom line principle, i.e. the environmental, social and economic aspects such that improvement opportunities can be identified for subsequent enhancement. The ultimate goal of the index is to drive the sustainability development in Honk Kong in the long run.

The index is not alike the common international green building rating systems or certification schemes, it focuses on the building's operational phase evaluation with regard to the triple bottom line, whilst some international green building rating systems mainly encompass the building's design and construction phases evaluation within the environmental aspect.

The index is formulated to provide a flexible application for different users, and any type of buildings, which includes domestic building, accommodation building, office building, industrial building and shopping centre.

The index offers a composite index of current building sustainability performance indicators and it encompasses 20 performance indicators (P.I.) for evaluating the performance of 10 core issues of the social, economic and environmental aspects of the building. The indicators are easily understood by various building professionals. Each indicator supplemented with a detailed or technical definition or explanation to minimise potential misinterpretation and the risk of ambiguity for each indicator.

Factual based measurement approach is adopted to reflect the status of the respective performance indicators. Building sustainability performance data were gathered by conducting a territory-wide benchmarking survey. The survey inputs were analysed via a statistical model, as such ranking for each sustainability performance indicator was generated, as a result the benchmarking tool to measure buildings' sustainability performance in Hong Kong is formulated and made known to the public.

The index raises the building sustainability awareness of both professional and the public, as clear messages of building sustainability issues are to be conveyed to the professionals who may ultimately bring about improved sustainable development in Hong Kong, on the other hand the index is designed and formulated to disseminate the message to the general public. By subscribing to the index, innovation and appropriate technology are encouraged to improve the built environment throughout the building life cycle.

3. OVERVIEW OF HKQAA SBI FRAMEWORK

3.1. FRAMEWORK DEVELOPMENT

The framework of the index is made reference to the latest international standards and best practices of the sustainability in building construction together with several key ISO standards. According to ISO/DIS 26000, the sustainable development consists of three interdependent dimensions – economic, social and environmental (International Standardization Organization, 2009). In addition, ISO/TS 21929-1 and ISO 15392 concur that the sustainability performance of buildings should be closely linked with environmental, social and economic aspects in its life cycle (International Standardization Organization, 2008 and 2006). By reviewing the common international green building rating or certification schemes and UNEP SBCI research papers, suitable Indicators of the respective Issues have been identified.

The index offers a composite evaluation method for measuring the current building sustainability performance of the social, economic and environmental aspects of a building. It focuses on measurable outcomes that can be linked to current statutory requirements, recommended practices and the Hong Kong building sustainability performance data gathered from desktop research or the territory-wide building sustainability performance benchmarking survey conducted by HKQAA.

3.2. PERFORMANCE INDICATORS

The index encompass 20 performance indicators (P.I.) for tracking and evaluating the performance of 10 core issues of the social, economic and environmental aspects of a chosen building. The performance indicators with regards to each core issues in different aspects are tabulated in table 1.

Table 1: Performance Indicators of HKQAA SBI

Aspects	Issues	Performance Indicators
Environmental	Climate Change	Greenhouse gas (GHG) Emissions
	Ozone Destruction	Release of ozone-depleting substances into the atmosphere
	Biodiversity	Ecology in building
	Use of Resources	Use of fresh water
		Use of biodegradable or organic materials
		Waste recycling
Social	Building Security and Safety	Building strength and quality
		Fire prevention
		Safety of lifts and escalators
		Emergency planning
		Designing out crime
	Health and Comfort of Users	User comfort – Lighting comfort
		User comfort – Thermal comfort
		User comfort – Noise control
		Indoor air quality
		Quality of fresh water
	Social Infrastructure	Accessibility to transportation, public facilities and barrier free facilities
	Harmonized Neighbourhood Relationship	Neighbours' satisfaction
Economic	Asset Value	Rateable value of building
	Building Maintenance	Expenses on maintaining building's operational continuity

4. TERRITORY-WIDE BENCHMARKING SURVEY

The territory-wide benchmarking survey (the Survey) was conducted by the HKQAA from July to November 2012. Information collected from the Survey provides a wealth of data on the sustainability performance in the environmental, social and economic aspects of the buildings in Hong Kong. The objective of the Survey is to find out the norms of the building's sustainability performance in Hong Kong, which form the measurement benchmarks of the Index.

