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ORIGINAL RESEARCH ARTICLE

The effects of green management practice on organizational performance success: An empirical study in HK building industry

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ABSTRACT

Building development has been causing adverse environmental effects with emissions of greenhouse gas in the range of about 40% and consumed energy of about 35% in 2018 in developing countries. Expediting green management practices in an environmental, economic, and social manner becomes crucial in the building industry. Guiding from the systematic literature review, a whole building life cycle engagement of Green Marketing Strategy (GMS) and Green Technology Development (GTD) as green management practices to achieve organizational performance success in terms of Green Performance Success (GPS) & Finance Performance Success (FPS) lacks scholars' studies. From a theoretical point of view, the pre- and post-building phases' critical factors should be further explored and investigated. Few research studies can be identified for the conventional construction projects in selecting critical organizational performance success factors in their pre- and post-project stages. This research aims to provide an understanding into the effects of the green management practices on organizational performance success through a questionnaire survey follows by post-survey interviews, case studies, and green expert interviews so as to incentivize the promotion of the green management practices to combat global warming and greenhouse gas emissions. The results of a moderated hierarchical regression analysis revealed that green management practices in terms of green marketing strategy and green technologies development have a significant impact on firm performance in terms of green performance success and financial performance success. Further investigations of how the supplier cooperation and green building uncertainty moderate green management practices on organizational performance are studied. The experts' interviews directed that the government take a leading role in asserting green management practices implementation, particularly in making green building development mandatory. Advanced construction information technology (e.g., building information modeling) should be used to inspire the building process to generate and manage building data to improve the green building technological design incorporation to recycle the building elements with waste reduction. Above all, the instituting of a robust and operational market platform for the green materials and products with a performance index would enhance the vision and mission of green marketing strategy to reduce the materials costs progressively. Commitment and cooperation of suppliers to deliver suitable green performance materials and products is also beneficial to the building industry. As the study indicated, the higher level of technological and logistical integration with the suppliers' base will lead to higher levels of environmental collaboration and building firms' performance.

Keywords: Green Management Practices; Green Marketing Strategy; Green Technologies Development; Supplier Cooperation; Green Building Uncertainty

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1. Introduction

1.1 Research purposes and motivations

1.1.1 Research background

The buildings were responsible for greenhouse gas emissions (GHG) and energy consumption in the developing countries with 40% and 35% respectively in 2018[1]. The increase has accounted for a 7% rise since 2010. It may be double or potentially triple in the next centuries, an alarming level for the global warming effect that an urgent call should

be demanded to preserve the natural resources and sustain green and healthier well-being.

What about Hong Kong? The dominant source of GHG comes from the generation of electricity amounting to about 70%. Building and construction activities/operations in Hong Kong have consumed about 89% of electricity, mainly from air conditioning, lighting systems, and water pump systems. That means buildings in Hong Kong contribute to about 60% of GHG emissions. The second-largest source is 16% from the transport sector and 14% from waste management[2]. Hence, bringing down the consumption of electricity in the building operations will definitely curtail a large amount of GHG emissions in Hong Kong.

1.1.2 Arguments

Effective environmental management or commonly called green management is particularly crucial in the construction industry, which usually involves multi-parties. Green management is a prerequisite to link up all concerted efforts of all parties concerned to allay the negative impacts of the environmental performance of building development, operations, maintenance processes, and engineering systems throughout their building life cycle[3]. In the systematic literature review, two elements of green management practices (GMP) in the construction industry can be established as green marketing strategy (GMS) and green technologies development (GTD)[4]. Green management is focused on monitoring both the green technologies development process and green marketing strategic running of the building development to conserve the natural resources from these GMS and GTD processes[5]. These two elements of green management practices, GMS and GTD, have been accepted as green management tools in the last decade in the Hong Kong construction industry[6].

Green technologies development is "the development to create building structures, using green construction processes and green building technologies to drive up green environment throughout the whole buildings' lifecycle"[7]. GTD will be one of the measures considered viable to implement environmental, economic, and social green in the construction industry. GTD aims not only to achieve better green performance success but also to escalate humans' productivity, health, and well-being of occupants with better internal air quality, thermal and audial comfort[8]. It is urgent to implement green management practices through various organizational strategies such as green marketing strategy, procurement policies, and green technologies development to trigger a GPS and FPS to deliver the green construction[9]. GTD adoption is not free of barriers and obstacles. Barriers such as higher cost premiums in complying with green standards and knowledge deficiency in the green products and techniques will deter stakeholders from adopting GTD in the construction industry. However, there are also drivers and challenges to adopting GTD. An increase in energy efficiency, enhancing occupants' health and well-being, conserving the natural resources, and reducing the whole building lifecycle costs were the widely accepted driving forces for GTD's adoption. Another measure is the green marketing strategy, which is a holistic marketing management process to avoid any adverse effect on human and natural green well-being[10]. GMS is adopted to add values to the customers and establish customers' long-term relationships and development in the construction field[9]. However, successful implementation of GMS requires the derivatives of green management and leadership's collective strategic principles, green vision, and mission that are of paramount importance to direct these green organizational activities and the corporate aspirations to build up a green culture in the organization.

Green management is a culture built up in the green organization aiming to improve environmental management such as developing the personnel to pursue ecological activities, ecological energy-saving systems, environmental communications, and conservation of the natural resources. Green management comprises those green leadership attributes that will be innovated under this study to integrate the GMS & GTD in pursuing the organization's performance success (OPS) inclusive of GPS and FPS of the building development firms in Hong Kong. Under the analysis of the systematic literature review from 48 papers published before the end of 2019[11], a study of the integration of GMS & GTD as green management practices is rare to use to determine the green performance success (GPS) and ultimately achieving the organization's financial performance success (FPS).

1.2 Research questions

In this connection, this research aims to bridge this research gap by proposing and validating a research model of how the green management practices of GMS and GTD influence the firm's green and financial performance in the building industry in Hong Kong. Other moderating factors that may affect the relationship between green management and firm performance during the project execution are also studied.

In light of the above objectives, the research questions can be developed as follows:

First: What kind of effects of green management practices in GMS and GTD will be placed on the building organizational performance?

Second: Are there any moderating factors that will strengthen or weaken the impact of green management practices on organizational performance?

1.3 Justifications of this research in construction industry

1.3.1 Research gap

Guiding from the systematic literature review, a whole building life cycle engagement of GMS and GTD as green management practices to achieve organizational performance success in terms of GPS & FPS lacks scholars' studies. From a theoretical point of view, the pre- and post-building phases' critical factors should be further explored and investigated. Few research studies can be identified for the conventional construction projects in selecting critical organizational performance success factors in their pre- and post-project stages. In cross-examinations with those traditional building projects, green management is unique in such ways as: multi-disciplined green experts are required and design will be prone more to be iterated to review the materials used; advanced simulation and analysis to avoid negative environmental impacts; higher construction standards for the reuse and recycles of the green materials; additional site precautions for waste management, and innovative and novel materials[12]. Hence, the success factors for the green building projects establishments and organizational performance success will not tally with those of traditional ones. Further investigations will need to sort out the inter-relationship between the design and construction phase against that for the building operation and running stage, particularly for assessing the financial performance for the whole building lifecycle costs. Previous findings have elaborated that the initial planning phase may contribute a heavy burden on the green projects due to requirements to engage large multi-disciplined green experts[13]. But what happens afterward in the operation and building maintenance stage? This points to the research gap again.

Robichaud and Anantatmula[14] and Ofori-Boadu *et al*.[15] have also emphasized the crux of the initial phase of the green management practice with organization performance success such as FPS. However, their outcomes have not been verified. Green management practice should review those constituents that may have greater stimulation of the FPS throughout the project's whole building life cycle. This further study may allow the project stakeholders to prioritize those green factors that may have a heavy impact on the project's FPS in the whole building life cycle. It is noteworthy that there is as yet little exploration of these green elements essential to encourage the adoption of green management practices in terms of GMS & GTD in the construction industry. This adoption is another research gap.

To give a glimpse of some of the green critical factors, the top most significant factors that will be overlooked are compulsory environmental stipulations by the government, tendering conditions laid down by stakeholders that may be hard to accomplish, for instance, to set up renewal energy facility to consume 30% less energy in the whole building lifecycle. Other factors may include "guidelines and criteria set up for the green procurement by the government" which is the topmost vital, followed by "building life-cycle considerations adopting green construction technology, green marketing strategy and undertaking green management" and "executives' green management commitments and requirements". A further investigation like advanced construction information technology is necessary (e.g., building information modeling to be engaged to inspire a more stringent and concise design to eliminate the design discrepancies and divergences, thus avoiding reworks. Moreover, a full green materials market database will ease the procurement process and gradually decrease the green materials' costs. Those green suppliers' performance status en-

gaged in the provision of the green materials should be built up to save the time of pre-qualification. These are all worth further investigation.

1.4 Unique characteristics of the construction industry

1.4.1 Contributions

The study of the interrelationship of GMS and GTD taking as green management practices should offer good value to the construction industry with its unique characteristics amongst other sectors. The building sector calls for the various discipline of consultants, designers, architects, contractors, sub-contractors, suppliers and manufacturers. The duration of their interactions is only on a one goes until the completion of the project. This temporary working nature will constitute a highly complex interrelationship and collaboration strategies that may be required. Green management practices with green leadership skills are therefore particularly crucial in achieving organizational performance success.

Green management is also facing the same drawback. All these multi contracting parties will work for only one project duration with a dedicated but usually tight construction period. Costs will thus be escalated, and productivity will be low. Without a possibility of long-term collaboration among these temporary partners, what can GMS and GTD in terms of green management practices, step in to manage this challenging situation for organizational performance success as both green performance success (GPS) and financial performance success (FPS)? A comprehensive study on this application is worth further research. Without adopting green management practices in GMS and GTD, a single contractor cannot deal with such challenging, innovative green procurement of technologies and materials and renewable energy facilities, particularly on a complex and large project. The integration of green marketing strategy (GMS) and green technologies development (GTD) as GMP in driving the OPS of the building field as a whole should be worth further exploration and investigation.

1.5 The significance of green management practices on organizational performance success

The 4P conventional marketing synthesis of product, price, place, and promotion is noteworthy. Still, the conversion of this concept to green marketing strategy (GMS) needs further exploration as it is a crucial process to achieve green products and services in driving the organizational performance success in terms of GPS/FPS in the building activities of Hong Kong.

In contrast, green management principles are significant in improving organizational performance success if adequately implemented. According to reference [16], the potential positive effect of green management is attributable to the following underlying factor:

- Information and analysis

The GMP to collect information and analyze the customer needs is viable to ascertain the green products specifications like energy-saving appliances on top of other customer requirements like thermal comfort, etc. Other GMP like using Quality Function Deployment and Failure Mode and Effects Analysis can be included in the design for green tools and practices[17]. This paper will seek beyond the green management concepts and find evidence of how the association of green GMS and GTD can support the company's contributions toward organizational performance success.

- Adaptation of green technologies development to green management practices

The construction sector is crucial for the economy, employment, and green environment. The growth of construction activities will reach 90% in 2030, around $16 trillion for the three major cities of the US, India, and China, accounting for 60% of the global market[18]. Green building technologies development is always a concern, but green technologies development is relatively new and will be more demanding. Its philosophy has been expanded only since the 1980s soon after the Brundtland Commission Report entitled "Our common future"[19].

Both GTD and GPS became the primary concern to all construction counterparts. Integration of GTD to green management practices should be the vital direction to be explored and adapted if organizational performance success in terms of GPS and FPS can be achieved. Adequate tools and practices should be established to achieve positive environmental effects, particularly in waste management and resource conservation, including green facilities

designed for the complete building life cycle with the least environmental disturbance. The development of green management practices in this area is the research gap that will be postulated in this study.

2. Literature review

The literature review begins with the definition of green building; green management practices followed by green technologies development (GTD), and how green marketing strategy (GMS) contributes to green management practices. Green performance success (GPS) and financial performance success (FPS) are defined as organizational performance success. Exploration is also discussed of the project building owners (PBO) is also essential in support of GPS, and their inspiration, impetus, and commitment will be investigated. The selection of drivers and barriers is made through a literature review to find the crucial moderators for this study.

2.1 Green building

Building development has been causing adverse environmental effects with emissions of greenhouse gas in the range of about 40%. It consumes energy of about 35% in 2018 in developing countries[1].

The development of green buildings can deter the negative impact on the environment, but it can also foster the needs of society and the economy. Unless the green building is well defined, it will hinder the promotion and implementation of green building. It is thus worthwhile to critically review the extant green building studies so far. Most of the green building studies predominantly dominate to deter the environmental negative effect, while others in social and economic aspects are often neglected. The following sections will give a full report regarding green building in all aspects of studies.

2.2 Green certified building

Green building is defined/certified under various green performance certification (GPC) rating tools. The leading GPC include BREEAM (Building Research Establishment Environmental Assessment Methodology) in the UK, LEED (Leadership in Energy and Environmental Design) in the USA, CASBEE (Comprehensive Assessment System for Built Environment Efficiency) in Japan, Green Globes in Canada, Green Star in Australia, Green Mark in Singapore, and BEAM Plus NB (Building Environmental Assessment Method Plus for New Building) in Hong Kong. All these GPCs were developed by the green building council in each country/region. In Hong Kong, it is HKGBC (Hong Kong Green Building Council). The assessment is carried out by professionals accredited by the local green building council. The World Green Building Council has been established to link up all these local councils over the world. Each structure of these GPCs is similar to a large extent with variations under local climatic, environmental, economic, and geographic conditions[20].

2.3 Environmental aspects

Green building studies are often laid on the efficiency in the use of energy, water, materials/resources, and GHG emissions[21,22]. For instance, design, which helps to save energy and to reduce fly ashes could be used for structural elements of green buildings, reducing the waste to the landfills[23,24]. By the same token, the implementation of precast technologies helps to reduce construction waste to a large extent[25]. Indeed, precast reinforced concrete panels and prefabricated steel are the most commonly accepted green building techniques in Hong Kong to alleviate the adverse impact on the environment[25].

