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An empirical survey of the perceived benefits of implementing the Mandatory Building Inspection Scheme (MBIS) in Hong Kong

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Abstract

Purpose – This paper aims to review the current state of building decay in Hong Kong, and attempts to identify and analyze the perceived benefits of implementing the Mandatory Building Inspection Scheme (MBIS) via an industry-wide empirical questionnaire survey.

Design/methodology/approach – A total of 340 professional respondents who have gained hands-on experience in either new building works or building management or building repair/maintenance were requested to complete a survey questionnaire to indicate the relative importance of those benefits identified in relation to MBIS. The perceived benefits were measured, ranked and compared according to the different roles of industrial practitioners, and between the residents in private premises and those in public estates.

Findings – The survey findings suggested the most significant benefits derived from implementing MBIS to be: (1) Raise the overall building safety towards residents and the general public; (2) Create more job openings and business opportunities in building repair and maintenance services; and (3) MBIS is an effective solution to address the problems with building decay (e.g. dilapidation and control over existing unauthorized building works). The results of factor analysis indicated that the 13 perceived benefits of implementing MBIS were consolidated under three underlying factors: (1) Addressing building dilapidation and assuring building safety; (2) Improving living environment and upgrading property values; and (3) Creating more job openings and business opportunities.

Social implications – As MBIS was officially launched on 30 June 2012, it is expected to be one of the proposed effective measures in resolving the long-standing problems of building neglect and deterioration in Hong Kong and overseas, especially to those existing old private premises.

Originality/value – In the long run, the number of prematurely ageing buildings would be reduced, and the service life span of existing private premises would be prolonged. This is in line with the sustainability principle of providing a better living and working environment within the community as a whole.

Keywords: Building inspection, Building management, Building safety, Building repair and maintenance, Old private buildings, Hong Kong

1. Introduction

Buildings provide a safe and comfortable environment for living, working and other human activities. However, they will become dilapidated as time goes by; and may pose danger to the residents or even the general public. As there is a close linkage between the built environment and people's state of health (Schmitt *et al*., 1978; Tanaka *et al*., 1996; Yau *et al*., 2009). The problem of building decay has long emerged in Hong Kong, and it is not difficult to find some dilapidated buildings which lack proper building management and/or maintenance especially in the old districts such as To Kwa Wan, Mong Kok, Wan Chai, and Kwun Tong (Choi, 2008). Poor upkeep of buildings may threaten public safety and health and the residents themselves. It should be an imminent need for addressing this long-standing besetting problem of building neglect and deterioration, particularly to those existing old private premises.

The Mandatory Building Inspection Scheme (MBIS) is one of the building maintenance policies officially executed by the Government of the Hong Kong Special Administrative Region in June 2012. The objectives of this paper are to review the current situation of building maintenance and repair in Hong Kong in general, and to report on the key findings of an empirical survey on the potential benefits associated with implementing MBIS in particular. The perceived benefits of MBIS were identified, rated and ranked by the residents in private premises and public estates for cross-comparison. As the implementation of MBIS is at a germinating stage, the research outcomes of this study could provide some useful insights in facilitating the smooth implementation of the scheme.

2. Literature review on building maintenance and repair

2.1 Current situation of building decay in Hong Kong

The urban decay is becoming serious in Hong Kong day by day. The condition of the building will be deteriorated while the building age increases due to the fair construction quality and lack of proper building maintenance practices (Law, 2008). In addition, Chan and Morris (1997) also pointed out the construction speed of buildings was achieved at the expense of quality in late 1960s and early 1970s; it is consistent with the supposition of Leung and Yiu (2004) – the private buildings constructed in the 1959-1965 and 1971-1975 cohorts were vulnerable to premature deterioration of reinforced concrete because of the high chloride content of concrete used for their construction. Furthermore, Hui *et al*. (2008) believed that the hot and wet climate in Hong Kong is directly associated with the old age of the buildings, together with the less stringent statutory requirements and poor quality of construction materials and workmanship, play a role in the ageing trend.

For those buildings over 30 years old, the emergences of various building defects such as concrete spalling, water leakage, structural or non-structural cracking are commonly observed. Minor defects can generate enormous problems or even catastrophes. The outcomes of building deterioration will cause injuries or fatalities because of the sudden collapse of existing buildings or its structural elements. In January 2010, an over 55-years-old tenement block of 5 storeys of flats located in To Kwa Wan, Kowloon entirely collapsed within 20 seconds, conducive to four deaths and two injuries (Apple Daily, 2010). There are thousands of buildings in Hong Kong that are more than 50 years old. The unfortunate building collapse incident has instigated the alarming need for regular and proper building maintenance throughout the territory of Hong Kong.

In fact, those poorly maintained buildings are attributed to several causes including the difficulties encountered when implementing maintenance works and the lack of a comprehensive and effective maintenance scheme (Leung and Yiu, 2004). Besides, the maintenance works for the common parts such as entrance lobbies, access corridors and staircases are often hindered due to the multi-ownership arrangement of Hong Kong's multi-storey buildings (Lai and Chan, 2004; Yau *et al*., 2008). In addition, the lack of a comprehensive government policy on building management and maintenance, together with the unawareness of building care among building owners, contribute to the problems (Yau *et al*., 2009). Fung (2008) believed the initiatives of owners, absence of management corporations, owners' ignorance and financial difficulties are the main reasons associated with building neglect. Chan (2008) opined that several owners ignore their legal responsibilities and their building care culture is weak. Lau (2011) advocated a huge problem to be a large number of so-called "three no's" buildings in many old districts. The "three no's" denote "no management", "no maintenance" and "no owners' corporation". As a result, the problems of building maintenance are further aggravated; so a long-term holistic measure should be launched to overcome the present deteriorating situation.

According to the study of Hong Kong 2030 (2001), it was estimated that the number of old buildings will have increased drastically, especially the buildings of 30 years old or above of which the number will almost be double by 2016. With reference to the Housing, Planning and Lands Bureau (2006), there are about 39,000 private buildings in Hong Kong, about 13,000 of which are over 30 years old. Furthermore, the number will increase to 22,000 within ten years' time by 2018. A trend of fast decaying building stock has been observed. According to the Buildings Department (2012), more than eight thousands of statutory orders were issued by the Buildings Department to demolish, repair or investigate the defective buildings or its elements within the period from 2006 to 2012. The large number of statutory orders revealed the serious situation of the dilapidated buildings in Hong Kong (Table 1).

Table 1. Statutory orders issued on dangerous buildings, investigation on buildings defects and defect drains (Buildings Department, 2012)

Year	Demolition	Building repairs	Investigation on buildings defects	Defective drainage repair / investigation	Total
2006	14	636	47	344	1,041
2007	2	690	20	371	1,083
2008	11	459	22	435	927
2009	8	530	81	524	1,143
2010	13	1319	326	588	2,246
2011	6	394	44	352	796
2012	1	307	182	321	811
Total number of statutory orders issued (2006 - 2012)					8,047

Over the years, the Government of the Hong Kong Special Administrative Region has implemented a basket of schemes like the voluntary Building Safety Inspection Scheme (BSIS), Building Safety Loan Scheme (BSLS), Coordinated Maintenance of Buildings Scheme (CMBS) and Building Management and Maintenance Scheme (BMMS) which aimed to resolve the problems of building neglect (Poon, 2008). Although these measures have not completely settled the problems, they have enhanced the public awareness of building management and maintenance. The incentive towards the building owners to carry out proper maintenance to their buildings has been increased gradually (Housing, Planning and Lands

Bureau, 2006). However, it should be noticed that the Building Management Ordinance (Chapter 344), Buildings Ordinance (Chapter 123), Deed of Mutual Covenant and Government Lease have stipulated that it is the duty of private building owners to maintain their buildings in a good and substantial repair and condition (Chick, 2003). Thus, there should be a scheme in place to remind and ensure the owners to take their responsibility for the upkeep of their buildings in the long run.