4.1. METHODOLOGY

4.1.1. COVERAGE OF THE SURVEY

The Survey covers 5 building types, they are Domestic Building, Accommodation Building, Industrial Building, Office Building and Shopping Centre.

4.1.2. DATA COLLECTION AND CONVERSION

Operational performance data were collected from the buildings that fall into the scope of the survey, which covers the following issues:

- Waste recycling;
- Use of fresh water;
- Consumption of refrigerant with ozone-depleting substances;
- Use of environmentally-friendly materials;
- Criminal case reporting;
- Provision of emergency plans;
- Installation of ecological facilities;
- Greenhouse gas emissions; and
- Percentage change in rateable value of building.

In addition, the basic information of the building, such as the saleable area of the building, age of building, building type and the location of the building, was collected for analysis.

Data was collected by self-administered questionnaire. A set of questionnaire along with a cover letter was mailed, e-mailed and faxed to the building owners, property managers, incorporated owners, owners' committee, etc. of the sampled buildings.

The figure was reported on both the basis of "per 10,000 square feet of saleable are of building" and the basis of an accumulation of the data of the past 12 months, therefore the data of the buildings with different size can be analysed on the same basis.

4.1.3. SAMPLE SELECTION

Buildings from the database of the Home Affairs Department of HKSAR and those managed by HKQAA's clients were invited to participate in this Survey. In total, 813 building undertakings that fell within the scope of the survey were successfully enumerated.

Data reported by the respondents have been thoroughly checked to ensure that they are reliable for analysis. Checked items included completeness of entries, consistency

among data items and creditability of reported data. Dubious cases were followed by telephone call or by field verification visit.

4.2. RESULT

4.2.1. MAJOR FINDINGS OF THE SURVEY

As reflected in the Survey, several major findings are discovered and listed in table 2.

Table 2: Major Findings of the Survey

Findings Categories	Domestic and Accommodation Buildings	Industrial Buildings, Offices and Shopping Centre
Consumption of refrigerant with ozone-depleting substances	Over 50% of the buildings reported "0kg" consumption.	Over 80% of the buildings reported "0kg" consumption.
	For buildings using ozone depleting refrigerant, the average consumption is around "1kg". The range is from 0 to 16kg.	For buildings using ozone-depleting refrigerant, the range is from 2kg to over 1,000kg.
	The age of buildings that do not consume ozone depleting refrigerant is generally 5 years older than those buildings that consumed ozone depleting refrigerant.	No significant differences in age and saleable area between buildings that consumed or not consumed ozone depleting refrigerant.
Greenhouse gas (GHG) emission	The average emissions are 18 metric tons.	The average emissions are 178 metric tons.
	The range is from 0.7mT to over 300mT.	The range is from 0.36mT to over 3,000mT.
	The average emissions for buildings situated in Hong Kong Islands are around 4mT lower than those situated in Kowloon and New Territories.	No significant difference between "Industrial Buildings and Offices" and "Shopping Centre" on the average emissions.
	The GHG emissions of buildings aged above 30 years old are significantly lower than those buildings with less than or equal to 30 years old.	The GHG emissions of buildings aged above 30 years old are significantly higher than buildings with less than or equal to 30 years old.
Installation of ecological facilities	Over 88% of buildings installed 1 to 3 types of ecological facilities (out of 10 suggested facilities).	Over 90% of building installed 1 to 2 types of ecological facilities (out of 10 suggested facilities).
	The range is from "0" type to "7" types".	The range is from "0" type to "3" types.
	Garden, landscaping with Native Plants and Nursery Plants are commonly found.	Landscaping with Native Plants and Nursery Plants are commonly found.
	The performance of public buildings and private buildings are similar.	The performance of shopping centre, office and industrial buildings are similar.
Provision of emergency plan	Over 55% of building installed 7 to 8 types of emergency plans (out of 11 suggested plans).	Over 50% of building installed 6 to 8 types of emergency plans (out of 11 suggested plans).
	Buildings aged less than or equal to 30 years old are generally better than buildings aged above 30 years old.	Buildings aged less than or equal to 30 years old are generally better than buildings aged above 30 years old.
Use of environmentally –friendly materials	Buildings in average used 3.65 types of biodegradable materials (out of 8 suggested materials).	Buildings in average used 2.48 types of biodegradable materials (out of 8 suggested materials).
	Recycled materials, locally produced materials and biodegradable materials are commonly used.	Recycled materials and locally produced materials are commonly used.