2.4 Social aspects

Construction activities are a social process[26]. In the construction context, the green buildings' social aspects cover living quality, occupational health and safety, corporate social responsibilities, and future professional development[27,28]. On the other hand, in the building operation context, the green building's social aspects tally with a healthy and safe environment for all stakeholders like the construction personnel, users, occupants, and operators[29]. It was posited that social green performance indicators should be taken into account human impacts (including the occupants' perception), social impacts, and consideration of local community[30]. In some cases, the Chartered Institute of Building adopts the corporate social responsibility performance as one of the criteria when awarding contracts. This performance has motivated the building industry to place a vital focus on green social aspects in construction activities. Some gurus argued

that green education should be a social aspect dimension of the GPC rating tool over the building's whole life cycle[31]. They recommended several educated indicators to the existing GPC rating tools, including training provisions in using public transport and bikes, awareness of local environmental issues, the know-how of both national and regional green-related regulations, understanding of waste recycling and reduction and reuse. Some researchers also identified security within the campus and access provision to disabled and disadvantaged occupants as green social indicators for green universities[32]. Others have also suggested covering well-being and comfort of occupants, accessibility to public facilities, and level of awareness of green building issues[33].

2.5 Economic and cultural aspects

Apart from the environmental indicators of GPC, the significance of social, economic, and cultural aspects of green building has rarely been discussed[33]. These cover the economic value, impacts on the local economy, cultural perception, and inspiration[34]. The benefits of energy refurbishments are reflected in the cost savings that have improved energy efficiency and the potential value added to the property like improved rental value and market value[35]. These cost savings will help to shorten the payback period of investment for energy efficiency implementation to the green building.

2.6 Recent green performance assessment tools for green building

Under the consideration of the different aspects to define green building, the green building certification systems have opted to change the green performance indicators to include those social, economic, and cultural aspects of green building. For instance, one of the six categories of Green Star in Australia, Governance differs from the type of Management in BEAM Plus v2 New Building in Hong Kong. The governance category has stepped up to corporate and community levels of management, including corporate control and social responsibility, together with the provision of green education for the local community. For instance, points will be awarded for:

Corporate level reporting in green processes:

- Performance in health and safety, such as providing recreational facilities and local transport integration in the green building design.
- Economic input like the provision of local employment opportunities and adding value to the building.

Above all, the clear definition of green building should embrace the environmental aspects of green building development and the other dimensions like social, economic, and cultural green performance indicators. This clear definition of green building is important for all multi-building parties involved like the developers, architects, consultants, building contractors, sub-contractors and all other green suppliers and manufacturers so that a clear vision and mission of the green building development can be put forward to effectively reduce the carbon footprints encountered to date. The green management practices can then aim to achieve further motivation for promoting and implementing green building developments.

2.7 Green management practices

Under the study of Wu *et al*.[36], green management of the construction refers to the management actions throughout the whole building operations to avoid adverse environmental effects and preserve natural raw materials, including water and energy. Green management aims to provide occupants with a contented living environment complying with the green requirements. The green management's core value is to achieve "customers oriented with optimal impacts to the environment".

2.7.1 Customers oriented

Customers are also the end-users and the natural environment. Green management should provide an end product with a contented internal air quality, thermal, and audial comfort with the comfortable outdoor environment. An objective of green management is to conserve the natural environment and minimize its negative impacts. "The customer-oriented" can be manifested in **Figure 1**.

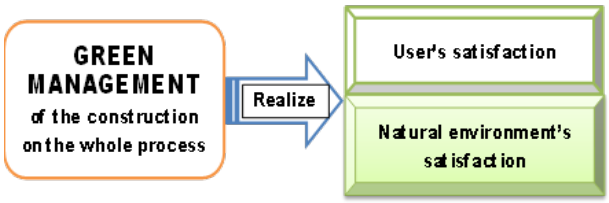


Figure 1. "The customer-oriented" flow diagram.

2.7.2 Optimal impacts on the environment

Green management pursues to maximize and sustain in the long term the building's green rewards while minimizing the building lifecycle's adverse effects on the natural environment with good considerations/implementations in each phase of programming, design, construction/rebuilding, maintenance, and waste disposal. The optimal impacts chart is illustrated in **Figure 2**.

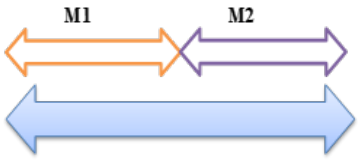


Figure 2. Optimal impacts diagram. M = min (M1 + M2). M1: environmental impacts. M2: the downsize impacts on the environment. M: entire effects on the environment.

Life cycle analysis (LCA) was considered essential to promoting the green management of the construction. The integration idea—"customers-oriented with optimal impacts to the environment" defines the green workflow process in a whole building life cycle to sustain green and healthy architecture underlying perfect guidance to green management. Green management strives to maximize the long-term green benefits of the architecture and minimize the whole building life cycle adverse environmental effects by incorporating such schemes as programming, design, and building, rebuilding, and discarding[36].

To effectuate the green management on a green building project, the following measures should be taken[37]:

(1) To implement integrated environment management to draw green rewards while alleviating the negative environmental impacts simultaneously;

(2) To set up the environmental performance desired level complying with local environmental policies and regulations, which project building stakeholders want to attain;

(3) To develop an organizational structure, identifying the relationship, responsibilities, and communications mode among important participants involved in the projects;

(4) To adopt green construction practices such as using recycled paving blocks and using precast and modular integrated construction;

(5) Finally, to set up a platform of green materials, green technologies, and green suppliers to help in regular updating and sharing of the green information to all practitioners concerned.

The green management study cannot be left behind by the study of a project manager's green management attributes. A competent project manager is vital to green performance success. There are a significant number of papers concentrating on evaluating green management styles in driving the green building delivery in the construction industry. A survey was undertaken to identify a successful and optimum green management style for managerial and executive positions for green management[38]. A green management model will be formulated with green technologies development (GTD) to identify the project manager's this green management style.

The success of green management practices relied on prime factors like the active commitment of top management, green marketing strategy with green procurement, green technology development with waste minimizing and cleaner technology advancement, green certification, and the customers' concerted support[39].

Green management practice cannot be treated as isolated action; it will correlate with various kinds of stakeholders[40,41]. For instance, if a company works with other suppliers, it will easily communicate with partners and other manufacturers like cement and steel-making factories. The company can then be more comfortable selling those residue products as raw materials to customers.

With the advance of GTD, the pivotal attributes of green management should be evaluated. Previous managerial competencies studies did not have mainly evaluated the critical skills and traits required to deliver a successful GTD project. Unlike any traditional building project, it can be evaluated that green management may face challenges such as higher green construction costs and the risks ensued from various kinds of project delivery schemes like design and build options for green projects where

the green standards may be ambiguous or difficult to achieve. It is noteworthy that it will take longer to plan and approve any innovative green products and green construction technologies for execution as no past job references can be identified. The analysis by Hwang *et al.*[37] exposed top ten challenges that would be encountered by green management in managing and control of green projects: 1) the longer duration for the pre-construction process to define green standards and the renewal energy facility to be adopted by the project stakeholders; 2) difficulty in the procurement of subcontractors with GTD experience and ability; 3) deficient in green products and equipment knowledge; 4) the high supply cost of green products and equipment; 5) substantial communications and interaction with green consultants to clarify the green specifications and standards to be followed; 6) frequent design changes to comply with adoption of green standards that may be hard to construct; 7) ambiguous terms in the green specifications in the construction details; 8) risks escalated in performing green techniques and materials; 9) non-traditional construction sequences which may not be familiar with traditional contractors; and 10) unfamiliar working sequences for green construction techniques.

These will dedicate critical green management know-how and traits that are essential to resolve the above hiccups that have been identified. After all, green manager's critical knowledge areas involve proper schedule management, planning, and control of stakeholders, communication, close coordination with green consultants and green subcontractors and suppliers, and the cost and green quality. To sum up, the crucial green management skills required are those project management competencies in problem analysis and resolution, making decisions, team building and collaboration, persuasion & motivation. The two essential constituents of green management practices are GTD and GMS, as defined below.

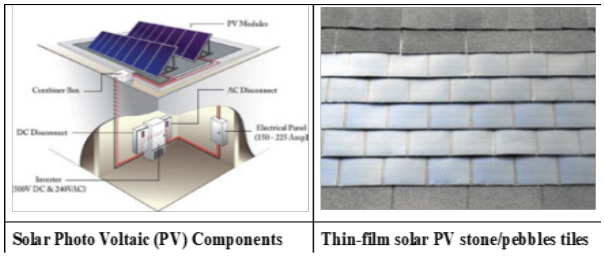
2.8 Green technologies development (GTD)

A GTD's perspective was developed from the "green revolution" that sparkled in the 1980s and was commonly referred to as intelligent buildings sustainable for future generations to preserve the natural resources[42]. GTD is focused on improving the living environment with green technologies available with good interior environmental comfort for the occupants' well-being. The features of GTD commonly acknowledged are blended with living conditions with nature and architecture and reduction of environmental pollution[43]. Aside from the above ecological benefits, green buildings are more preferred for inhabitation than those traditional ones, with the results to step up human's productivity and comfort[44].

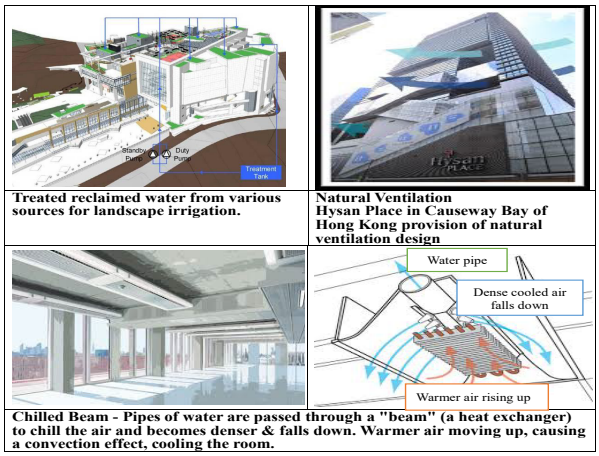
A GTD can conserve the natural environment extensively for the whole building life cycle like energy, water, and materials resulting in reducing environmental pollution and providing comfortable and healthier habitable internal spaces for the occupants' well-being[45]. Since the 1990s, GTD has pinpointed the natural environment and other green issues such as cost-effectiveness and corporate social responsibility. Green buildings have progressed remarkably worldwide with a tremendous amount of buildings graded "green"[46].

However, GTD would require new green building technologies and materials with complex architectural design, which makes GTD more challenging than traditional buildings delivery[47,48]. In a number of studies, it comes to review that the work productivity, time, and price of GTD were inferior to that of conventional projects[49–51]. Innovative organizational strategies like green marketing strategy (GMS) and green procurement policies under proper green management are crucial to the green performance success (GPS) of green projects[52]. Therefore, traditional marketing strategies and project management practices should be reformed and embedded with a green perspective so as accomplish green projects[14,15].

Despite the economic growth in the last century, almost 2 billion people still lack proper electricity supply and sanitization access. Green technologies development (GTD) in this study will target to sustain economic growth and maintain the natural resources and environmental services for our well-being. It will strive to pursue new and reliable energy development from natural resources like wind and water (see illustrations in **Figure 3(A)**) to reduce GHG emissions and environmental warming. Other examples of green technologies are shown in **Figure 3(B)**.



(A)



(B)

Figure 3. (A) Illustrations of green technologies development in renewable energy. **(B)** Illustrations of green technologies.

Illustrations of new and renewable energy development may comprise:

(1) Solar photovoltaic (PV) components draw the energy from the sun. These may be in the form of thin-film solar PV stone/pebbles tiles;

(2) Solar ventilation preheat collector operation, traps the heat in a solar wall and distribute it to all rounds of the building;

(3) Wind and water turbines transform the natural wind and water running energy into electrical energy;

(4) Heat pump drawing heat energy from the earth's inner core;

(5) Organic waste produces fuels for transportation and generate electricity.

Examples of green technologies may include:

(1) Treated-reclaimed water from cooling towers, running water from cleaning and recreational facilities for plantation of soft landscape area;

(2) The water generated from the centralized air conditioning system in the shopping mall is gathered for the plantation. Water consumption can be reduced to 68% per year and saved for the plantation;

(3) Greenings provide the mall's rooftop and elevation to the public facilities rooms;

(4) Slanted glass panes divert the sound in the balcony;

(5) Reduce 8 dB (A) can be achieved with a window with acoustic inlay;

(6) Natural ventilation design in buildings with landscape floor/refuge floor open for natural ventilation;

(7) Daylight design of the building with natural lighting in the atrium;

(8) Chilled beam—Distributed water through the ceiling pipes through a "beam" can exchange the heat to chill the air and becomes denser & falls. Warmer air moves up, causing a convection effect, and cooling the room;

(9) Modular Integrated Construction—The free unit of modules with finishes and features can be prefabricated in a factory under the Hong Kong Building Department code[53] and delivered to the site for installation;

(10) Concrete precast panel production—The precast concrete unit is produced under a Hong Kong code of practice of 2016 with a reusable mould cured in a controlled environmental condition and delivered to the site and lifted in place as a standard unit for the building.

Building activities in its lifecycle consume 35% of energy and account for 40% of GHG emissions[1]. Renewable energy sources should be considered in new buildings and existing buildings to mitigate the above effects.