An extensive desktop literature search proved that proper maintenance of buildings can maintain or even enhance their property values (Chau *et al*., 2003; Hui *et al*., 2008; Martinaitis *et al*., 2004, Robinson and Reed, 2002). Besides, a well-organized and properly preventive maintenance programme can ensure healthy building conditions by avoiding maintenance failures as reported by Small (2009); and the owner may also participate in building care with a view to better living environment and healthier lives (Yau, 2010). Fong (2008) pointed out that if the life of the building can be prolonged, it can save money incurred from repair and maintenance works in the long run.

2.2 Execution of building inspections in different countries or cities

Various mandatory building inspection measures have been implemented in different countries or cities, for example, in Singapore, New York City and City of Chicago. These countries or cities have promulgated their own building inspection schemes in 1990s which is much earlier than MBIS in Hong Kong. The implementation details of individual schemes, such as target buildings, inspection cycle, scope of inspection items, etc varied between different countries or cities. For instance, the target buildings requiring mandatory inspections in Singapore cover non-residential buildings up to the age of 5 years old and residential buildings up to the age of 10 years old. In contrast, all kinds of buildings would be inspected regularly depending on the building height or floors but regardless of their ages in both New York and Chicago. The full implementation mechanisms of the three schemes have been compared with MBIS and were documented in a recent journal paper by Chan *et al.* (2014).

3. Mandatory Building Inspection Scheme (MBIS)

With the purpose of engaging the whole community in putting into place long-term measures to resolve the problem of building neglect and deterioration, the Housing, Planning and Lands Bureau (HPLB) conducted a two-stage public consultation in 2003 and 2005, respectively (Development Bureau, 2010a). Based on a community consensus reached through extensive public consultations over the years, the government announced in Mid-2007 a plan to legislate for the implementation of the Mandatory Building Inspection Scheme (MBIS).

According to the Development Bureau (2010b), the Buildings (Amendment) Bill 2010 had already stipulated the statutory framework for MBIS. It was introduced into the Legislative Council (LegCo) on 3 February 2010 for scrutiny by the members. With the enactment of relevant amendments to the Buildings Ordinance through the Buildings (Amendment) Ordinance 2011 in June 2011 and the subsidiary legislations including the Building (Inspections and Repairs) Regulation in December 2011, the MBIS was introduced (Buildings Department, 2012).

The Buildings Department (2012) indicated that the registration of Registered Inspectors (RIs) responsible for statutory building inspections and supervision of prescribed maintenance works after inspections has commenced since 30 December 2011, and favourable responses and intense support have been solicited from the practising construction professionals including architects, engineers and surveyors in town. Full implementation of MBIS came into operation on 30 June 2012. The milestones of the development of MBIS are listed in Table 2 for reference.

Table 2. Milestones of the development of MBIS in Hong Kong (Chan *et al.*, 2014)

Time	Event
December 2003	First stage of public consultation paper on building management and maintenance was published (Housing, Planning and Lands Bureau, 2004).
October 2005	Second stage of public consultation paper on proposed mandatory building inspection was published (Housing, Planning and Lands Bureau, 2006).
Mid-2007	Government announced the legislation plan for the implementation of MBIS.
3 February 2010	The Buildings (Amendment) Bill 2010 was introduced into LegCo for scrutiny by the members.
June 2011	The Buildings (Amendment) Bill 2010 was passed as the Buildings (Amendment) Ordinance 2011 and enacted.
August 2011	The draft Code of Practice for MBIS was first published by the Buildings Department.
December 2011	The subsidiary legislations including the Building (Inspection and Repair) Regulation of the Buildings (Amendment) Ordinance 2011 introducing MBIS was enacted.
30 December 2011	The registration of Registered Inspectors (RIs) commenced.
30 June 2012	Full implementation of MBIS commenced.

3.1 Implementation of MBIS

According to the Buildings Department (2011), the Buildings (Amendment) Ordinance 2011 incorporated and promulgated both the MBIS and the Mandatory Window Inspection Scheme (MWIS). The essential features of MBIS are enumerated in Table 3 for perusal.

A prompt solution to the control of building decay is through legislation of the Mandatory Building Inspection Scheme (MBIS) for ensuring regular building inspections and timely repairs. The MBIS was developed to cover existing private buildings aged 30 years old or above, except domestic buildings not exceeding three storeys. The BD requires these building owners to carry out the prescribed inspection and repair works found necessary of the common parts, external walls, projections and signboards of the buildings under the supervision of an RI once in every ten years.

Table 3. Essential Features of MBIS (Chan *et al.*, 2014)

Feature	Details
Age of target buildings	Any private buildings aged 30 years old or above (except domestic buildings not exceeding 3 storeys in height)
Inspection cycle	Once in every 10 years
Scope of inspection items	Only building elements essential to public safety: External elements and other physical elements; structural elements; fire safety elements; drainage systems; and unauthorized building works (UBW) in the common parts and on the exterior of the building
Qualifications of professional service providers	Registered Inspectors (RIs) under Buildings Ordinance: Authorized Persons (APs), Registered Structural Engineers (RSEs), Registered Architects, Registered Professional Engineers of the relevant disciplines, and Registered Professional Surveyors of the relevant disciplines, who have possessed relevant work experience in the field of building construction, repair and maintenance based in Hong Kong
Implementation of prescribed building repair and maintenance works	Registered Contractors (RCs): Registered General Building Contractors (RGBCs) and Registered Minor Works Contractors (RMWCs) of the appropriate class or type under the Buildings Department

Each year, the BD will select a total of 2,000 existing private buildings (500 quarterly) for serving the statutory notices under the MBIS. The target buildings selected each year for implementing the MBIS would represent a mix of buildings in different conditions and age profiles in different districts. A selection panel comprising representatives from relevant professional institutions, relevant non-government client organizations, property management professionals, District Councils in old districts and relevant government departments, was established to advise necessary advice and opinions to the BD on the selection of target buildings. In order to arrest the long-standing building neglect problems in Hong Kong, the enthusiastic participation and continuous support from the construction professionals is crucial. A holistic overview of the historical development and implementation mechanism of MBIS can be referred to the paper by Chan *et al.* (2014) for reference.

4. Research methodology

An industry-wide empirical questionnaire survey was conducted from March to April of 2013 in Hong Kong to collect the views and opinions of various key project stakeholders on the perceived benefits of implementing MBIS within the construction community. A total of 13 perceived benefits of MBIS identified from the contemporary literature constituted the basis of the survey questionnaire, followed by a "pilot" survey with some well-experienced experts in new building construction or building repair and maintenance to verify the adequacy of items and clarity of the survey form. So the final survey form was found sufficient, clear and appropriate.

Respondents were requested to rate their levels of agreement against each of the identified benefits according to a five-point Likert scale from 1 to 5, where "1" represented "strongly disagree", "3" = "neutral or no comment" and "5" denoted "strongly agree" on the statements. Electronic mail communications were launched wherever possible towards the target

respondents for reminding the return of completed questionnaires before the stipulated deadline. Respondents were also invited to suggest and rate any other unmentioned benefits on the survey form based on their personal discretion and actual experience, but ultimately no new benefits were proposed by them.