Findings Categories	Domestic and Accommodation Buildings	Industrial Buildings, Offices and Shopping Centre
Use of fresh water	The average consumption is 215 m^3.	The average consumption is 1,201 m^3.
	The range is from 0m^3 to over 7,000m^3.	The range is from 0m^3 to over 4,400m^3.
	The consumption for buildings in Kowloon and New Territories is generally higher than that of buildings in Hong Kong Island.	The consumption for shopping centre was significantly higher than that of office and industrial building.
Waste recycling	The average recycled amount is 1,304kg.	The average recycled amount is 2,573 kg.
	The range is from 0kg to over 12,000kg.	The range is from 0kg to over 150,000kg.

4.2.2. SCORING APPROACH

By analysing the survey data with our statistical model, a representative 3-level ranking scorecard is developed for each performance indicator. The performance data collected were ranked and divided into three equal intervals. The lower and upper boundaries of the middle intervals will be set as the mark for scoring. According to different questions, the group ranked ahead will score the highest "3", the other two groups will score "2" and "1" in sequence.

5. BENCHMARKING PROCESS

The benchmarking process consists of 4 steps.

Step 1: Submission of subscription form

- Buildings wishing to subscribe to the Index should complete and submit the HKQAA SBI subscription form to HKQAA, indicating the subscription category opted for. The subscription categories are "Verified Report Disclosure" and "Self-Declared Report Disclosure".

Step 2: Filling in the building sustainability performance report

- Buildings should fill in their sustainability performance in the HKQAA SBI Metrics Handbook and Report Template.
- Note: Buildings subscribing to the "Verified Report Disclosure" category have to engaged a listed SBI verified to verify the integrity of the reported information before submitting the report to HKQAA.

Step 3: Compiling of the HKQAA SBI score

- HKQAA will calculate the Index score of subscribing buildings by comparing the buildings' reported performance to the three levels of performance targets, with a maximum score of 3 being awarded to buildings which conform to the level 3 criteria, and so on. Scores are then aggregated and averaged to arrive at the final HKQAA SBI score.

Step 4: Disclosure of reported performance

- Subscribing buildings' reported performance information will be displayed on the HKQAA SBI website.
- Buildings will be entitled to use the HKQAA SBI Mark, either "HKQAA SBI Self-Declared Mark" or "HKQAA SBI Verified Mark" in their printed materials and

websites. This Mark will also be displayed on the HKQAA SBI website next to the building's name.

6. SUMMARY

HKQAA SBI is a building sustainability performance disclosure and benchmarking scheme developed based on the latest international standards and best practices of the sustainability in building construction together with several key ISO standards, with the following benefits:

- A simple and inexpensive tool for building stakeholders to benchmark, disclosure and understand the sustainability performance of their buildings;
- Identifies areas for continual improvement, enhances the building's appreciation potential;
- Showcases the building's quality and value by reporting of sustainability performance;
- Designed with a balance of social, economic and environmental considerations;
- Facilitates buildings to measure and benchmark their sustainability performance against the norm performance of the buildings in Hong Kong as a whole.

7. ACKNOWLEDGEMENTS

With many thanks for the generous contribution of:

- Ir Prof. Peter M.K. Mok, Chairman at Hong Kong Quality Assurance Agency;
- Mr. PC Chan, Chief Operating Officer at Hong Kong Quality Assurance Agency.

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