The transformation of sustainable development to green development can be further elaborated as follows: Parkin[54] defined the most acceptable definition of sustainable development among almost 200 other definitions: "Sustainable development meets the current needs and aspirations without causing damages to the prospects of the future gen-

erations."[19]. The Earth Summit in 1992 defined the development of sustainability as an "Economic process to maintain in line with earth's bearing capacity". It aims to balance the needs of the community, the natural environment, and commercial development while maintaining the natural raw materials[55]. Adding the renewable energy commitment for GTD, four (4) dimensions of green technologies development (GTD) can be established:

Community GTD is obligated with a legal, moral, and ethical social responsibility of the building organizations:

(1) Natural GTD aims to minimize the use of natural raw materials and waste management;

(2) Commercial GTD will focus on high financial returns for the green building activities[56];

(3) Energy GTD obligates to innovate new and renewal energy sources to mitigate the GHG emission.

These four (4) dimensions of GTD can be illustrated in **Figure 4** below:

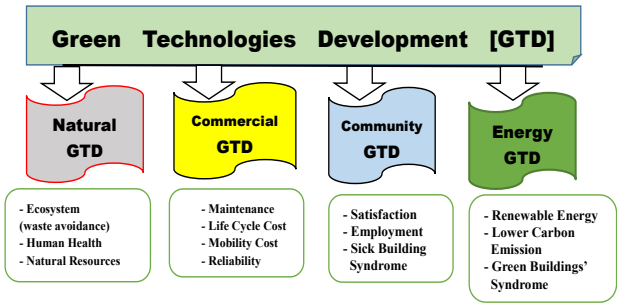


Figure 4. The four (4) dimensions of green development.

2.9 Green marketing strategy (GMS)

The 4P conventional marketing synthesis of product, price, place, and promotion is converted to a 4C sustainable marketing mix of customer resolution, customer cost, convenient accessibility, and connected exchange by McCarthy to include the criteria for sustainability into a marketing strategy. This sustainability perspective in marketing strategy can be further evolved as a green marketing strategy to place more emphasis on environmental protection, energy conservation, and renewable energy, thus transforming a sustainable marketing mix to a green marketing mix comprising of another 4C's, i.e., Corporate social responsibility, Competitive advantage, Conserve & renewable energy, and Customer relationship management.

The GMS is a process to sell products/services with green elements (1) with no harmful content, (2) that are recyclable, (3) that are made from renewable wood/bamboo products from a man-made forest, (4) having no excessive packaging and (5) that are designed to be mendable and reusable, not being thrown away.

Vinod Kumar *et al.*[57] has given a comprehensive evaluation and evolution from marketing strategy to that of green marketing strategy:

(1) Marketing strategy lays down the vital choices in products, marketing activities, and resources to the customers' satisfaction. It concerns the positioning, marketing mix, and branding strategy of the company[58].

(2) The GMS is a holistic marketing management process to avoid any adverse effect on human and natural green well-being[10].

Hence, the target of GMS is to attain a desirable competitive edge for the company[59]. It should preserve the natural raw materials and use less, but the principle of marketing is to consume further[60]. To make a balance, GMS should be formulated with a profit in return for reducing environmental impacts[10]. Thus, GMS can help achieve a competitive advantage and cost savings with innovations for better distribution and better promotion strategies. The companies should hence address the importance of GMS issues to beat down the intense competition in the green market.

Green management practice in the context of GMS aims to enhance GMS efficiency build up in the environment[61,62] as well as stepping up the OPS of a company and other parts of the GMS[63–65], thus building up the company's competitive edge in the building industry[66–68]. The merit is accrued from the growth in the constructive corporate prestige associated with the market share and profitability increase[69,70]. Various kinds of research have been made to study the critical success factors to evaluate, analyze, and monitor the organizational performance in the execution of GMP in GMS aspect[71]. The factors may cover the market pressure, organizational factors, inter-organizational factors, information management, active commitment from the top management and suppliers, and the improvement of green materials and products performance index.

2.10 The green marketing mix

In GMS, the green marketing mix will turn into a more innovative manner:

(1) Corporate social responsibility (CSR) (green products)

Green marketing is a part of the CSR to produce green products. Green products are usually durable, non-hazardous, made from reused constituents, and have eco-friendly packaging with reusable and refillable containers[72].

The GMS may cover any reusable, less packaging materials, using a sustainable source of raw materials and eco-friendly design products that are repairable and easy to dispose of, safer and more agreeable to use[73,74].

(2) Competitive advantage (green price)

Green products can charge a more competitive price by adding value to take care of the health of the customers and the communities at the same time while preserving natural resources. Consumers are more likely and willing to pay as they also contribute to greening the environment[74]. The green price can thus shape green products as a competitive edge for the company.

(3) Conserve & renewable energy (green place)

Instead of using other imported energy, the company can shift to local production. This local production will tally with using renewable energy by conserving energy use through managing the logistics of transportation. This green place strategy avoids the transport of the product from a distant area, thus reducing long transport costs and the carbon emission consequent from the different modes of transportation.

(4) Customer relationship management (green promotion)

Customer relationship management helps the consumers to access the environmental information platform to get in hold of the recent green products produced by the company together with its competitive features. This GMS not only helps to promote the relationship with the customers but also helps to promote the marketing of green products in a straightforward and convenient channel through the internet and eco-labels[75].

2.11 Why firms should adopt GMS

Many researchers have posited several rationales behind why firms should adopt the use of GMS. An environmental marketing strategy will offer an opportunity to achieve the vision and mission of the company[76]. It is believed that the firm should be more ethically and socially responsible[77]. Government regulations and stipulations have become more stringent to force firms to be environmentally concerned and responsible[78]. Eco-friendly competitors will add social and environmental pressure on firms to make changes in their green marketing strategies and activities[78]. The production and manufacturing factories have followed green production to produce green products and recycle products, thus forcing the firms to adopt the use of green products accordingly modifying their favor in green marketing development[79].

2.12 GMS in the building industry

Commencing from the late 80s of last century, green marketing building company has formulated GMS to use green eco-friendly products in response to those environmentally conscious consumers. Promotion in GMS in this kind of building company will cover the following activities:

(1) Establishing the relationship between the environment and the green product/service;

(2) Encouraging an eco-friendly lifestyle;

(3) Displaying the social responsibility for the environment.

GMS focuses the effort to produce green products that are considered safe for the environment[80]. In the context of the building industry, the green construction product is a green building. Green Building is energy efficient with lower operating costs and does not provide any adverse effects on the environment[81] incorporating:

(1) Using energy, water, and other resources efficiently;

(2) Looking after the health and environmental comfort of the users with increasing productivity;

(3) Reducing waste and recycling the use of wastewater generated in households like dishwashers, bathtubs, washbasins for plantation and other implementations[82];

(4) Setting up a renewable energy scheme in the building. Renewable energy may comprise those solar photovoltaic (PV) components to draw the sun's energy, transforming the natural wind and water running power into electrical energy and

drawing heat energy from the earth's inner core using heat pumps.

(5) Development of vegetable areas like green roofs as insulation envelops against sunlight, thus lowering the use of energy use in air-conditioning in the building. Other vegetable areas can be a rooftop or intermediate refuge floors used as a garden of the building. In all cases, the plants are freestanding planters placed on top of the top of the level of the building. The use of planting pots can be an alternative to have a pleasing greening effect. A building may have significantly lower overall energy consumption. It can rationally use raw materials and resources without any excessive burden on the environment and reduce the environmental comfort of the tenants living there. This use of raw materials is one way of achieving green products, the green building, through the adoption of GMS. Generally, construction companies do not normally formulate the GMS system.

2.13 Green performance success (GPS)

In 2009, the Green Building Council Limited in HK (HKGBC) was established to raise awareness of green building development and has updated a Building Environment Assessment Method Plus New Building (BEAM Plus NB) v2 in Sept 2019 to improve the green standards for the construction sector in HK. Based on this standard, several green performance successes (GPS) criteria are established in **Table 1**. The setup will help to evaluate the green performance success (GPS) to achieve green building construction. It will be used as a key success criterion for the green performance success (GPS) assessment in this study.

Table 1. Key GPS criteria under BEAM Plus v2 (09/2019) for evaluating the green performance under this study

GPS criteria under BEAM Plus NB v2 (09/2019)	Abbreviation
Design and build management	DBM
Green sites	GS
Waste reduction	WR
Energy consumption	EC
Water consumption	WC
Human environmental quality	HEQ
Innovations	IN

In BEAM Plus NB v2 (09/2019), credits are grouped into the following categories:

(1) DBM—Design and Build Management;

(2) GS—Green Sites;

(3) WR—Waste Reduction;

(4) EC—Energy Consumption;

(5) WC—Water Consumption;

(6) HEQ—Human Environmental Quality; and

(7) IN—Innovations.

DBM integrates design and builds, incorporating the design teams with building professionals covering all processes from design to construction with the following targets:

(1) Combines design and build to expedite the construction process;

(2) Pursue green practices and processes;

(3) Implement green design and green technologies and renewable energy facilities;

(4) Foster green building education.

GS integrates neighborhood with site location with the following core objectives:

(1) Merge the neighborhoods with the site;

(2) Enhance the use of recycled materials;

(3) Provide green site environment with plantation;

(4) Use of renewable energy for the site set up.

WR minimizes the waste accumulation by aiming to:

(1) Use the materials efficiently;

(2) Reuse and recycle the building materials; and

(3) Cut down the waste generations.

EC reduces the building operation energy consumption and focuses on:

(1) Control the use of energy;

(2) Use renewable and alternative energy facilities; and

(3) Adapt energy savings tools and equipment.

WC alleviates the water consumption by pursuing to:

(1) Conserve waste usage;

(2) Recycle the water for harvesting and washing; and

(3) Treat the water discharged from the buildings.

HEQ designs to achieve environmental comfort and air quality such as indoor environmental quality (IEQ) and concentrates to:

(1) Device for the green living;

(2) Maintain thermal and audial comfort; and

(3) Build up interior and outdoor air quality.

IN promotes and rewards true innovations and focuses to:

(1) Innovate green technologies; and

(2)Source and develop green materials.

The scoring system is devised for each of the above environmental performances for green certification with bronze to platinum medals award. **Table 2** shows the weighting % and maximum scores needed for each environmental performance category. The minimum % and scores required for gaining the green certification award are presented in **Table 2**.

Table 2. The weighting % and maximum scores to be obtained for each environmental performance category

Category		Weighting	Score
Design and Build Management	DBM	18%	20
Green Sites	GS	15%	20
Waste Reduction	WR	10%	15
Energy Consumption	EC	28%	30
Water Consumption	WC	8%	11
Human Environmental Quality	HEQ	21%	18
Innovations	IN	Bonus	10

Table 3. The minimum % scores obtained for each grade of the GPS

Award	Minimum percentage for each category	Total score
Platinum	25%	≥80%
Gold	20%	≥60%
Silver	15%	≥50%
Bronze	10%	≥30%

Table 4. Demonstration example (remarks: C = B/A; E = C × D ×100)

Classification	The credits applied (A)	The credits assessed (B)	% assessed credit (C)	The weighting (D)	Weighted assessed points (E)	Classification award
DBM	25	18	72%	18%	13.0	Gold
GS	20	12	60%	15%	9.0	Gold
WR	15	10	67%	10%	6.7	Gold
EC	30	20	67%	28%	18.8	Gold
WC	11	5	45%	8%	3.6	Bronze
HEQ	18	6	33%	21%	6.9	Bronze
IN	10	2	NA	Bonus	2.0	NA
				Overall award rating	60.0	Gold

In this example, the complete score attained is 60.0, and the rating individually in DBM, GS, WR, and EC is Gold, the rating in WC & HEQ is Bronze. However, because of adding the bonus of IN, the overall rating is 60 (≥60%) and can therefore be awarded as Gold.

The determination of GPS is rested on achieving at least a bronze medal under BEAM Plus NB v2 (09/2019). The above green performance success (GPS) achievement can provoke project building stakeholders to accentuate the green performance of the buildings and quality of well-being via better site selections with good public transportation accessibility and locally available services and integration as well as energy/water saving together with installation of renewable energy facilities throughout the whole building life cycle.

In Hong Kong, the green development was commissioned by the Government in 1997 to formulate the GTD strategies taking a deep concerted effort in balancing the environment, social and economic concerns. In 2018, the Green Building Council of HK (HKGBC) launched a green building vision—"To make homes healthier for people" that provides an action list for construction professionals, i.e.,

(1) Design to cut down the waste;

(2) Trigger the use of precast and modular integrated construction (MIC) methods to reduce waste;

(3) Conserve and enhance a different variety of natural resources;

(4) Promote the use of green building materials to avoid pollution;

(5) Preserve and recycle water usage;

(6) Install energy-saving facilities like LED lighting.

A new energy scheme has been kicked off by the Environment Bureau of HK in late 2018 to spur customers of the power company to install solar/wind power systems. The installer can sell their surplus electricity to the city network at a rate 5 times

above the present rate. This tariff fit-in arrangement will help to facilitate money return for this power generation setup and will entice others to follow suit. While complying with social and environmental requirements, GTD can also drive profits to the organization[83]. Some of the primary green drivers in HK for GTD are the government green stipulation like BEAM Plus, brand name, and the advantage over the competitors[84–86]. On the other hand, Williams and Dair[87] have reviewed several green management challenges/barriers in England via some case studies. The barriers include but are not limited to no green processes considered/favored by the stakeholders, deficient of green experts and high costs premium perceived against the actual costs, and inadequate development of green materials and technologies. Additionally, the survey of over a thousand construction business leaders by Boston Consulting Group (BCG) and MIT Sloan Management Review has revealed the lack of the right and effective green information to make green building development decisions, thus delivering defective green projects by these unqualified companies[88]. These green building development drivers/benefits coupled with their challenges/barriers will be further explored as moderators for GPS in the study.