4.1 Collection of research data

Industrial practitioners, including those from the relevant government works departments, related non-government client organizations, private property developers, project consultants, contractors and property management companies in Hong Kong, were the target respondents of the questionnaire survey. The target survey respondents from relevant government works departments including the Buildings Department (BD), Architectural Services Department (ArchSD) and Housing Department (HD) were randomly selected from the website of the "Telephone Directory of the Government of the Hong Kong Special Administrative Region and Related Organizations". The construction professionals from these three departments including architects, engineers and surveyors are most likely involved in MBIS or building maintenance works. Questionnaires were sent to different client organizations including both the public sector and private sector as well. The public client organizations consist of the three mentioned works departments, the Hong Kong Housing Society (HKHS) and Urban Renewal Authority (URA). The target private property developers, project consultants, contractors and property management companies were selected through the personal networks and contact lists from the past research projects of the researchers.

Altogether, 852 sets of self-administered blank survey questionnaires were dispatched to individual target respondents by means of postal mail, electronic mail and hardcopy distribution by hand. All the key potential project stakeholders in relation to MBIS from relevant government works departments, prospective private property developers, consulting firms, main contractors, subcontractors and property management companies had been covered in the list of target respondents of the questionnaire survey. They included architects, building surveyors, structural engineers, property services managers, maintenance surveyors, technical officers, quantity surveyors and project managers. Thus, their perceptions and opinions gleaned could substantially represent the construction and building maintenance industry on the implementation of MBIS. Finally, there were 340 completed survey questionnaires returned with a response rate of about 40%. The possible reasons for those who did not return their questionnaires are that the respondents did not know much about MBIS or they were busy with their current personal work commitments. Hence, the data analysis of this research study was based on 340 valid survey questionnaires.

In this paper, the respondents' level of agreement on the 13 perceived benefits will be compared based on their current residences as MBIS only targets at the old private buildings which exclude the public sector residential estates. "Owned private premises" and "Rented private premises" will be grouped into the "Private group" whereas "Owned public flats for sale" and "Rented public flats" will be classified into the "Public group". Altogether, 66.5% of the respondents lived in private premises while 26.1% lived in public flats and the remaining 7.4% fall outside of these two groups. All the respondents were experienced professionals in either "new works" or "building management or repair/maintenance" who should be able to give reliable data and genuine opinions to the research (Table 4). More than two-thirds of the respondents had acquired over 5 years of working experience in 'new works' while nearly one-third of them had gained less than 5 years of experience within the construction industry. Over 45% of the respondents had derived over 5 years of working experience in "building management or repair/maintenance" (Table 4). As all the respondents

possessed direct hands-on experience in the construction or repair/maintenance industry, their opinions solicited from the questionnaire survey would be reliable and representative of the survey population, and reflected the perceived benefits of implementing MBIS. The survey data were analyzed using the Statistical Package for the Social Sciences (SPSS).

Table 4. Background information about the survey respondents

Information about respondents	Number of respondents	Percentage
A. Type of organization		
1. Public Client	80	23.5%
2. Private Client	50	14.7%
3. Consultant	85	25.0%
4. Contractor	96	28.2%
5. Property Management Company	29	8.5%
Total	**340**	**100%**
B. Years of working experience in new works		
1. No experience	24	7.1%
2. Less than 5 years	86	25.3%
3. 5-10 years	68	20.0%
4. 11-15 years	47	13.8%
5. 16-20 years	31	9.1%
6. More than 20 years	84	24.7%
Total	**340**	**100%**
C. Years of working experience in building management or repair/maintenance		
1. No experience	72	21.2%
2. Less than 5 years	112	32.9%
3. 5-10 years	46	13.5%
4. 11-15 years	37	10.9%
5. 16-20 years	29	8.5%
6. More than 20 years	43	12.6%
7. Missing	1	0.3%
Total	**340**	**100%**
D. Type of current residence		
1. Private Group	226	66.5%
2. Public Group	89	26.1%
3. None of the above	25	7.4%
Total	**340**	**100%**

4.2 Statistical tools for data analysis

In our study, the five-point Likert scale was applied to calculate the mean score of each benefit according to the level of agreement given by each respondent on the survey form (i.e. 1 = Strongly disagree; 2 = Disagree; 3 = Neutral or no comment; 4 = Agree; and 5 = Strongly agree), and then used to determine the relative rankings by comparing each individual mean score, as previously adopted by Chan *et al.* (2010). The mean score determines the relative rankings of different benefits in descending order of importance. It was subsequently used to cross-compare the relative significance or importance of the benefits of MBIS between the "Private group" and the "Public group". After that, the Cronbach's alpha reliability (the scale

of coefficient) measures were used to verify the internal consistency or reliability amongst the responses under the adopted Likert scale of measurement regarding the perceived benefits of MBIS (Santos, 1999).

Based on the current residence of survey respondents, they were divided into two major groups for analysis: the "Private group" and "Public group". Kendall's concordance analysis and the chi-square test were conducted to measure the agreement of different respondents on their rankings of benefits based on mean values within a particular group (Chan *et al.*, 2010). The level of agreement between any two respondent groups on their rankings of benefits of implementing MBIS in construction was measured by the Spearman's rank correlation coefficient (r_s). The Spearman's rank correlation coefficient, (r_s) ranges between -1 and +1. A value of +1 indicates a perfect positive linear correlation while negative values indicate perfect negative linear correlation meaning that low ranking on one is associated with high ranking on the other.

The Mann-Whitney U test and the Kruskal-Wallis test are non-parametric tests undertaken to detect whether statistically significant differences or divergences exist in the median values of the same factor under study between any two respondent groups and between three or more respondent groups, respectively (Chan *et al.*, 2010). For example, in the Mann-Whitney U test, the results are interpreted by the Z-value and p-value. If the actual calculated p-value is less than the pre-determined significance level of 0.05, then the null hypothesis that no significant differences in the median values of the same factor between the respondents of the "Private group" and those of the "Public group" can be rejected. Thus, it can be concluded that the median values of a certain benefit of MBIS between the two respondent groups are significantly different from each other (Chan *et al.*, 2010).

5. Presentation and discussion of survey results

Results derived from the analysis of empirical questionnaire survey were cross-referenced to the published literature wherever appropriate. In this study, the Cronbach's alpha coefficient for the thirteen rated benefits of MBIS was 0.837 which was much higher than the threshold value of 0.70 according to Norusis (2002). It was indicated that there is acceptable internal consistency (reliability) in terms of the correlations amongst the 13 individual benefits, and the 5-point Likert scale used for measuring the MBIS benefits is reliable and internally consistent among the responses at the 5% significance level.

The perceived benefits of implementing MBIS in Hong Kong were assessed from two different perspectives of the "Private group" and "Public group". The mean scores of each benefit for each respondent group were calculated and each benefit was ranked in descending order of the mean scores within a particular group as shown in Table 5.

The Kendall's coefficient of concordance (W) for the rankings of benefits was 0.120, 0.136 and 0.103 for "All respondent group", "Private group" and "Public group" respectively. The computed W's were all statistically significant with a significance level of 0.000.