2.14 Financial performance success (FPS)

OPS can secure several FPS to the project building stakeholders (PBS), both visible and non-visible. Under this study, the FPS will focus on the analysis and evaluation of life cycle cost savings, design savings, upgrades in the construction process/workers' productivity, and an increase in social value and status[89]. The number of FPS is shown in **Figure 5** below:

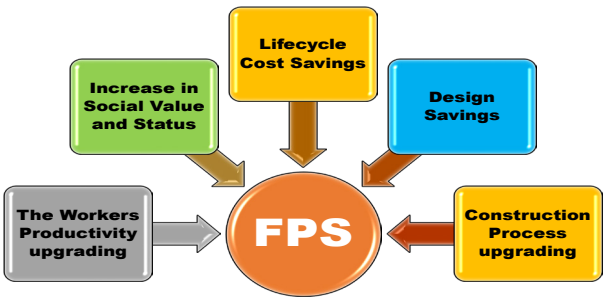


Figure 5. The number of FPS.

(1) Lifecycle cost (LCC) savings

LCC marks the holistic "costs and benefits over the life of a particular product, technology, or system"[90]. The benefits can be accrued from the savings in the optimum usage of utilities and reduced building operations and maintenance costs, comparing the projected expenses against those actually incurred[91]. As a reference, Lockwood C. has reckoned that in its initial year, one building has contributed "…42 percent less energy and 34 percent less water than standard buildings of comparable size"[92].

The savings in design come to the next source of benefit savings, including[93]:

- Use of optimally sized facility as stipulated in the design;
- Minimize the size of sewer and utility line and paving area, etc.;
- Integrated natural lighting/ventilation and highly efficient motors to optimize the design of the mechanical, electrical, and plumbing (MEP) system, particularly to reduce the energy consumed by the water pressure booster pumps system;
- Implement a grid-connected photovoltaic system for solar energy intake and the use of recycled water for washing and planting;
- Reuse and recycle materials like using locally demolished materials to reduce transportation costs and boosts the local economy.

(2) Upgrading the construction process

"Environmentally conscious construction practices can markedly reduce site disturbance, minimize the quantity of waste sent to landfills, and conserve the natural resources during construction. It can also minimize the prospect of adverse indoor air quality and thermal & audial comfort in the finished building"[94].

(3) Upgrading the workers' productivity

The improved environment air value and thermal well-being will enhance the workers' health, reduce absenteeism, decrease turnover, and increase productivity[89]. The elimination of noxious particles in the building will relieve the stakeholders' liability[95].

(4) Increase in social value and status

A building certified green will be made known and acknowledged by the public with an increase in social status and value. This increase in social value is a way to turn green to gold concept allowing the inhabitants to enjoy improved air quality and thermal and audial comfort. On the other hand, building

green should defeat the old concept as soon as the learning curve flattens and the green market reached its summit. The cost reduction of green materials has down the cost premiums of most of the green contractors. It should be noteworthy that to sustain the above FPS, the early kick-in of green experts like those beam-pro and LEED authorized persons (AP) will be beneficial to the whole green project to the fruitful achievement of green building projects with economic value and FPS.

2.15 The moderating roles of drivers and benefit

2.15.1 The drivers and benefits

The drivers and benefits of the green projects' delivery can be identified under the following categories:

(1) The Hong Kong Green Building Council (HKGBC) in 2018 envisaged that: "To make homes healthier for people and planet" which underlined core action lists for the building industry as:

- Minimizing waste in the project design;
- Promoting the Modular Integrated Construction (MIC) method to reduce waste;
- Conserving and enhancing different variety of life;
- Non-contaminating the environment, use non-contaminated construction products;
- Preserving water resources;
- Using energy-saving and efficient appliances with valid energy-efficient accredited (Energy Star) certificates.

(2) At the same time (2018), the Hong Kong Environment Bureau also launched a renewable energy scheme to spur households/companies to install renewable energy facilities such as rooftop solar or wind systems. The investors can apply to sell their excess supply to the city's power grid at up to five times the current retail price. The idea of this "feed-in-tariff" is to shorten the payback period of the investment and entice more residents and companies to make such purchases, increasing the share of clean energy in the city's primarily fossil fuel-based power generation.

(3) Project building owners' motivation and commitments

Project building owners (PBO) are vital project participants in the GD and its successful delivery of green building projects. Their motivations and commitments will definitely constitute a grave driving force toward the adoption of green project activities, which will positively impact the relationship between GM and OPS. With the PBO commitment (OC) and motivation (OM), they can assure both the green performance success (GPS) and financial performance success (FPS) of green projects. These factors can be visualized as a major source of drivers and benefits to the green project's development. Most of the core papers under the systematic literature review generally reflected the dedicated inter-relationship of various practitioners involved in the construction field about the green marketing strategy (GMS) and green technologies development (GTD). The role of PBO, the OC and OM's synergy and how the OM will increase the OC, and how OC and OM trigger the GPS and FPS in GTD remains uncertain in the extant literature review. Under the study by Krane *et al*.[96], PBO can be identified as those who finance the building projects and use the buildings as the end-users who operates and runs the building through its whole life cycle.

In cross-comparison to the conventional buildings, green buildings take more process delivery such as additional site environment precautions, renewal energy efficiency, design iterations to comply with green certifications, and repeated simulations to test the energy facilities to achieve the green objective[97]. Besides, various multi-discipline project specialists are required to participate incessantly to give their green practices competencies. Moreover, sophisticated building facilities, techniques, and materials such as chilled beams need to be integrated into the green design building system[98].

A chilled beam is a type of convection heat exchange system where a series of water pipework is pierced through a "beam" in the ceiling to chill the air passing around it. The air chilled is denser and will come down to the floor level allowing the lighter and warmer air moves upwards for the replacement. This constant air movement/interchange will ultimately cool down the environment. This difficult green building design delivery will have to call upon various participant building professionals such as green designers, green project managers, contractors, and quantity surveyors. While the above participants' role is very important to overcome the

above green complexities of the green buildings' delivery, PBS is often left behind. The involvement of PBO is termed as OC supporting the GTD in the following ways, as illustrated in **Figure 6** below.

Figure 6. The project building owners' commitment.

(1) Provide green vision and mission statement

The vision & mission statement should contain the scope, goals, and actions required to bring green building projects. The wording should be clear, concise, understandable, and achievable to all green participants[99]. The green building rating system to be adopted by PBO should be well indicated in the statement, such as BEAM Plus v2 in Hong Kong or LEED in the US.

(2) Finance the green project delivery to ensure its success

The investments placed on the green building projects will signify and accentuate the PBO's determination for green building development. A lot of researchers agreed that early resolution of PBO would indicate the SC with previous stage[100–105]. This initial green building development directive by PBO can be transformed into green mission statements to initiate the site determination with the green design set up[106].

(3) Integrate other project participants

This OC to establish the collaborative green project environment is vital to bring all participants together at the earliest stage to evolve and share green knowledge, particularly at the design stage[107]. The integration of all participants will cut down the timing for familiarization among all parties concerned, thus ensuring each participant's early contribution to secure the implementation of GTD for GPS.

(4) Embark top management support

The PBO's top management support initiation in the PBO's organizations can engage technical green professionals to support other practitioners during the GTD process. The top management on behalf of the PBO will ensure:

- that the best economically valued green design option is chosen, and
- that the PBO's investments can be paid back within the schedule defined in the project vision.

(5) Inculcate the project team participants to build up the concepts of GTD

The education of the green project team in the PBO's organization is critical to achieving the PBO's mission of GTD. For instance, PBO is the cause of green contribution to industrial building activities in India[108]. PBO often takes up the role of green project leadership, which may stimulate the education of other project team participants. The support of PBO in the educational institutions often influences the development of green research and may engage independent researchers as advisers to GTD. The findings from the researcher can often be treated as educational input to improve the GTD[107].

(6) Lead the commissioning of the green project

Various green certification schemes are available in the market such as BEAM Plus v2 (09/2019), LEED, etc., which will be considered the PBO green certification frameworks to guide the whole building lifecycle activities in its design, construction, and operation. This PBO commitment to the commission of separate experts for this green assessment should be at a very early stage of the GTD so that the green advice can be embedded in the design before construction[109].

(7) Recruit and empower green project team

PBO may participate in the procurement selection process of sub-contractors with green building experience and know-how; suppliers for the green building materials; green project teams who have experience in the GTD[100]. This participation may help to step up the collaboration of the whole working team. In certain circumstances, the PBO may lay environmental criteria as the benchmarks to choose the green building team[110].

It should be noteworthy that green building is prone to innovation. It may encounter radical transformation to suit the environmental changes in the course of construction, delivery and use in the project. The PBO empowers other green practitioners

to have a freehand to initiate and apply the creative design option, and materials are essential for the GPS. Usually, PBO will empower the practitioners to think imaginatively instead of strictly adapting the green specification and the Government's stipulations. What PBO can do in this aspect is to leave open-mindedness for the specific requirements and allow others to tinker with their imaginations to work out the best innovative solutions.

(8) Encourage improved green performance of the project participants

The GTD is often highly sophisticated and discouraging for the participants to achieve the GPS. PBO, in this aspect, can devise creative measures to encourage the participants to improve their green performance during the GTD stages. PBO may take the initiative to lay down the incentive scheme in the construction agreement with the contractors to stimulate their impetus to ramp up their GPS[111]. PBO can make use of the project meetings to evaluate individuals and reward those with high green performance. In some cases, PBO can improvise a competitive award among the project team members to step up the participants' GPS.

In support of the above PBO commitment, the pervasive incentive is the individual's level of motivation. The incentives may comprise the following as illustrated in **Figure 7** below:

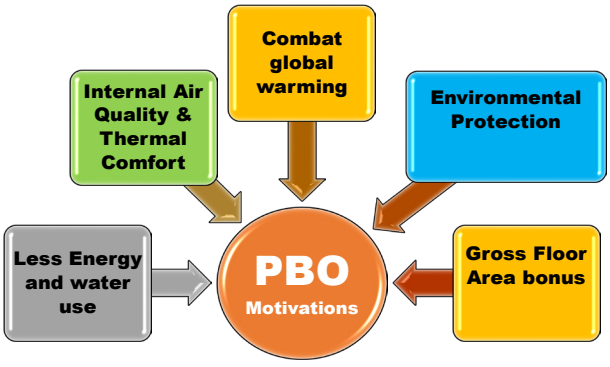


Figure 7. The project building owners' motivation.

- The concern for global warming;
- Environmental protection and
- Respect for the government green policies and regulations such as gross floor area bonus and particular loans for the GTD;
- Other functional associated benefits include energy and water conservation and improvement of internal air and comfort for the health of the occupants.

The above indicates that project building stakeholders' motivation will stimulate and encourage their commitments and in synergy, will both step up the successful GTD in the building industry. The conceptual framework below in **Figure 8** will clarify the above PBO motivation and commitment.

Figure 8. The conceptual framework for the synergy of project building owners' motivation and commitment.

As illustrated in the literature review under this study, the PBO motivation (OM) steps up their commitment towards the significant achievement of the green building projects. However, it is difficult to devise strategies to invoke this OM. At the same time, more researches are vital to discover and confirm the effects of this OM to exacerbate the green management practices in construction[112]. As part of the project participants, the PBO indicates their vision and makes their vital directives for the successful achievement of the green building projects[28,113].

2.16 Challenges and barriers

Based on the systematic literature review, green management practices may encounter various challenges and barriers that may negatively affect the relationship of GMP impact on the OPS of GMS and FPS. The top five barriers under the study of Bon-Gang[114] are listed as follows:

(1) The high initial cost of using green substitutes like compressed fiberboard for plywood. The initial cost may be ten times that of using ordinary plywood. Adapting green alternatives to meet the green certification standard may also incur a hefty initial price unless the market has flattened its learning curve.

(2) Unfair benefits distribution in that PBO will be charged a very high rate for the green building certification whilst the occupants accumulate most of the paybacks like enhanced indoor eco-friendly quality and savings in water and energy use consumption.

(3) Deficiency in green products information will force PBO to engage green professionals for a fee to meet the standards for green certification.

(4) Tough and complex government green stipulations for certifying each performance category

should be evaluated with test commission reports. This stipulation will have a demotivating effect on the PBO to go green.

(5) Unaware of the effectiveness of the green technologies as this effect on environmental performance is still uncertain and inconvincible. No empirical evidence can be found, for instance, improved indoor air quality on productivity and health.

Other Barriers can be identified from perspectives of government stipulations & policies; building products, building development organization, the property market, and the supply of building materials.

(6) Government stipulations & policies

Government policy is crucial to effectuate green initiatives in building development in Hong Kong[115]. Only the promotion by Hong Kong Green Building Council (HKGBC) is inadequate. The sufficient government policy support to attract developers to adopt green projects is essential[116]. Therefore, insufficient and ineffective governmental policy support is considered a barrier to green project development.

(7) Building products

The increase in procuring green building products can be considered the most significant barrier barring the building organizations from adopting green project practices[117]. It is estimated that green building products in China will increase the investment by 12% on average[118]. This additional cost is even higher for the first market adopter as they lack available information on the implementation of this green design and building process[119]. This financial risk may cause the developers to adopt the green project's development which may lead to the risks of eroding their FPS[120].

(8) Building development organization

Improving OPS through green project development imposes a high requisition of building industry experts[121]. It is reported that professionals who are not keen on adopting green building products tend to use more such products[119]. This overestimation will prompt the developers to use traditional procurement practices with less uncertainty[115]. It should be stressed that managers' low green awareness and bad green experience will significantly slow down/even discourage the green development adoption[119].

(9) The property market

The consumers' increasing demand for green building products will trigger the property developers' business opportunities[88]. However, should the consumers attend to the property's location and value, the demand for green products will be lower[116]. This demand happens in Hong Kong and China property market and can be a hurdle to green project development.

(10) The supply of green building materials

The lack of green building materials and authorized certifications will be considered a vital hindrance in adopting green project practices. In most countries, professionals cannot evaluate the alternative green building materials because of this certification information. Consequently, most developers are hesitant to use these non-authoritative certified green building materials[116,122].

To wrap up, challenges and barriers concerned with those uncertainties of green building performance of the green building products, lack of consumers' market demand and deficiencies of green professionals and unawareness of green building technologies and authoritative green-certified building materials[123]. These barriers, again like drivers, are wide to elaborate their effect on the relationship of green management with organizational performance success. Green Building Uncertainty (GBU) encompasses contingency factors of green building technologies and building materials, green specifications, and market prospects for inter-firm collaborations, which render difficulties in the deduction of the causal relationships of green management on the organizational performance success[124]. Thus, GBU will be chosen as another moderator in this study. It thus can be seen that PBO commitment is one of the drivers for the green project success while the GBU is one of the barriers that may be encountered. These two are logically chosen as the two moderators for this study.

3. Theoretical framework & hypotheses development

In this research, two survey questions will be addressed:

First: What will the effects of Green Management practices in terms of GMS and GTD be placed on the building organizational performance?

Hypotheses will be put forward based on the

systematic literature review under Appendix 1. Notwithstanding the GPS/FPS, which is well illustrated in the above literature review, it is noteworthy to restate the measured items which can be quantified for FPS consideration under this study. The perceived FPS comprises both tangible and intangible benefits for certified green buildings under GPS assessment.

The tangible benefits to project building owners (PBO) can be quantified, like savings in water, materials, and energy. Intangibles are that corporate prestige, and enhanced workers' productivity with improved environmental air quality and thermal comfort. The study by Sustainable Building Pathways[125] in Australia listed the following added value to the PBO:

- Better staff productivity due to improved internal air quality (IEQ);
- Higher occupancy level and lower tenant turnover;
- Lower building lifecycle costs, and;
- Better social value in conserving the environment.

The Pathway also reported increasing demands for green products, and many companies are increasingly embracing green management practices to meet this demand from customers and staff expectations. The improved environmental conditions of green-certified buildings have convinced most of the tenants to retain and are less likely to move and will like to pay higher rent once the employees are pleased to work in such a healthy environment. It is remarkable to reveal from the US research that the main reasons for the relocation of the businesses are poor lighting and stuffy air (poor IEQ) and differentiated hot and cold spots from the traditional air conditioning systems. Thus, the increased occupancy rate and lower tenant removal rates will significantly add value to the PBO. The Pathway states that: green buildings have offered substantial improvements to productivity with less absenteeism due to enhanced internal and external environmental air quality and thermal comfort.

Another study by McGraw Hill Construction and Urban Green Council[126] in a survey with all the project participants including architects, building contractors, consulting engineers, and project building owners (PBO) about their participation, perceptions, and behaviors about green buildings has identified the FPS that:

(1) An average operating costs anticipated a decrease between 8%–9%;

(2) An average expected increase in building values around 7.5%;

(3) An average Return on Investment (ROI) anticipated improving 6.6%;

(4) An average anticipated increase in occupancy of 3.5%;

(5) An average anticipated increase in rental charge of 3%.

The Australian Building Council in 2006[127] reported that green buildings have lesser annual operating costs and more professional asset management. Local researchers also illustrated a 65% consumption decrease in energy and water, accounting for an operating costs reduction annually per square meter of usable floor area from US$120 to 50%. The following figure is giving the evidence:

(1) Maximum 25% increase in occupant productivity;

(2) Less staff turnover;

(3) Minimum 14% ROI investment returns;

(4) Free marketing promotion;

(5) 10% increase in the market value of the asset;

(6) 5%–10% increase in the rental charge.

Based on the above values, measurements will be put forward in this study as:

(1) The efficiency of operational expenditure;

(2) Maximize the building values;

(3) Improve the Return on Investment (ROI);

(4) Maximize the cost efficiency of to build;

(5) Deliver/achieve cost certainty;

(6) Improve the market value of the asset.

Second: Are there any moderating factors that will strengthen or weaken the effect of GMP on OPS?

As illustrated in the literature review under this study, drivers and benefits encompass the firm owners' motivation and commitment, the incentives provided by HKGBC and HK Environmental Bureau, and the government gross floor area concession for adopting green project delivery.

However, these drivers are mostly applicable to all building organizations in Hong Kong. To be more specific, many enterprises in the Hong Kong construction industry have recently stepped up their green management practices through the virtue of the Supplier Cooperation (SCO).

Subletting various trades and product delivery is a common construction management practice in Hong Kong, particularly in green management practices where specific green products and resources are required to cope with the green certification process[128]. This kind of practice not only can reduce total costs through higher productivity in unique trades and product production but can dissipate associated risks and responsibilities[128]. However, the fragmentation of works and goods produced in the building industry calls for higher cooperative relationships lest the firm performance will be jeopardized[129]. Previous studies posit an encouraging moderating effect of SCO on the relationship between the GMP and the firm's FPS[130,131]. Knowledge about the moderating effects of supplier cooperation in this situation is limited. No study has so far been focused on these moderating effects across the entire Triple Bottom Line (TBL) involving social, green, and economic dimensions. This study will focus on the green work and financial work dimensions of supplier cooperation (SCO).

The theoretical basis for supplier cooperation can be derived from the following Resource-based View (RBV) and Resource Dependence Theory (RDT). The extended resource-based view (ERBV) provides a theoretical basis for the supplier cooperation conceptual model in that:

(1) RBV: explores the firm performance and its specific, rare and valuable resources, which empower the firm with a competitive edge[132,133]. The RBV has been stretched to green development, associated with green marketing strategy[130,134]. Green development might advance a precious & rare resource depending on customer perception.

(2) RDT: also uses resources to clarify organizational performance. Firms are open systems that rest on the exterior environment but aim to diminish their environmental uncertainty and reliance on the suppliers[135]. Closer relationships with suppliers enhance interdependence[136,137]. Pfeffer and Salancik instigated close cooperation as a preliminary account of resource reliance as it signifies joint regulation over the partner's activities. In this direction, the RDT might be used to clarify how to accrue the scarce and precious resources that are dominant in the RBV. Thus, suppliers can be considered a specific resource, yet the supplier may be unclear to the buying firm unless the supplier is aggressively managed in the form of supplier cooperation.

The extended resource-based view (ERBV) above explicates gaining a competitive advantage and places emphasis on the connections among the influence of the building owners, green management practices and organizational performance. Above all, the focus on the supplier cooperation in the green measures of the building companies such as GMS and GTD is in line with the ERBV perspectives.

Works of literature have posited empirical support for the association of green supply cooperation on the triple bottom line (TBL) basis accounting for economic, green and social work dimensions[138,139]. Researchers have found reliable backing for the link between SCO proficiency and the company's FPS[138,139], in particular, due to the substantial financial return that ensued from the keen tie-up of buyer-supplier linkage[140].

Further, green adoption relies on the focus on triple bottom line (TBL) approach that concurrently accounts for green, social and financial work. It is the supplier in the context of the firm's green work, and economic work will be under the scope of this study as a moderator.

Since the late 20th century, there is extensive growth of companies in Europe and the USA to implement green management practices. The suppliers of these companies are often required to comply with the environmental codes like ISO 14001 (environmental management system), failing which, the suppliers will gradually be phased out. The green efforts exerted by the suppliers help the companies' green management to achieve better green performance. The moderating effects of SCO will have a significant impact on the green management practices to effectuate good organizational performance success. Based on the above literature survey, the key SCO factors can be summed up as follows in **Table 5**.

On the other hand, challenges and barriers concerned with those uncertainties of green building performance of the green building products, lack of consumers' market demand and deficiencies in green-professionals and unawareness of green building technologies and authoritative of green certified building materials[123]. These barriers, again like drivers, are wide to elaborate their effect on the relationship of green management with organiza-

Table 5. The core of SCO features that stimulate the relationship of building firms' GMP and OPS

Items	Supplier cooperation core features that stimulate the relationship of GMP and the OPS
1	Supply management capabilities of the building firms enabled supplier cooperation.
2	Supplier cooperation is a measure to increase the supplier corporate social responsibility compliance and the building firms' social value.
3	Supplier cooperation enabled the improvement of suppliers' environmental capabilities as well as those of the building firms.
4	Supplier cooperation is especially pursued by building firms with a comprehensive green marketing supply strategy and green technologies development.
5	Supplier cooperation leads to better delivery manufacturing performance as well as the building firms logistic and site storage/housekeeping performance.
6	High level of technological and logistical integration, as well as reduction of the supplier base, lead to higher levels of environmental collaboration and performance of the building firms.
7	Supplier cooperation leads to the better environmental and economic-financial performance of the building firms.
8	Supplier cooperation has positive quality, delivery, flexibility performance, and environmental performance impact on the building firms.

tional performance success.

Green construction/building measures are underlined in contract prescriptions, and conditions, and the green participants and stakeholders are subject to uncertainties in these green building constructions termed in this study as green building uncertainties (GBU)[141]. These undesired GBU will jeopardize the construction scheduled objectives and may cause cost and time overruns and ultimately failure to complete the green projects. The common GBU can be identified as follows under different sources after a diligent literature survey[142].

(1) The project team

Knowledge, and experience in green building technologies and design systems are crucial for green certification under Beam Plus v2 (09/2019) [142]. The uncertainties and potential of project delays will significantly diminish if the project participants such as consultants, contractors, and subcontractors are acquainted with the green certification processes and demand level required. On the other hand, the GBU will be higher if the project participants are working on green standards that are not competent.

(2) Construction products

Sourcing of environmental-friendly building products and green building technologies is vital in green building project delivery. However, these products are normally not tested and assessed over long and acceptable periods[142]. Project participants should take these uncertainties into account regarding their long-term product durability and technologies[143]. On the other hand, the uncertainties related to the availability and on-time delivery of these green products under the green certification system may be challenging depending on manufacturing conditions.

Unfamiliarity with these green products, materials, and building technologies is another uncertainty that should be aware[15,144].

(3) Contractual roles and responsibilities

The project practitioners' prescribed roles and accountabilities relating to green projects may be inadequately defined, and these definitions may not tally with that required under the green certification systems. For instance, the Beam Plus v2 (09/2019) has published and set out numerous standards that require the project team to embrace an integrated design and construction management approach to green buildings. Various assessment credits are laid down as guidance to project team to pursue in their assessment of their design and built elements. These green standards may contravene the local legislation and cannot be fully reflected under the contract conditions. These will constitute another GBU.

(4) Economics and financial attributes

Gross floor area concession in the new green building projects has encouraged project owners to pursue and invest in green projects in Hong Kong. Procurements of green projects, however, might institute a specific set of uncertainties risking both the time schedule, cost and profit estimations. Resolutions to insurance would help to mitigate or minimize these undesired uncertainties, but the insurance policies developed for green building projects are yet to be developed in the current market.

The green building concept is commonly reckoned as a marketing promotion that perceived green buildings as high quality of living[145,146]. The rental and sale value of green buildings may attract higher rates than usual. It was reported that rental and sale

premiums of green commercial buildings increased in a range from 2%–27% and 9%–25%, respectively[147]. But these raise in rental and sale premiums may not be covered by the loss encountered in the extra time overruns on planned schedules due to the uncertainties in the unavailability of green materials, inexperienced of the project team in handling the green technologies and process for green certification.

The typical uncertainties[142] identified after the literature survey can be elaborated in the following **Table 6**.

Table 6. The typical green building uncertainty (GBU)

Item	GBU category		Description
1.0	The project team	1.1	Uncertain if the project team has green construction practice and know-how.
		1.2	Uncertain if the contractors and subcontractors have common and accepted green standards within their expertise and proficiency.
2.0	Construction products	2.1	Uncertainties in the new green materials, untested products, and technologies in their long-term sustainability and performance.
		2.2	Uncertainty of competence in new construction products and know-hows.
		2.3	Failure to receive the green construction products in a timely schedule causing project delay.
		2.4	Defective performance of energy-saving appliances.
3.0	Contractual roles and responsibilities	3.1	Inadequate lay down the project team's prescribed roles and accountabilities.
		3.2	Irregularities between formal regulations and the green certification methods like LEED and BEAM Plus.
		3.3	Uncertain in the potential benefits gained by the project owners and participants due to the stringent standards of the green certification measures like LEED and BEAM Plus.
4.0	Economics and financial attributes	4.1	Uncertain in the rental & sale value return due to delay related to green construction procedures and conditions.
		4.2	Failure to use financial incentives (e.g., low financing rates) due to project delays.
		4.3	Inadequate insurance cover for green construction.
		4.4	Uncertainty in the cost the certification process involving high sophisticated standards and procedure.

To wrap up, again, the reasons why GBU will act as a moderator in this study are:

(1) Green Building Uncertainty (GBU) encompasses contingency factors of green building technologies and building materials, green specifications, and market prospects for inter-firm collaborations, which render difficulties dedicating the causal relationships of green management on the organizational performance success[124].

(2) Firms must be proficient in adjusting to new settings and possibilities in a competitive business situation[148].

(3) Furthermore, firms have sought to implement green management to improve their organizational performance success. The above SCO and GMU will have progressively moved into a more/less environmentally green direction that may strengthen or weaken the effect of GMP on OPS. Thus, both SCO and GBU can be considered moderators of the impact of GMP on OPS. In this sense, the incidence of moderators may twist how the green building development organizations construe the part of green management in this context[114].

This possibility will be explored by scrutinizing hierarchical moderated regressions that comprise green management practices and SCO and GBU together. It thus can be seen that SCO is one of the drivers for the green project success while the GBU is one of the barriers that may be encountered. These two are logically chosen as the two moderators for this study.