Table 5. Results of the ranking and Kendall's concordance test for the perceived benefits of implementing MBIS (Categorized by Current Residence)

No.	Benefits of MBIS	All respondent group		Private group		Public group	
		Mean	Rank	Mean	Rank	Mean	Rank
2	Raise the overall building safety towards residents and the general public.	4.13	1	4.17	1	4.07	1
7	Create more job openings and business opportunities in building repair and maintenance services.	4.06	2	4.03	4	4.04	2
1	MBIS is an effective solution to address the problems with building decay (e.g. dilapidation and control over existing unauthorized building works).	4.04	3	4.06	2	3.99	3
4	Assure the building quality in terms of structural safety, fire safety, hygiene, environment, etc.	3.9941	4	4.0222	5	3.96	4
5	Reduce the occurrence of accidents arising from building ageing and deterioration (e.g. concrete spalling).	3.9912	5	4.0177	6	3.94	5
3	Ensure a regular holistic building inspection to be undertaken by property owners as their legal responsibilities.	3.98	6	4.00	7	3.93	6
11	Enhance the public awareness over the importance of building upkeep.	3.97	7	4.04	3	3.85	9
6	Generate more job openings and business opportunities in building inspection.	3.96	8	3.97	9	3.88	7
10	Lengthen the service life of the existing premises.	3.95	9	3.99	8	3.86	8
8	Improve the existing living environment.	3.73	10	3.75	10	3.66	10
9	Upgrade the rental and resale value of the property.	3.62	11	3.63	11	3.55	11
12	Raise the image of Hong Kong as a world metropolitan city by maintaining the existing buildings in good condition at all times.	3.50	12	3.49	12	3.47	13
13	Reduce the financial burden of BD in carrying out regular building inspections themselves.	3.39	13	3.34	13	3.49	12
	Number (N)	323		214		86	
	Kendall's coefficient of concordance (W)	0.120		0.136		0.103	
	Actual calculated chi-square value	463.442		348.773		106.650	
	Critical value of chi-square from table	21.03		21.03		21.03	
	Degree of freedom (df)	12		12		12	
	Asymptotic level of significance	0.000		0.000		0.000	

H_0 = Respondents' sets of rankings are unrelated (independent) to each other within each group
Reject H_0 if the actual chi-square value is larger than the critical value of chi-square from table

Note: Items were rated on a 5-point Likert scale (1 = Strongly Disagree; 3 = Neutral and 5 = Strongly Agree).

Since the number of attributes considered were greater than seven, as mentioned previously the chi-square value would be referred to rather than the W value. According to the degree of freedom (13 - 1 = 12) and the allowable level of significance (5%), the critical value of chi-square from table was found to be 21.03 (Siegel and Castellan, 1988). For all the three groups (i.e. all respondent group, private group and public group), the actual computed chi-square values were all much greater than the critical value of chi-square of 21.03. They included 463.442, 348.773 and 106.650 for "All respondents", "Private group" and "Public group" respectively (Table 5). This result indicates the null hypothesis that "Respondents' sets of rankings are unrelated (independent) to each other within a certain group" has to be rejected. Consequently, there is sufficient evidence to conclude that there is significant degree of agreement among the respondents within each survey group and all respondents on the rankings of the benefits of MBIS. The concordance test ensures the data and opinions collected from the questionnaire survey to be valid and consistent for further analysis.

5.1 Overall ranking of the benefits of MBIS

The mean values for the benefits as rated by all respondents ranged from 3.39 to 4.13. For those scored by the respondents living in private premises, the mean value ranged from 3.34 to 4.17 while those rated by the respondents living in public estates the mean value spanned from 3.47 to 4.07. The results showed that the difference of the mean values for "Private group" (4.17-3.34 = ***0.83***) is greater than "Public group" (4.07-3.47 = ***0.60***) when considering all the 13 perceived benefits collectively; it reflects that the respondents living in private premises share a larger diversity of their opinions on those benefits among themselves. In general, all respondents agreed with all the 13 perceived benefits of implementing MBIS as all the mean values were above 3 (spanning from 3.39 to 4.13) and close to each other which were found skewed towards the "agree" category. Hence the respondents were agreeable to the benefits elicited in general but with different levels of agreement only.

All the respondents ranked Item 2 "Raise the overall building safety towards residents and the general public." as the top perceived benefit which directly echoed the primary reason for introducing MBIS by the government - the problem of building neglect poses potential threats to residents and the public (Buildings Department, 2012; Development Bureau, 2010b; Housing, Planning and Lands Bureau, 2006). The outbreak of the Severe Acute Respiratory Syndrome (SARS) and fatal building-related accidents are the catastrophic consequences of building neglect (Yau, 2010). It is expected that MBIS can ensure a regular building inspection and proper maintenance practices for the old private buildings and hence eliminating the occurrence of tragic casualties in future due to the sudden collapse of either part of the building structures or their structural elements such as concrete spalling and fall of mosaic tiles. As MBIS is a preventive approach for building inspection and maintenance, the buildings will be required to be inspected regularly and the building conditions can be recorded timely, if there are any building defects to be observed, they can be rectified before the minor defects evolve into serious problems (Chan, 2008). The MBIS covers the building elements that are essential to public safety which can ensure the building safety up to a certain satisfactory level of safety requirements and safeguard the residents and the public through the implementation of MBIS. Therefore, all the above reasons also contributed to the high mean values of the other two closely related benefits, i.e. Item 4 "Assure the building quality in terms of structural safety, fire safety, hygiene, environment, etc" and Item 5 "Reduce the occurrence of accidents arising from building ageing and deterioration (e.g. concrete spalling)".

Besides, the respondents ranked Item 7 "Create more job openings and business opportunities in building repair and maintenance services." as the second most important benefit. As the demand for Registered Inspectors (RIs) and Registered Contractors (RCs) engaged in building inspection and repair works is expected to exhibit a significant growth through the implementation of MBIS, more job openings and business opportunities will be generated in the market to undertake the potential volume of prescribed inspections and supervisions in near future (i.e. 2,000 buildings per year). It is anticipated that the building maintenance market will keep growing in Hong Kong due to a myriad of existing premises requiring timely renovations at different periods of time under MBIS and more contractors are expected to develop or expand their business in this sector. This result is in line with the findings from Choi (2008). Tan *et al.* (2012) also advocated that there will be more opportunities in repair, maintenance and renovation works than new construction for those contractors responsible for building maintenance and specialist contractors in the long run with the execution of MBIS. It is also one of the intangible benefits brought by the maintenance works of building stock (Housing, Planning and Lands Bureau, 2006).

Similar to the nature of top perceived benefit, respondents ranked Item 1 "MBIS is an effective solution to address the problems with building decay (e.g. dilapidation and control over existing unauthorized building works)." as the third most profound benefit which is consistent with the primary objective of implementing MBIS (Buildings Department, 2012; Development Bureau, 2010b; Leung and Yiu, 2004). It also reinforced the result derived in the public consultation report (Housing, Planning and Lands Bureau, 2007). Moreover, the survey finding from Yau (2010) pointed out that the private homeowners in Hong Kong were fear of punishment to engage in management and maintenance of their buildings. The general awareness of property owners of the need and obligation to maintain their properties is low and often a passive "wait-and-see" attitude is taken until problems arise (Chan, 2004). It confirmed that command-and-control mechanisms can be one of the most effective tools to mitigate and tackle the challenges towards building ageing and deterioration.

Tan *et al.* (2012) opined that well-maintained buildings can contribute to sustainable development by providing a comfortable living environment, extending the service life of existing premises and reducing embodied energy used. In short, the "mandatory" requirements towards the private flat owners can ensure the full discharge of their legal maintenance responsibility for holistic preventive measures and this feature makes MBIS an effective solution to overcome the problems of building decay.

5.2 Comparison of survey results between private group and public group

Having established the internal consistency of the rankings within the respondent groups, the next stage of analysis was to test whether there is any significant agreement / disagreement on the rankings between the survey groups, which is indicated by the Spearman's rank correlation coefficient (r_s) using the SPSS software package (SPSS, 2002). The correlation coefficient of the rankings between the "Private group" and "Public group" on the benefits of MBIS was 0.861 with a significance level of 0.000 as indicated in Table 7. Therefore, the null hypothesis has to be rejected. Hence there is adequate evidence to conclude that there is significant correlation between the "Private group" and the "Public group" in general on the rankings of MBIS benefits. In particular, the four items, Item 2 "Raise the overall building safety towards residents and the general public", Item 10 "Lengthen the service life of the existing premises", Item 8 "Improve the existing living environment" and Item 9 "Upgrade the rental and resale value of the property", were ranked the same (i.e. as the 1st, 8th, 10th

and 11th respectively by both private group and public group as discerned in Table 5), manifesting that the respondents from the private group and public group shared unanimous perceptions particularly on the rankings of these four benefits.

Table 7. Results of the Spearman's rank correlation test between the private group and public group on the perceived benefits of implementing MBIS

Comparison of rankings	r_s	Significance level	Conclusion
Private group vs Public group	0.861	0.000	Reject H_0 at 5% significance level

where H_0 = No significant correlation on the rankings between two groups

H_a = Significant correlation on the rankings between two groups

Reject H_0 if the actual significance level (p-value) calculated is less than the allowable value of 5%

The rankings of other benefits were also found to be very close to each other with the ranking variance of within two places at most except the benefit of Item 11 "Enhance the public awareness over the importance of building upkeep." ("Private group" ranked as the third and "Public group" ranked as the ninth). Since MBIS excludes the existing building stock in the public sector, the flat owners from the "Public group" may overlook or even disregard its importance. But in general, this result implies that both the respondents of the "Private group" and the "Public group" shared significant level of agreement on the rankings of perceived benefits of MBIS.

Furthermore, the Mann-Whitney U test was undertaken to examine if there were any significant differences in the median values of the responses between the two respondent groups on each of the thirteen benefits of MBIS under scrutiny. When the actual calculated p-value is less than the prescribed significance level of 0.05 for a certain benefit, a large variation in the median values is detected. As indicated in Table 9, only the actual p-value of one benefit was less than 0.05, whilst the others were not statistically significant. A significant difference in the median values between the "Private group" (163.87) and the "Public group" (141.40) was found in the benefit of Item 11 "Enhance the public awareness over the importance of building upkeep". The private sector should be much more conscious about the usefulness of MBIS than the public sector. This result has reflected that the respondents from the "Private group" were in general more agreeable to the benefits and hence rated them much higher than the "Public group" (11 out of a total of 13 items). The target buildings under MBIS only cover those old private buildings; therefore it has a direct and obvious influence on the private property owners where the respondents living in public estates may overlook or even ignore the essence of the scheme and thus affecting the rating on those perceived benefits.

Table 9. Results of the Mann-Whitney U test between the private group and public group on the perceived benefits of implementing MBIS

No	Benefits of MBIS	Mean rank		Z-value	p-value[a]
		Private group	Public group		
1	MBIS is an effective solution to address the problems with building decay (e.g. dilapidation and control over existing unauthorized building works).	162.45	146.69	-1.646	0.100
2	Raise the overall building safety towards residents and the general public.	161.81	146.61	-1.623	0.105
3	Ensure a regular holistic building inspection to be undertaken by property owners as their legal responsibilities.	160.57	149.75	-1.097	0.272
4	Assure the building quality in terms of structural safety, fire safety, hygiene, environment, etc.	160.25	150.56	-1.015	0.310
5	Reduce the occurrence of accidents arising from building ageing and deterioration (e.g. concrete spalling).	160.63	151.31	-0.940	0.347
6	Generate more job openings and business opportunities in building inspection.	160.98	148.69	-1.154	0.248
7	Create more job openings and business opportunities in building repair and maintenance services.	156.58	159.83	-0.310	0.757
8	Improve the existing living environment.	160.47	148.14	-1.195	0.232
9	Upgrade the rental and resale value of the property.	159.47	150.78	-0.831	0.406
10	Lengthen the service life of the existing premises.	161.80	144.73	-1.775	0.076
11	Enhance the public awareness over the importance of building upkeep.	163.87	141.40	-2.274	0.023*
12	Raise the image of Hong Kong as a world metropolitan city by maintaining the existing buildings in good condition at all times.	158.50	153.15	-0.507	0.612
13	Reduce the financial burden of BD in carrying out regular building inspections themselves.	150.82	163.70	-1.226	0.220

[a] p-value less than 0.05 which indicates significant statistical differences

5.3 Comparison of survey results between five organizational role groups

The Spearman's rank correlation coefficient of the rankings between the five organizational role groups (i.e. Public Client, Private Client, Consultant, Contractor and Property Management Company) on the benefits of MBIS is listed in Table 8. Among 10 combinations of comparison, the correlation coefficient of the rankings between the "Consultant" group and the "Property Management Company" group was 0.447 with a significance level of 0.125. Thus, the null hypothesis cannot be rejected in this case. There is adequate evidence to conclude that there is in general no significant correlation between the "Consultant" group and the "Property Management Company" group on the rankings of MBIS benefits, the rankings of some perceived benefits are varied, such as the benefit of Item 7 "Create more job openings and business opportunities in building repair and maintenance services." ("Consultant" group ranked as the 8th and the "Property Management Company" group ranked as the 2nd); and Item 6 "Generate more job openings and business opportunities in building inspection." ("Consultant" group ranked as the 9th and the "Property Management Company" group ranked as the 1st). One possible reason for the differences

may be due to the current state of the whole construction market in Hong Kong. Since there is an unprecedented construction boom of the Ten Major Infrastructure Projects going on at different stages of development in town, the "Consultants" may be more interested and heavily involved in these new projects rather than in the sector of building repair/maintenance and inspection works which are not discerned as their contemporary core business. However, the "Property Management Company" counterparts may disregard this factor as they are neither professional consultants nor maintenance contractors and thus not directly benefited from these new sector of projects for the time being, hence a big difference on the rankings between them.

Table 6. Results of the ranking and Kendall's concordance test for the perceived benefits of implementing MBIS (Categorized by Organization)

		All respondent group		Public Client		Private Client		Consultant		Contractor		Property Management Company	
No.	Benefits of MBIS	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
2	Raise the overall building safety towards residents and the general public.	4.13	1	4.19	1	4.14	1	4.14	1	4.05	3	4.1379	=4
7	Create more job openings and business opportunities in building repair and maintenance services.	4.06	2	4.15	2	4.04	3	3.9167	8	4.08	1	4.1724	=2
1	MBIS is an effective solution to address the problems with building decay (e.g. dilapidation and control over existing unauthorized building works).	4.04	3	4.11	4	4.08	2	4.04	2	3.98	5	4.0000	=7
4	Assure the building quality in terms of structural safety, fire safety, hygiene, environment, etc.	3.9941	4	3.91	9	4.0200	=4	3.98	3	4.06	2	4.0000	=7
5	Reduce the occurrence of accidents arising from building ageing and deterioration (e.g. concrete spalling).	3.9912	5	3.99	8	3.96	6	3.9294	=5	4.01	4	4.1724	=2
3	Ensure a regular holistic building inspection to be undertaken by property owners as their legal responsibilities.	3.98	6	4.05	6	4.0200	=4	3.94	4	3.96	6	3.9310	=9
11	Enhance the public awareness over the importance of building upkeep.	3.97	7	4.09	5	3.94	7	3.9294	=5	3.86	9	4.1379	=4
6	Generate more job openings and business opportunities in building inspection.	3.96	8	4.13	3	3.8800	=8	3.77	9	3.93	7	4.28	1
10	Lengthen the service life of the existing premises.	3.95	9	4.03	7	3.8800	=8	3.9176	7	3.89	8	4.10	6
8	Improve the existing living environment.	3.73	10	3.84	10	3.64	10	3.63	11	3.72	10	3.9310	=9
9	Upgrade the rental and resale value of the property.	3.62	11	3.58	12	3.54	11	3.66	10	3.60	11	3.76	11
12	Raise the image of Hong Kong as a world metropolitan city by maintaining the existing buildings in good condition at all times.	3.50	12	3.71	11	3.40	12	3.50	12	3.41	12	3.38	13
13	Reduce the financial burden of BD in carrying out regular building inspections themselves.	3.39	13	3.44	13	3.38	13	3.33	13	3.39	13	3.50	12
	Number (N)	323		78		50		79		90		26	
	Kendall's coefficient of concordance (W)	0.120		0.141		0.137		0.118		0.126		0.161	
	Actual calculated chi-square value	463.442		131.714		82.156		111.846		136.243		50.376	
	Critical value of chi-square from table	21.03		21.03		21.03		21.03		21.03		21.03	
	Degree of freedom (df)	12		12		12		12		12		12	
	Asymptotic level of significance	0.000		0.000		0.000		0.000		0.000		0.000	

H_0 = Respondents' sets of rankings are unrelated (independent) to each other within each group
Reject H_0 if the actual chi-square value is larger than the critical value of chi-square from table

Note: Items were rated on a 5-point Likert scale (1 = Strongly Disagree; 3 = Neutral and 5 = Strongly Agree).