3.1 The theoretical framework development

Quite a number of construction management literature point out that green marketing strategy (GMS) and green technologies development (GTD) are associate affirmatively with green performance success (GPS), and financial performance success (FPS)[149–151]. Effective environmentally friendly green management practices are vital in triggering a building firm and its green buildings toward OPS[152,153]. The green product environmental improvement can ascertain various paybacks such as better flats sales, enhanced market performance, competitive edges, and enhanced business prestige and image[154,155]. Close and direct collaboration, connection, communal understanding, and commu-

nication between building organizations, suppliers and manufacturers will entail and produce a lean clean production, site delivery process, and improved GPS. A mutually beneficial goal would thus have implicated both the building product manufacturers and building development firms[156].

The implementation of GMP can trigger the cooperation with upstream suppliers through their GMS to achieve the delivery of green building materials with green performance features and environmental benefits, which in return will foster both financial paybacks/FPS[157,158]. The value of GMP partnership with manufacturers within a GMS will manifest as FPS such as shortening the production lead times, productivity, just-in-time transport and greatly enhancing the site space mobility and accessibility, thereby facilitating the building operation efficiency and productivity as well[159]. GTD may also initiate a green product innovation, thereby contributing considerable paybacks/success to GPS and FPS[160–162]. Thus, the executing of GMP in terms of GMS and GTD is essential and contributable to the building firms in their GPS and FPS. The following **Figure 9** outlines the theoretical structure used in this study, which was put forward to explore building organizations instigating green management practices (GMS and GTD) and the related impact of variations in organizational performance success (GPS and FPS) as defined under this study.

3.2 The hypotheses

3.2.1 GMP and OPS

It is postulated in this research elaboration that the dual GMP has an affirmative and straight effect on the OPS. Currently, it is posited that SCO and GBU moderate the association between GMP and OPS. Thus, the following hypotheses are put forward to determine whether the building firm green management practices effectively contribute to GPS and FPS.

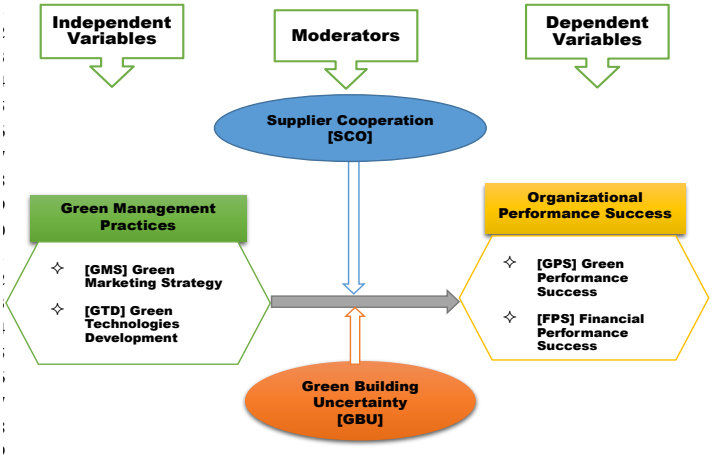
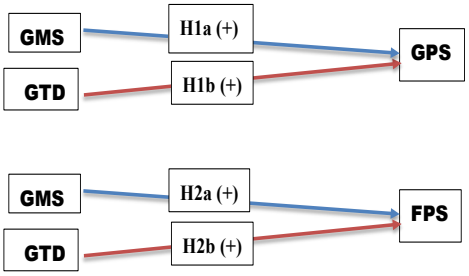


Figure 9. Framework to explore the effects of green management practices on the organizational performance success.



The hypotheses are defined as:

H1a: Firm steps up Green Marketing Strategy (GMS) adoption promotes Green Performance Success (GPS) of the building projects.

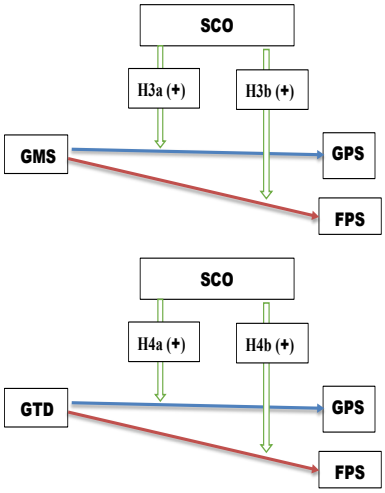
H1b: Firm steps up Green Technologies Development (GTD) adoption promotes Green Performance Success (GPS) of the building projects.

H2b: Firm steps up Green Technologies Development (GTD) adoption promotes Financial Performance Success (FPS) of the building projects.

3.2.2 Moderator: Supplier cooperation (SCO)

Notwithstanding the drivers from the government stipulations and policy in giving gross floor area concession to those projects instigating green elements and pursuing BEAM Plus v2 (09/2019), Adopting the supplier cooperation will place grave driving forces to moderate the relationships of GMS/GTD with GPS/FPS[107,110,111]. To be more

specific as mentioned before, it was revealed that supplier cooperation in the firm's green work dimension in pursuing green building projects is crucial for GMP's effect on the OPS and will act as a good moderator in this respect. Based on the literature above, the following hypotheses under the effect of SCO can be posited:



The hypotheses are defined as:

H3a: Supplier Cooperation (SCO) moderates positively the relationship between the firm's Green Marketing Strategy (GMS) and Green Performance Success (GPS).

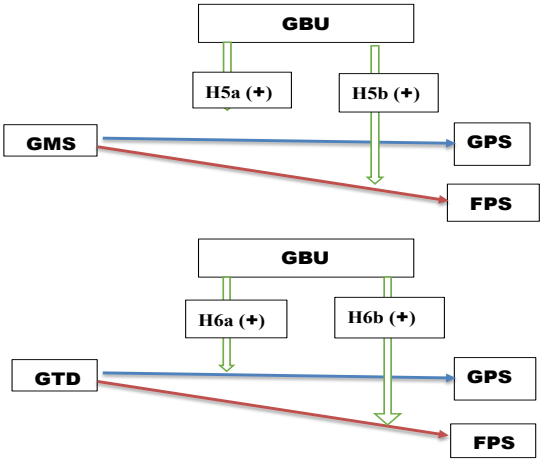
H3b: Supplier Cooperation (SCO) moderates positively the relationship between the firm's Green Marketing Strategy (GMS) and Financial Performance Success (FPS).

H4a: Supplier Cooperation (SCO) moderates positively the relationship between the firm's Green Technologies Development (GTD) and Green Performance Success (GPS).

H4b: Supplier Cooperation (SCO) moderates positively the relationship between the firm's Green Technologies Development (GTD) and Financial Performance Success (FPS).

3.2.3 Moderator: Green building uncertainty (GBU)

It can be ascertained that the more potential changes in the adoption of environmental policies in GMS/GTD, the more the GBU may be faced by a building firm in the development of green projects[163]. When various GBU is present, it induces market uncertainties, and it is tough for building organizations to make an investment resolution, and the company may step up its management resources to combat these uncertainties. The GBUs may have a positive impact on GMP to strengthen the firm's management resources on the business performance of the main contractors as well[164–166]. In this regard, coupled with those GBU in the above literature review, the following hypotheses can be posited.



The hypotheses are defined as:

H5a: Green Building Uncertainty (GBU) moderates positively the relationship between the firm's Green Marketing Strategy (GMS) and Green Performance Success (GPS).

H5b: Green Building Uncertainty (GBU) moderates positively the relationship between the firm's Green Marketing Strategy (GMS) and Financial Performance Success (FPS).

H6a: Green Building Uncertainty (GBU) moderates positively the relationship between the firm's Green Technologies Development (GTD) and Green Performance Success (GPS).

H6b: Green Building Uncertainty (GBU) moderates positively the relationship between the firm's Green Technologies Development (GTD) and Financial Performance Success (FPS).

3.3 The theoretical basis for the development of each hypothesis

To sum up, the hypotheses so far developed are listed in **Table 7**.

The previous literature review and discussion lead to the above hypotheses and research model in **Figure 9** and **Table 7**. Green management practices are identified by Silvius and Schipper[167], as those management practices to "assure profitable, fair, transparent, safe, ethical and environmentally friendly project delivery aiming at a project deliverable that is socially and environmentally acceptable

Table 7. The hypotheses build-up

No.		Hypotheses [H]
1.	H1a:	Firm steps up Green Marketing Strategy (GMS) adoption promotes Green Performance Success (GPS) of the building projects.
2.	H1b:	Firm steps up Green Technologies Development (GTD) adoption promotes Green Performance Success (GPS) of the building projects.
3.	H2a:	Firm steps up Green Technologies Development (GTD) adoption promotes Green Performance Success (GPS) of the building projects.
4.	H2b:	Firm steps up Green Technologies Development (GTD) adoption promotes Financial Performance Success (FPS) of the building projects.
5.	H3a:	Supplier Cooperation (SCO) moderates positively the relationship between the firm's Green Marketing Strategy (GMS) and Green Performance Success (GPS).
6.	H3b:	Supplier Cooperation (SCO) moderates positively the relationship between the firm's Green Marketing Strategy (GMS) and Financial Performance Success (FPS).
7.	H4a:	Supplier Cooperation (SCO) moderates positively the relationship between the firm's Green Technologies Development (GTD) and Green Performance Success (GPS).
8.	H4b:	Supplier Cooperation (SCO) moderates positively the relationship between the firm's Green Technologies Development (GTD) and Financial Performance Success (FPS).
9.	H5a:	Green Building Uncertainty (GBU) moderates positively the relationship between the firm's Green Marketing Strategy (GMS) and Green Performance Success (GPS).
10.	H5b:	Green Building Uncertainty (GBU) moderates positively the relationship between the firm's Green Marketing Strategy (GMS) and Financial Performance Success (FPS).
11.	H6a:	Green Building Uncertainty (GBU) moderates positively the relationship between the firm's Green Technologies Development (GTD) and Green Performance Success (GPS).
12.	H6b:	Green Building Uncertainty (GBU) moderates positively the relationship between the firm's GTD and financial performance success (FPS).

throughout its lifecycle".

The Green management practices embracing green management model skills can stimulate the GMS and GTD to have GPS and social success[168–170]. This paper has stepped further to introduce a more holistic and continuous approach termed as green management model. From these arguments, the following hypothesis of green management practices inclusive of GMS and GTD on organizational performance success can be derived:

Green marketing strategy (GMS) has been considered useful to step up GPS[122,171]. GMS is a set of green marketing formulations to avoid adverse environmental impacts[172].

The appraisal set off by Balaras *et al*.[173] revealed that the implementation of green wall products and insulating glazing elements would save the residential buildings' energy by 60% and 20%, respectively. It is reckoned that the same kind of saving of around 30% for using green wall materials is recorded in the study by Galante and Pasetti[174]. In this regard, GMS has also given the company's financial value as GMS can step up its prestige, thus triggering more business opportunities for the company in return[117]. This energy-saving implies the positive value to investigate the following hypothesis H1a:

(1) H1a: Firms step up GMS adoption promotes GPS of the building projects

The trigger of GTD in the building activities is the major cause of concern to avoid adverse environmental effects as building establishment accounts for one of the top three for GHG emissions and global energy consumption[175]. Various studies have concluded that GTD can retrieve a substantial financial return with GPS in reducing around 30% in GHG emissions and energy consumption and saving about 15% of maintenance costs with approximately 4% occupancy ratio escalation together with 30% step-up in occupants' gratification[126,176–179]. These positive impacts on GPS by GTD are worth analyzing in depth under the following hypothesis H1b proposed:

(2) H1b: Firms step up GTD adoption promotes GPS of the building projects

The GMS can be further developed into an efficient platform of green products and green suppliers to assure FPS. Deficiency of the GMS in the green elements supply in the market and information sharing of green suppliers will hinder the FPS[180,181]. The poor collaboration between scholars and the green developers will hinder the innovative study of green products to effectuate the FPS, thus adding another barrier to FPS[181,182].

The top management support initiation in formulating a clear and precise green vision and

mission statement/commitment will remove the obstacles to prosper the GMS[181,182]. This top management's support comprises financial allocation and commitment and establishing a multi-disciplined green expert team to innovate green practices, green technologies, and new energy set up. Low set up of this team with inadequate green knowledge and know-how will hinder the FPS[180].

Not many studies have addressed finding the enablers to adopt GMS. In this study, the proposed enablers for green project activities were designated as GMS under the systematic literature review in Appendix 1. Thus, it can be established that GMS can strengthen the GMP with a positive effect on the Financial Performance Success (FPS) of the organizations. These positive effects of GMS on FPS of the building firm posit the following hypothesis H2a.

(3) H2a: Firms step up GMS adoption promotes FPS of the building projects

The green certification of the building, such as BEAM Plus and LEED, will determine the GPS in this study. However, the economic returns from this green building certification will trigger the development of GTD to achieve GPS in return. The green market will be created and expanded while the productivity, comfort of the occupants, and the building lifecycle costs will be receiving economic advantages. It can thus be concluded that GPS will simultaneously gain an increase in the financial performance success (FPS) of the organization for GTD of the construction projects.

The US green market value has increased from $42 billion in 2008 to $135 billion in 2015[183]. Current studies in GTD could have a good economic return[184]. At the same time, good environmental performance can also significantly step up FPS with a possible escalation in the market performance[185–188]. This positive correlation of GTD and FPS of the construction projects can be explored further under the hypothesis H2b below:

(4) H2b: Firms step up GTD adoption promotes FPS of the building projects

Suppliers follow the building firm's recommended environmental/green practices and technologies development such as ISO 14001 standards (performance evaluation guidelines for environmental management systems), leading to further green collaboration[189]. These joint collaboration green efforts help the building firm activate a more efficient supplier connection, cooperation, and accomplish better green performance results[190]. In this connection, supplier cooperation in the building firm's green work moderates the relationship linking its green management practices (in terms of Green Marketing Strategy and Green Technologies Development and green performance[191].