Table 8. Results of the Spearman's rank correlation test between five organizational groups on the perceived benefits of implementing MBIS

Comparison of rankings	r_s	Significance level	Conclusion
Public Client vs Private Client	0.807	0.001	Reject H_0 at 5% significance level
Public Client vs Consultant	0.661	0.014	Reject H_0 at 5% significance level
Public Client vs Contractor	0.709	0.007	Reject H_0 at 5% significance level
Public Client vs Property Management Company	0.776	0.002	Reject H_0 at 5% significance level
Private Client vs Consultant	0.921	0.000	Reject H_0 at 5% significance level
Private Client vs Contractor	0.901	0.000	Reject H_0 at 5% significance level
Private Client vs Property Management Company	0.557	0.048	Reject H_0 at 5% significance level
Consultant vs Contractor	0.777	0.002	Reject H_0 at 5% significance level
Consultant vs Property Management Company	0.447	0.125*	Accept H_0 at 5% significance level
Contractor vs Property Management Company	0.674	0.012	Reject H_0 at 5% significance level

where H_0 = No significant correlation on the rankings between two groups
H_a = Significant correlation on the rankings between two groups
Reject H_0 if the actual significance level (p-value) calculated is less than the allowable value of 5%

Another obvious ranking difference between them exists on Item 1 "MBIS is an effective solution to address the problems with building decay (e.g. dilapidation and control over existing unauthorized building works)" which was ranked as the 2nd by the "Consultant" group and as the 7th by the "Property Management Company" group. The reason behind may be attributed to the fact that professional consultants including architects, engineers and surveyors perceive MBIS as effective in resolving the long-standing problems with building dilapidation based on their professional knowledge and hands-on experience. However, the non-professional staff from the Property Management Companies often undertake regular holistic building inspections and repairs as their legal responsibilities even without the execution of MBIS in town, and thus building decay will be minimized. Their divergent views led to a significant ranking variance between them in this case.

Besides, the Mann-Whitney U test was also undertaken between the five organizational role groups. Since there are too many statistical data under analysis, only those benefits less than 0.05 are indicated in Table 10, whilst the others are not statistically significant. Significant differences in the median values between the "Public Client" group (92.44) and the "Consultant" group (72.18); the "Private Client" group (36.27) and the "Property Management Company" group (46.43); the "Consultant" group (51.71) and the "Property Management Company" group (72.31) were found in Item 6 "Generate more job openings and business opportunities in building inspection." The result of Kruskal-Wallis test (Table 11) also reflected a similar significant difference in that benefit (p-value = 0.009) with the lowest mean value of 3.77 for the "Consultant" group, mean value of 3.88 for the "Private Client" group, middle mean value of 3.93 for the "Contractor" group, mean value of 4.13 for the "Public Client" group, and the highest mean value of 4.28 for the "Property Management Company" group, as indicated in Table 6. The primary reason for the differences was probably related to the current business areas of focus among the various respondent groups.

Table 10. Results of the Mann-Whitney U test between five organizational groups on the perceived benefits of implementing MBIS (only the items which have significant statistical differences were listed)

No	Benefits of MBIS	Mean rank		Z-value	p-value[a]
6	Generate more job openings and business opportunities in building inspection.	Public Client	Consultant	-2.940	0.003*
		92.44	72.18		
		Private Client	Property Management Company	-2.013	0.044*
		36.27	46.43		
		Consultant	Property Management Company	-3.189	0.001*
		51.71	72.31		
7	Create more job openings and business opportunities in building repair and maintenance services.	Public Client	Consultant	-2.164	0.030*
		90.04	75.32		
8	Improve the existing living environment.	Consultant	Property Management Company	-1.969	0.049*
		53.75	66.41		
11	Enhance the public awareness over the importance of building upkeep.	Public Client	Contractor	-2.151	0.031*
		95.88	81.37		
		Contractor	Property Management Company	-2.258	0.024*
		58.97	74.05		
12	Raise the image of Hong Kong as a world metropolitan city by maintaining the existing buildings in good condition at all times.	Public Client	Private Client	-2.064	0.039*
		70.03	57.05		
		Public Client	Contractor	-2.634	0.008*
		97.69	79.03		

[a] p-value less than 0.05 which indicates significant statistical differences

Table 11. Results of the Kruskal-Wallis test between five organizational groups on the perceived benefits of implementing MBIS

No	Benefits of MBIS	p-value[a]
1	MBIS is an effective solution to address the problems with building decay (e.g. dilapidation and control over existing unauthorized building works).	0.434
2	Raise the overall building safety towards residents and the general public.	0.558
3	Ensure a regular holistic building inspection to be undertaken by property owners as their legal responsibilities.	0.707
4	Assure the building quality in terms of structural safety, fire safety, hygiene, environment, etc.	0.777
5	Reduce the occurrence of accidents arising from building ageing and deterioration (e.g. concrete spalling).	0.457
6	Generate more job openings and business opportunities in building inspection.	0.009*
7	Create more job openings and business opportunities in building repair and maintenance services.	0.213
8	Improve the existing living environment.	0.097
9	Upgrade the rental and resale value of the property.	0.603
10	Lengthen the service life of the existing premises.	0.395
11	Enhance the public awareness over the importance of building upkeep.	0.086
12	Raise the image of Hong Kong as a world metropolitan city by maintaining the existing buildings in good condition at all times.	0.094
13	Reduce the financial burden of BD in carrying out regular building inspections themselves.	0.781

[a] p-value less than 0.05 which indicates significant statistical differences

5.4 Factor analysis of the benefits of MBIS

Factor analysis is considered as a statistical technique to identify a relatively small number of individual factors which can be used to represent the relationships among sets of many interrelated variables (Norusis, 1993). It was used to analyse data collected from the questionnaire survey and identify the underlying cluster of MBIS benefits. On top of the descriptive statistics in the previous section, factor analysis was conducted to reduce the 13 individual MBIS benefits into a more manageable number of "underlying" grouped factors.

Two analytical techniques, which are the principal components analysis (PCA) and Promax rotation method, were employed in factor analysis of this study. PCA was used to identify the underlying clustered factors and to determine the interdependence of variables due to its simplicity and distinctive characteristic of data-reduction capacity for factor extraction. PCA can generate a linear combination of variables which account for as much of the variance present in the data as possible. The 13 MBIS benefits were consolidated into three underlying grouped factors after factor analysis. The total percentage of variance explained by each factor was examined to determine how many factors would be required to represent that set of data. Principal factor extraction with Promax rotation and Kaiser normalisation was carried out through the SPSS FACTOR program on the 13 MBIS benefits from a sample of 340 responses.

There are two ways to rotate factors, namely, oblique and orthogonal. An orthogonal rotation method (e.g. varimax, equamax, quartimax, etc.) constrains factors to be independent of each other, while an oblique rotation method (e.g. promax, oblimin, quartimin, etc.) allows factors to be correlated. The results of an orthogonal rotation are in fact more complex than the results of an oblique rotation and can be misleading with the presence of significant correlations among factors (Fabrigar et al., 1999). Furthermore, many constructs in research cannot be expected to be independent of each other, so the oblique rotation approach would be appropriate to obtain several theoretically meaningful factors (Hair et al., 2010). Promax is one of the most commonly used oblique rotation methods (DeCoster, 1998; Biber, 2009) which has been adopted by a multitude of researchers (e.g. Lam et al., 2008; Karna et al., 2009; Choi et al., 2011). Therefore, Promax rotation method was finally applied to this study for further discussion. Table 12 contains the details and initial statistics for each of the 13 benefits. The total variance explained by each factor was listed in the column under "factor loading". The percentage of variance explained and the cumulative percentage of variance explained are also indicated in Table 12.

The appropriateness of employing factor analysis was assessed in this study. The sample size is considered sufficient to conduct factor analysis as it complies with the ratio of 1:5 for the number of variables involved to necessary sample size as suggested by Lingard and Rowlinson (2006), i.e. 13 MBIS benefits multiplied by 5 samples required for each factor = at least 65 samples for assuring sufficient sample size to proceed with factor analysis. The number of samples collected is 340 in this study and the condition is met. Various statistical tests were also undertaken to examine the appropriateness of factor analysis for factor extraction. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the Barlett's test of sphericity for the extraction factors can be used. The KMO value ranges from 0 to 1, where 0 implies the sum of partial correlations is large relative to the sum of correlation, and thus factor analysis would not be appropriate (Norusis, 1993). A value close to 1 indicates that the patterns of correlations are relatively compact and factor analysis would generate distinct and reliable individual factors. According to Norusis (1993), the KMO value should be greater than the acceptable threshold of 0.50 for a satisfactory factor analysis to proceed. The acceptance level of KMO value is indicated in Table 13 (Field, 2005).

Table 13. Acceptance level of KMO value (Field, 2005)

KMO value	Degree of common variance
0.90-1.00	Excellent
0.80-0.89	Good
0.70-0.79	Middling
0.60-0.69	Mediocre
0.50-0.59	Poor
0.00-0.49	"Forget it"

Table 12. Factor structure of principal factor extraction and promax rotation on the 13 benefits of MBIS

No.	Benefits of MBIS	Factor Loading	Eigenvalue	Percentage of variance explained	Cumulative percentage of variance explained
Factor 1 – Addressing building dilapidation and assuring building safety					
1	MBIS is an effective solution to address the problems with building decay (e.g. dilapidation and control over existing unauthorized building works).	0.780	4.577	35.207	35.207
2	Raise the overall building safety towards residents and the general public.	0.771			
5	Reduce the occurrence of accidents arising from building ageing and deterioration (e.g. concrete spalling).	0.707			
3	Ensure a regular holistic building inspection to be undertaken by property owners as their legal responsibilities.	0.704			
4	Assure the building quality in terms of structural safety, fire safety, hygiene, environment, etc.	0.689			
11	Enhance the public awareness over the importance of building upkeep.	0.466			
Factor 2 – Improving living environment and upgrading property values					
8	Improve the existing living environment.	0.780	1.656	12.738	47.945
9	Upgrade the rental and resale value of the property.	0.761			
12	Raise the image of Hong Kong as a world metropolitan city by maintaining the existing buildings in good condition at all times.	0.755			
10	Lengthen the service life of the existing premises.	0.688			
13	Reduce the financial burden of BD in carrying out regular building inspections themselves.	0.439			
Factor 3 – Creating more job openings and business opportunities					
6	Generate more job openings and business opportunities in building inspection.	0.931	1.140	8.770	56.715
7	Create more job openings and business opportunities in building repair and maintenance services.	0.912			

Notes:
Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy = 0.817;
Barlett's test of sphericity:
Approximate x^2 value = 1395.927;
Degree of freedom = 78;
Significance level (p-value) = 0.000;
Cronbach's α reliability coefficient = 0.837

The KMO value for factor analysis in this study is 0.817 which indicates a "good" degree of common variance and is well above the acceptable threshold of 0.50 (Norusis, 1993). The Barlett's test of sphericity is used to test the hypothesis that the correlation matrix is an identity matrix, which indicates that there is no relationship among the items (Pett et al., 2003). The value of the test statistic for Barlett's sphericity is large (chi-square value = 1395.927) and the associated significance level is small (p-value = 0.000), implying that the population correlation matrix is not an identity matrix. The Cronbach's α reliability coefficient was used for checking internal consistency (reliability) between 0 and 1, based on the average inter-item correlation. The usual rule is that if the alpha value is larger than 0.70, it can be concluded that the adopted measurement scale is reliable (Norusis, 1993). In this study, the overall alpha value for the 13 MBIS benefits was found to be 0.837, implying that there is good internal consistency (reliability) in terms of the correlations among the 13 benefits, and the adopted measurement scale is reliable. As the requirements of KMO value and the Barlett's test of sphericity are both achieved, it can therefore be concluded that factor analysis was appropriate for this research and can be proceeded with confidence and reliability.

Three underlying factors were extracted in this case, representing 56.7% of the total variance in responses, which is very close to the minimum requirement of 60% as advocated by Malhotra (1996) and Hair et al. (2010), and is well comparable to other similar values derived by Akadiri and Olomolaiye (2012) of 53%, Ward et al. (1998) of 54%, together with Akintoye and Main (2007) of 54%. SPSS drops the factors from "4" to "13" as their Eigenvalues are less than 1.0. It means that they are less influential than the three observed underlying clustered factors. The 13 original MBIS benefits were all represented in one of these three underlying grouped factors. The criteria for group classification were that variable, which has the highest loading with a value larger than 0.50 in one component, belongs to that component (Awakul and Ogunlana, 2002). The first three grouped factors accounted for 35.21%, 12.74%, 8.77% of the variance, respectively.

All factor loadings of the 13 individual MBIS benefits were either higher than 0.50 or very close to 0.50 as suggested by Holt (1997). The higher the absolute value of the individual factor loading, (which cannot exceed a maximum of 1.0), the more a particular individual factor contributes to the underlying clustered factor (Proverbs et al., 1997). The values reflect the degree of contribution of individual factors to each underlying grouped factor. It is observed that the factor loadings and the interpretation of the individual factors extracted were reasonably consistent and sufficient. Figure 1 provides a plot of total variance associated with each underlying grouped factor. The plot indicates a distinct break between the steep slope of the large individual factors and the gradual trailing off of the rest. This gradual trailing off is called the 'scree' because it resembles the rubble that forms at the foot of a mountain (Norusis, 1993). The figure confirms that a 3-factor model should be sufficient for the research model. A positive sign of the factor loading represents that the individual factor is positively correlated to the MBIS benefits.