When the supplier cooperation with the building firm in sharing joint strategic alignment related to economic/financial prospects, the firm's competitiveness and proficiency with green management practices will be enhanced, thus leading to an increase in the firm's financial performance success[192]. Collaboration between the building firm and the suppliers can generate good relationships, trust, heightened expertise transfer, coordination, and productivity, thus lowering the production cost[193]. The proposed hypothesis in this direction can then be formulated as:

(1) H3a: SCO moderates positively the relationship between the firm's GMS and green performance success (GPS).

(2) H3b: SCO moderates positively the relationship between the firm's GMS and financial performance success (FPS).

(3) H4a: SCO moderates positively the relationship between the firm's GTD and green performance success (GPS).

(4) H4b: SCO moderates positively the relationship between the firm's GTD and financial performance success (FPS).

Unlike the common construction uncertainties that may include, inter alia, unknown site conditions, a sudden increase in cost of the construction materials, and unexpected weather conditions, Green Building Uncertainty (GBU) encompasses other contingency factors. They concern the environmental performance of green building technologies and building materials, the demand and supply of green building development, and the competence of the green project team to identify and manage the green projects standards/specifications required, which may affect the causal relationship of green management practices on the organizational performance success. When various GBUs are present, it induces construction risks, but, on the contrary, may initiate an impetus to the management to step up their management resources to combat these risks

situation[114]. For instance, the uncertainties of the environmental performance in the green building technologies and green building materials can be further evaluated with market research and performance checks in their past performance. The market prospects of the green building development can be easily evaluated with existing market sale conditions. These unexpected risk factors could therefore be ascertained, avoided, eliminated, reduced, transferred and even accepted as part of construction risk management. In this context, GBU may have triggered a step-up of the green management practices to exacerbate the organizational performance. This GBU's positive moderating effect on the relationship between the firm's green management practices (GMS/GTD) on the organizational performance (GPS/FPS) is worth investigating further under the following hypothesis H5a/H5b and H6a/H6b below:

(1) H5a: GBU moderates positively the relationship between the firm's GMS and green performance success (GPS).

(2) H5b: GBU moderates positively the relationship between the firm's GMS and financial performance success (FPS).

(3) H6a: GBU moderates positively the relationship between the firm's GTD and green performance success (GPS).

(4) H6b: GBU moderates positively the relationship between the firm's GTD and financial performance success (FPS).

3.4 Control variables

The company size is used as a control variable in this study. The size of the building firms may have different green management capabilities. Larger building firms will have more resources available than those medium and small-sized firms. Bigger firms are most likely to have more GMP investment and sources of green development and green marketing information, green technologies developed, and other environmental practices in energy renewal. The size of the building firm may be differentiated by the capital invested, value, and the number of the buildings' output per annum, and the number of wage earners employed. The capital invested, value, and the number of building projects will positively correlate with the number of employees, and it is more logical to use the number of full-time employees to differentiate the size of the building firms in this study as defined in **Table 8** below:

Table 8. Size of building forms defined

Size of building firms	Range of full-time employees employed
Small	Less than 25
Medium	25–50
Large	More than 50

4. Research methodology

This study will empirically examine the impact of green management practices in terms of green marketing strategy (GMS) and green technologies development (GTD) on the organizational performance success in terms of green performance success (GPS) and financial performance success (FPS). Further investigation will be made on the supplier cooperation (SCO) together with the green building

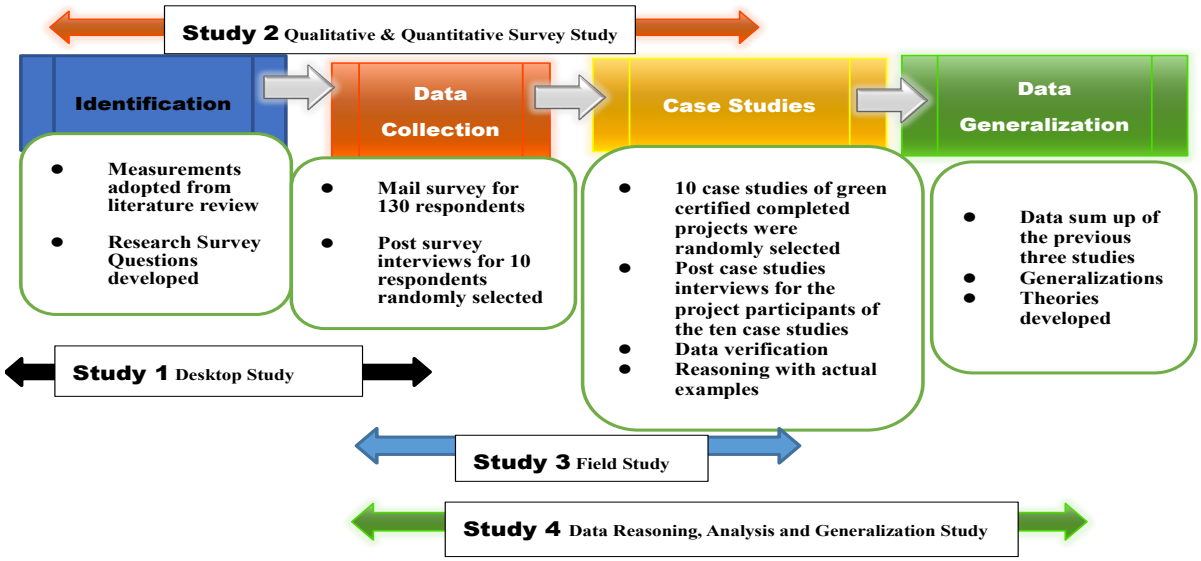


Figure 10. Overview of the four empirical studies.

uncertainty (GBU) that will affect the green management practices on the building firm performance. The research methodology involves four empirical studies to achieve the above objective, as indicated in **Figure 10**.

A mixed-methods comprising quantitative and qualitative research design is used to conduct this research. The data will be collected, analyzed, and combined for both analyses. This data integration elaborates a better insight into the research problem under study than using either one alone.

Quantitative research involves collecting close-ended data like rating scales, observation checklists for GMS and GTD green management practices, and tools to examine GPS and FPS. Questionnaires are used to resolve the above research questions with hypotheses as a checklist to collate the data for statistical analysis under the study. On the other hand, qualitative research focuses on open-ended data derived from post-survey interviews on the randomly selected focus groups. The qualitative data is analyzed to identify the track of possible ideas for the presentation. This research combination is conducive to better understanding and substantiation while offsetting the weaknesses inherent in using each research design alone. This triangulation of data allows assuring the research's validity by viewing the same research problems from various vantage angles. The desktop study includes research to provide data to build up the measurements from the various literature reviews to formulate the research survey questions.

The following four studies proceed to test the above hypotheses under the research model:

Study 1: In this study, measurements were built up for this study under the literature review. The measurements laid down the basis for the mail questionnaires survey to identify the effects of GMP on the OPS and the moderating effects of supplier cooperation and green building uncertainties in the Hong Kong building industry. The merit of executing the mail questionnaire survey is to accomplish "quantify-ability and objectiveness"[194].

Study 2: Integrating both the quantitative and qualitative research design to resolve the research problems can be evidenced by several researchers under the literature review[195]. Effects of GMP on OPS research in the building practices regularly use quantitative methodologies, like using mail survey questions for the data collection. However, qualitative methods using case studies and interviews are common[195]. This Study 2, therefore, combined both qualitative and quantitative data to reveal an entire picture of the green management practices application from 130 respondents using the mail survey randomly selected from those building organizations registered as members under Hong Kong Green Building Council (HKGBC). Post-survey interviews were convened for 10 participants randomly selected. In this case, both research design merits can be drawn, thus curtailing the drawbacks of any one particular research study alone[196]. A balance can be struck between qualitative interpretations of subjective experiences and quantitative statistical analysis to elucidate a social phenomenon[197]. Creswell[198] pointed out that using a combined research design will not only provide merits that compensated for the limitations of collecting data through either quantitative or qualitative research, but it will entice complete data evidence to review the study questions. The post-survey interviews will be targeted on the field to obtain more detailed information, points of view, and opinions to validate the preliminary data from participants from those project management teams like architects, building surveyors, building services consultants, main contractors, and sub-contractors.

Study 3: Study 3 can be carried out based on an empirical field study. Ten completed green certified construction projects are randomly chosen from those projects awarded under BEAM Plus New Buildings, Version 2.0. Thorough discussion and cross-comparisons can be done to ensure the data validity thus got. The 10 completed case studies are conducted into three stages data collection, reasoning, and final verification of the results. The data will be collected from various sources originating from visiting the sites, vetting the projects documents like the working programs, materials order and delivery schedule, the green management practices in terms of GMS, GTD, and the organization performance data. Interviews with the case studies' project management team members are used to substantiate this qualitative data file. Follow-up interviews for clarifications will also be arranged. Site observations for the actual implementation of the GMS and GTD on performance records are used to validate the data collected. The case studies' results

are further elucidated with the seniors and the key project in charge of running the construction sites of the case studies. A final conceptual analysis will be evaluated to develop a new conceptual construction model for the linkage between GMS and GTD as green management practices with the organizational performance success in the Hong Kong construction industry under the study.

Study 4: Study 4 is stepped in to finalize all the data collected from the above studies. Cross-reference to the theories developed is used to evaluate further and validate the data.

These four studies are targeted to give a full picture of GMS and GTD on the organization's performance success in terms of GPS and FPS. This kind of research methodology has the following contributions to the literature on GMS & GTD. First, using qualitative interview data, extended the understanding of GMS and GTD in the construction industry by uncovering four key dimensions of GMS and GTD. It relates to implementing: (a) what green technologies are adopted in the construction organizations to pursue green management practices, (b) the green marketing strategies adopted, (c) moderating effects executed by the supplier cooperation (SCO) and the green buildings uncertainty (GBU) on the association of GMP and the OPS in the construction industry, and (d) the attributes of GMS and GTD preferred and adopted as the green management practices. Second, using both qualitative and survey data, it identifies the influences of the dimensions of the idea raised, say the attributes of GMS, GTD, and the extent to which this issue is acknowledged by the green management. As such, this research extends Hirschman's[199] framework by showing that different aspects of partners in the construction industry can be targeted, covering all the sub-contractors, suppliers, and even manufacturers that relate to the goal of GMS and GTD identification. Third, it builds up a model to elaborate on why the green management practices value some GMS and GTD more than others. Using both quantitative survey and field research data, it shows that managerial responses to GMS and GTD are not simply a function of how frequently GMS/GTD input is generically offered[200], but rather, the GMS and GTD manifest other dimensions like the performance success in terms of green and financial performance success.

However, this mixed research design is also subject to several limitations that suggest directions for future inquiry. First, despite the robustness of most of the findings over four distinct contexts, statements about the generalizability and causality effect may not be feasible without further research settings. For example, because of the nature of the cross-sectional design of the first two studies and measures, it cannot be fully ruled out the reverse causality effect. For instance, it may be the case that a positive managerial response to GMS and GTD might not reinforce the level of GMS and GTD identification in the construction sites. Additionally, the studies did not fully demonstrate all mechanisms underlying the success of GMS and GTD. For example, no design of a study is used to test if the green management style and the green knowledge/technologies are adequate to execute GMS and GTD on the GPS and FPS in the construction sites. Future field studies research can be established to critically examine these relationships over time or utilize experimental methods to demonstrate this causal linkage[201]. Future research might also consider measuring other dimensions like green leadership style, management in total green quality, supply chain, logistic control in the construction field, and their inter-correlations/dependencies.

For instance, other research has examined organizational identification[202] and commitment by an immediate supervisor[203] or top management[204]. Finally, the case studies are limited to the investigation of the relationship between GMS/GTD and GPS/FPS. Other dimensions like quality management, environmental protection, and green leadership style have not evaluated their effects on GPS/FPS in the construction industry.

In contrast, the above-combined research design allows the integration of data collected for the single exploration of the effects of GMS and GTD on the GPS and FPS. The data integration synthesizes and utilizes various data sources will ensure a more comprehensive picture of the results devoid of any possible bias.

The rationale for using the design of this combined method can be justified as follows:

- The results acquired from one method can be further elaborated on with that from another process. Those desk top data in terms of research survey questions obtained in Study 1 can be used for

quantitative statistical analysis in Study 2.

- Variety and span of inquiry can be conducted. Both interviews and mail surveys inclusive of completed case studies can be used to probe into a greater depth to give various vantage points for the same phenomenon.
- It is possible to unearth both the irony and contradiction of the data. Remoulding the questions under study is also possible to enhance the robustness of the research. The research survey questions found in Study 1 may not be applicable to the actual case studies. A pilot study by gurus of green projects is used to modify the research questions to ensure more convincing results can be obtained.
- Various phenomenon aspects from different angles can be identified accurately (triangulation). Observations and mail surveys can be used to verify the data collected. Completed case studies can be used to further cross check the data obtained in the previous studies.
- The findings can be validated from the combined quantitative and qualitative data sources. The data can be further assessed and evaluated side by side in a discussion or by transforming the qualitative data into quantitative scores. For example, qualitative data to assess the SCO and GBU can be done through in-depth semi-structured interviews from green managers' personal experiences. In this case, the two types of data can then be validated for each other, leading to a solid foundation for concluding the integration.
- The quantitative findings can be used to explore qualitative data or vice versa. Based on the qualitative data, quantitative data can be built up. In this way, the qualitative results are clarified more precisely through the quantitative data. For example, findings from individual green managers' personal experiences can be further explored using the instrument survey data. This kind of study demonstrates the use of combined research design to elucidate quantitatively how the qualitative instruments might work. The quantitative data can augment the qualitative study outcome in this study.

4.1 Working variables

A survey questionnaire is instigated to compute Hong Kong building organizations' extant green management practices and organizational performance success. The variables measured in the questionnaire will be adopted from references [140], [205], [206], and [207]. The consultation will be sought from those green professionals of the HKGBC.