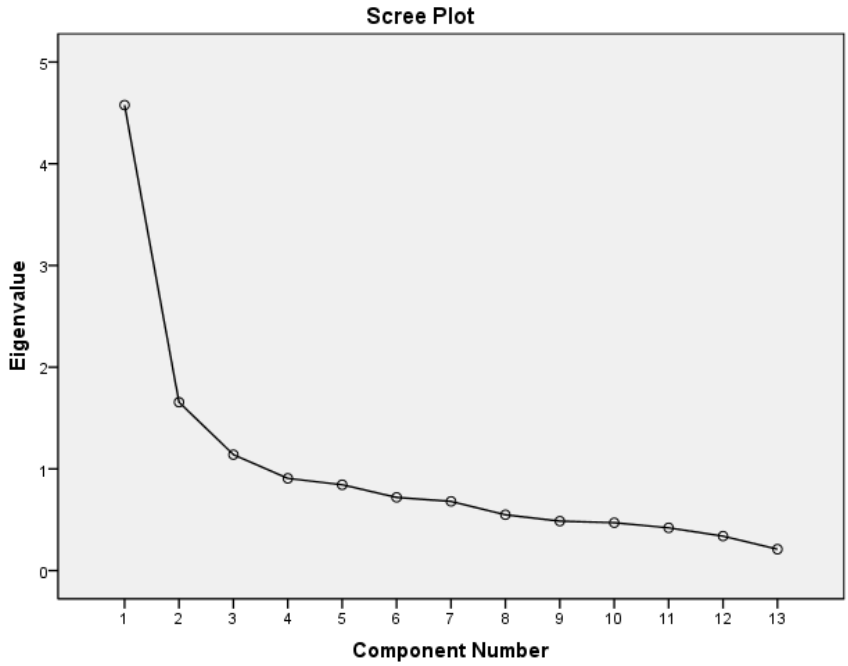

Figure 1. Scree plot of the 13 benefits of MBIS

5.5 Interpretation of the underlying grouped MBIS benefits

The grouped MBIS benefits were analyzed in descending order of significance to determine underlying features that linked them. In order to facilitate the explanation of the results of factor analysis, it is necessary to assign an identifiable, collective label to the groups of individual factors of high correlation coefficients, as each of the underlying grouped factors is an aggregation of individual factors (Sato, 2005). It is however stressed that the suggested label is subjective and other researchers may come up with a different label. The meanings of the three underlying grouped benefits of implementing MBIS are interpreted as follows (Table 14).

5.5.1 Factor 1 – Addressing building dilapidation and assuring building safety

Factor 1 is composed of six benefits primarily focusing on addressing building dilapidation and assuring building safety. It includes: MBIS is an effective solution to address the problems with building decay (e.g. dilapidation and control over existing unauthorized building works), raise the overall building safety towards residents and the general public, reduce the occurrence of accidents arising from building ageing and deterioration (e.g. concrete spalling), ensure a regular holistic building inspection to be undertaken by property owners as their legal responsibilities, assure the building quality in terms of structural safety, fire safety, hygiene, environment, etc., and enhance the public awareness over the importance of building upkeep. The overall result reflected that MBIS is one of the effective ways for addressing the problem of building dilapidation in Hong Kong. Yau *et al*. (2009) mentioned that Hong Kong is in lack of a comprehensive government policy on building management and maintenance, together with the unawareness of building care among building owners, and they were contributed to building decay. Small (2009) pointed out that a well-organized and properly preventive maintenance programme can ensure healthy building condition at all times by avoiding maintenance failures. Thus, MBIS can act as a preventive policy for managing and maintaining the existing premises in healthy condition and can also enhance the importance of building upkeep towards building owners.

5.5.2 Factor 2 – Improving living environment and upgrading property values

Factor 2 consists of five benefits which are concerned with the living environment, building conditions, image of Hong Kong and financial consequences after implementing MBIS. It includes improving the existing living environment, upgrading the rental and resale value of the property, raising the image of Hong Kong as a world metropolitan city by maintaining the existing buildings in good condition at all times, lengthening the service life of the existing premises, and reducing the financial burden of BD in carrying out regular building inspections themselves. Tan et al. (2012) opined that a proper maintenance scheme for the dilapidated buildings can contribute to sustainable development by providing a more comfortable living environment and extending the service life of the existing premises. A plethora of reported literature have substantiated that proper maintenance of buildings can maintain or even enhance their property values (Chau *et al*., 2003; Hui *et al*., 2008; Martinaitis *et al*., 2004; Robinson and Reed, 2002).

5.5.3 Factor 3 – Creating more job openings and business opportunities

Factor 3 comprises two benefits solely related to the creation of job openings and business opportunities in building inspection, repair and maintenance services. Tan *et al.* (2012) advocated that there will be more job opportunities in repair, maintenance and renovation works than new construction for those contractors responsible for building maintenance and specialist contractors in the long run with the execution of MBIS. It is also one of the intangible benefits brought by the maintenance works of building stock (Housing, Planning and Lands Bureau, 2006).

After the classification, the factors were ranked by using the Factor Scale Rating as adopted by Cheung (1999), Hair et al. (2010), Chong and Zin (2012), and Chen (2013). This is to understand the viewpoints of the respondents based on mean scale rating and the formula as follows:

$$F_i(SR) = \frac{\sum_{j=1}^{n} A(SR)_{ij}}{n}$$ where F_i (SR) is the factor score based on scale rating and A $(SR)_{ij}$ is the mean scale rating of the j-th item. For example:

$$\text{Factor scale rating 1} = \frac{\text{Mean of the items under Factor 1}}{\text{Number of items under Factor 1}} = \frac{4.04 + 4.13 + 3.9912 + 3.98 + 3.9941 + 3.97}{6} = 4.01755$$

According to the Factor Scale Rating of the three Factors listed in Table 12, the factor ranking scores indicated that the respondents perceived the Factor 1 "Addressing building dilapidation and assuring building safety" as most important benefit of MBIS, followed by the Factor 3 "Creating more job openings and business opportunities" and finally the Factor 2 "Improving living environment and upgrading property values)" in relative terms (Table 14).

Table 14. Ranking results of factor scale rating for the benefits of MBIS

Factor	Factor label	Factor scale rating	Ranking
1	Addressing building dilapidation and assuring building safety	4.01755	1
2	Improving living environment and upgrading property values	3.638	3
3	Creating more job openings and business opportunities	4.01	2

6. Conclusions

The primary objective of this paper was to review the current state of development of MBIS in Hong Kong and to investigate the major potential benefits of implementing MBIS as perceived by the key project stakeholders in either new building construction or building repair and maintenance. A total of thirteen statements describing various benefits of MBIS were compiled and ranked by a group of target industrial practitioners with direct hands-on experience in either new works or building management or repair/maintenance works via an empirical questionnaire survey. It also aimed to compare the ranking patterns and to test for any significant agreements or disagreements among the survey respondents in terms of their current residence and their organizational groups.

Generally, the industrial practitioners agreed that MBIS can raise the overall building safety towards residents and the general public. Both the “Private group” and “Public group” ranked it as the top benefit. They agreed that the implementation of MBIS can brought numerous benefits to Hong Kong, including creating more job openings and business opportunities in building repair and maintenance services, addressing the problems with building decay, assuring the building quality, reducing the occurrence of accidents arising from building ageing and deterioration, ensuring a regular holistic building inspection, enhancing the public awareness over the importance of building upkeep, generating more job openings and business opportunities in building inspection, lengthening the service life of the existing premises, improving the existing living environment, upgrading the rental and resale value of the property, raising the image of Hong Kong and reducing the financial burden of BD. Three underlying grouped benefits of MBIS have been derived through factor analysis, that is: (1) Addressing building dilapidation and assuring building safety; (2) Improving living environment and upgrading property values; and (3) Creating more job openings and business opportunities. Therefore, the execution of MBIS will be directly beneficial to overall building safety and public safety, and will also indirectly bring about positive effects to the property values and the job market.

The full implementation of MBIS has commenced since 30 June 2012. Although the effectiveness of it is still not fully known at this stage, it is expected to change the current situation. However, private property owners are required to take holistic preventive measures to maintain the overall safety of their own buildings as their legal responsibilities under MBIS, and the public awareness over the importance of upkeep of their properties can be enhanced. Its perceived benefits were taken into account of various key stakeholders including property owners, government, industrial practitioners and the general public and it is hoped that they can be achieved. The success of MBIS can resolve the long-standing problems of building dilapidation and building neglect in Hong Kong and overseas, and prevent any kinds of accidents relating to building deterioration from happening again.

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