A number of measurement criteria will be implemented to estimate the organizational performance success from recognized systematic literature review in Appendix 1. In particular, GPS indicators are referenced from reference [207], while those FPS are derived from references [89], [91], [92], [93], [94], and [95].

As the case for green management practices, measurement items will be adopted as referenced from references [158], [159] for GMS, and [160]. Referenced for GTD are derived from references [161], [162], and [163].

For the two moderators, measurement indicators for SCO will come from references [206] and [208], while measured items for GBU will be accepted from references [209], [210], and [211].

All measurements derived from the literature review will be undergone a pre-test from several green gurus accredited as BEAM Pro under HKGBC. Queries about the performance outcomes of GMS and GTD green management practices are answered using a 5-point scale where: 1 = none at all, 2 = mild, 3 = moderate, 4 = relatively significant, and 5 = significant.

4.2 The development of the survey questions

Research data will be solicited through a questionnaire survey from desktop Study 1, with respondents focusing on those building firms pursuing green building development with green management. The questionnaires will be dispatched by email in Study 2 to 130 green experts randomly selected from building organizations registered as members of the HKGBC. There are 140 registered organizational members under HKGBC, including three platinum patron members, 20 gold patron members, 16 silver patron members, six bronze patron members, 35 marble patron members, and 51 institutional members (HKGBC, 2020–2021). They were elected as the participants since they have relatively robust green building knowledge and expert competence to advice on the design of green marketing strategies and green technologies of green development in the Hong Kong construction

industry. Post-survey interviews for 10 respondents randomly selected are conducted to gather data on their experience. With their involvement in planning, procurement in tender, building, green certification implementation and building operation and maintenance, a comprehensive and reliable account of the questionnaires provided in this research can be provided with confidence.

To further validate empirically the data obtained above from actual green certified projects, 10 green-certified completed buildings identified among public (one will be chosen), industrial (two), institutional (two), and private sectors (five) were explored. This unit of analysis under this Study 3 is the project for this kind of ex-post-facto survey-based research. The green certified building projects should be awarded under BEAM Society[212] or LEED green certification in Hong Kong.

Five building firms from each case project comprise building developer, architecture firm, main contractor, building services firm, and environmental consultant firm for each project are contacted for review of the above survey questions. Project information will be compiled for further evaluation. This information makes up about 10 respondents in this Study 3, thus accounting for a total of 140 responses for both studies. The sample size is well above the one via software of G-Power Version 3, with expected sample size enumerated as 138. The hypotheses will be tested based on the questionnaire survey and a field study of 10 green projects in Hong Kong. This approach has allowed the time effect of variations of the success perception[213]. For this assertive/validated study, it is vital to eliminate this kind of misconception impact.

On top of the above survey questionnaires under Study 3, it is believed that a post-survey interview with managers and professionals from the above random-selected 10 green projects under BEAM Plus New Buildings, Version 2.0 is beneficial to (a) achieve a more in-depth insight and understanding of their green development mindset, including the organizational strategies used, driving forces, and barriers that may have been encountered; and (b) gain their expert advice and views on the survey outcomes.

Accompanying these complementary inputs and valued intuitions from these managers and experts, valued assessments and considerations can be evaluated in this next survey. The questionnaire survey items will be answered using a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree) to assess how the respondents perceived the two moderators (SCO and GBU). For GMS and GTD, the 5-point Likert scale (1 = no effect at all, 2 = fairly important, 3 = important, 4 = very important, and 5 = critically significant) is used to determine the relative importance of the GMS and GTD green management practices. For GPS and FPS, the 5-point Likert scale (1 = none at all, 2 = mild, 3 = moderate, 4 = relatively significant, and 5 = significant) is used to assess the relative performance achieved.

4.3 Research instrument

Based on the findings from the systematic literature review, the questionnaires will be completed under a five-scale point used by Likert ranging from agreeing to disagree, relative importance and relative performance achieved of the data instigated. The constructs' summary will be coded and will be laid down in a table format for the statistical test. As illustrations, the literature review measurements are listed in parallel with those selected for this study in **Tables 9, 10**, and **11**. Those that are not chosen were given grounds for the justification.

4.4 Variables operationalization

4.4.1 Vital information evaluation

The respondents' green knowledge in respect of GMS/GTD, SCO/GBU, GPS, and FPS is scored on a scale of 5 points. Those respondents who get a point lower than 4 will be discarded under the study. Only a score of 6.5 will be accepted.

4.4.2 Independent variables and dependent variables

As indicated in **Figure 9**, the independent variables are: green marketing strategy (GMS), green technologies development (GTD), the dependent variable is: green performance success (GPS), and financial performance success (FPS). Moderators associated with these independent variables and dependent variable effects are laid down as SCO and GBU.

Table 9. Summary of green management practice measurements adopted from literature review

GM practice	Code	Measure items	Selected for this study	Literature review
Green Marketing Strategy (GMS)	GMS1	The company has aligned the green marketing strategy with owner strategies for green building development.	√	[58]
	GMS2	The green project marketing strategy has considered green issues to select green products.	Overlap with GMS1	[57]
	GMS3	The company's green marketing promotion has focused on green performance rewards.	√	
	GMS4	The company has laid down the vital choices in green products, marketing activities, and resources to the customers' satisfaction.	√	
	GMS5	The company has laid down an information platform to include all the green suppliers and green products with good performance.	√	
Green Technologies Development (GTD)	GTD1	The project team has designed green building products to reduce the consumption of material/energy.	Overlap with GTD2	[48]
	GTD2	The project team has designed green building products for reuse, recycle, recovery of material, component parts.	√	[46]
	GTD3	The project team has designed green building technologies to avoid or reduce the use of hazardous products and their manufacturing process.	√	
	GTD4	The senior management has committed to green technologies development.	Focus on GTD than management support	
	GTD5	The company has collated all the database concerning green technologies development.	Focus on GTD than data collection	
	GTD6	The company has strived to pursue new and reliable energy development from natural resources and environmental services to reduce greenhouse gas (GHG) emissions, and global warming.	√	

Table 10. Summary of moderator measurements adopted from literature review

Moderator	Code	Measurements	Selected for this study	Literature review
Supplier Cooperation (SCO)	SCO1	Supply management capabilities of the building firms enabled supplier cooperation.	√	[138]
	SCO2	Supplier cooperation is a measure to increase the supplier corporate social responsibility compliance and the building firms' social value.		[139]
	SCO3	Supplier cooperation enabled the improvement of suppliers' environmental capabilities as well as those of the building firms.	√	
	SCO4	Supplier cooperation is especially pursued by building firms with a comprehensive green marketing supply strategy and green technologies development.	√	
	SCO5	Supplier cooperation leads to better delivery manufacturing performance as well as the building firms logistic and site storage/housekeeping performance.	√	
	SCO6	High level of technological and logistical integration, as well as reduction of the supplier base, lead to higher levels of environmental collaboration and performance of the building firms.	√	
	SCO7	Supplier cooperation leads to the better environmental and economic-financial performance of the building firms.	√	
	SCO8	Supplier cooperation has positive quality, delivery, flexibility performance, and environmental performance impact on the building firms.	√	
Green Building Uncertainty (GBU)	GBU1	The demand and supply of green building projects have faced uncertainty.	√	[124]
	GBU2	The development of green materials and green technologies are still in its infancy and are uncertain in their environmental performance.	√	[114]
	GBU3	Uncertain if the project team has green construction practice and know-how of standards that are not within their expertise and competence.	√	

Table 11. Summary of organizational performance success measurements adopted from literature review

Organizational performance success (OPS)	Code	Measurements	Selected for this study	Literature review
Green Performance Success (GPS)	GPS1	The project team has established engineering systems to reduce the waste emission compared with last year.	√	[212]
	GPS2	The project team has decreased the consumption of hazardous/harmful/toxic materials compared with last year.	√	
	GPS3	The project team has decreased in frequency the environmental accidents compared with last year.	√	
	GPS4	The project team has improved the company's environmental situation and prestige compared with last year.	√	
	GPS5	The project team has achieved the green certification award under BEAM Society[212] compared with last year.	√	
Financial Performance Success (FPS)	FPS1	The company has decreased its average operating costs compared with last year.	√	[126]
	FPS2	The company has increased the average building values compared with last year.	√	[127]
	FPS3	The company has improved the average return on investment compared with last year.	√	
	FPS4	The company has increased the average occupancy compared with last year.	√	
	FPS5	The company has increased the average rental charge compared with last year.	√	
	FPS6	The company has improved the market value of assets compared with last year.	The respondents did not readily find market value	

4.5 The measure

The participants in the above mixed-methods research design will be comprised of:

For Study 1:

• Build-up of measurements from literature review and formulation of research survey questions are compiled.

For Study 2:

• One hundred and thirty green experts are randomly contacted from firms chosen from the registered organizational members of HKGBC and other green building firms pursuing green development.

• Email of 130 survey questionnaires will be distributed.

• Post-survey interviews are conducted for 13 (10%) respondents to validate the mail survey data.

For Study 3:

• Ten completed green-certified buildings will be randomly selected among buildings from the public (one building), industrial (two), institutional (two), and private sectors (five) in the HK construction industry, on the understanding that the private buildings' energy consumption will be vastly affected the GHG emissions.

• At least five respondent building firms for each project comprising of a developer, architect, main contractor, building services firm, and BEAM-accredited consultant are approached for each project.

• Post-case-studies interviews were conducted for the 10 case studies randomly selected. These interviews will help to gain further insight into the professionals' mind-set of GMS/GTD, SCO/GBU, and GPS/FPS together with their expert advice and opinions on the survey results obtained.

For Study 4:

• Data reasoning, analysis, and generalization are conducted to formulate the theories to see if any practical theories can be formulated.

4.6 Ways to ensure the measure

The organizations selected will be accredited under BEAM Society[212] or LEED green certification in Hong Kong. Those green professionals will be assessed on a 5-point scale. Those with 4 points will be discarded. The average acceptable score will be 6.5 points. The data got will be weighed against the following control variable of the size of firm and project complexity to assure the data is more realistic and robust.

4.7 Test statistics

The statistical techniques to be adopted in this study to analyze raw data collected include reliability analysis, Pearson correlation and regression analysis, exploratory and confirmatory factor analysis, hierarchical regression analysis, and assessment of common method bias. The data analysis employs IBM SPSS Statistics 26.0 for the study of raw data. Two tests were performed to determine if the original data set were useful for factor analysis. The Bartlett test of sphericity was executed to examine whether the original set of variables was significantly inter-correlated. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was used to determine the extent of suitability for factor analysis.

5. The mail survey findings and results

5.1 The survey

The questionnaires set out under the literature review were evaluated by three BEAM professionals, the green experts accredited by the HKGBC and who are qualified to assess the green performance status of the buildings that apply for green certification under the Hong Kong Building Environmental Assessment Methods. Face-to-face discussions were arranged with the BEAM professionals for their review and proposed measurement items under the hypotheses and ensured the applicability and clarity of the questionnaires[214,215]. The questionnaires, having incorporated the comments, were dispatched by email to a sample of 130 practitioners who are from both the public and private building firms experienced in GMP in the building industry in Hong Kong. The participants were those who took the project management roles, and all came from companies of various trades including those from property developers, BEAM consultants, contractors, and suppliers. The companies were all listed as patron members of the HKGBC to ensure that they have experience in green construction industry. The consultants included architects, building surveyors, and engineers. The participants were invited by their acquainted industry colleagues and professionals to increase the sample size for the survey (a snowball sampling technique[216]). Eighty-three valid responses were received from the 130 questionnaires emailed, giving a response rate of 63.8%. Based on the study for the determining of sample size using Cochran's formulas[217], the minimum sample size will be 111 for a population of 1,679. The anticipated response rate of 65% would be achieved based on prior research experience. The response rate of 63.8% in this survey study is considered acceptable, on the understanding that unlike green technologies development, green marketing strategy has not been widely adopted as a green management practice in Hong Kong's building sector, the number of green experts in this connection is limited. This survey was focused on both the public and private building practices with practitioners from various professional project teams to increase the data validity as much as possible.

5.2 Demographics

Table 12 presents the descriptive statistics of the mail survey result.

Table 12. The sample descriptive statistics

No.	Variable	Category	Number	%
1	Company size	Large (> 50 employees)	53	63%
		Medium (25–50 employees)	8	10%
		Small (< 25 employees)	23	27%
2	Building experience	High (> 10years)	56	66%
		Medium (5–10 years)	14	17%
		Low (< 5 years)	14	17%
3	Project complexity	High	26	31%
		Medium	33	39%
		Low	25	30%
4	Percentage of green involvement	High (>30%)	22	26%
		Medium (10–30%)	39	46%
		Low (<10%)	23	27%

The sample predominately constitutes large-sized companies (63%), with large respondents

having building experience of over 10 years (66%). The project complexity was medium (39%), and the percentage involved in green building development was medium (46%). **Table 13** shows the title of the respondents.

Table 13. Title of respondents

Title	Subtotal
Project director/general manager	10
Senior project manager	18
Project manager	39
Sales manager	16
Total	83

The respondents comprise 10 project directors/general managers, 18 senior project managers, 39 project managers, and 16 sales managers. The average years of these respondents in the construction industry was 12.25 years, the average years of these respondents in the prevailing firms was 4.3 years.

5.3 Measures and exploratory and confirmatory factor analysis

In this research, the questionnaires presented a series of items for both green management practices and organizational performances. These measurement scales were adopted from previous research or newly developed as necessary. All the scales are 5-point Likert scales unless stated otherwise (1 = strongly disagree and 5 = strongly agree).

Two tests were performed to determine if the original data set were useful for factor analysis. The Bartlett Test of Sphericity was executed to examine whether the original set of variables was significantly inter-correlated, and the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was used to determine the extent of suitability for factor analysis.

For green management practices, the Bartlett Test of Sphericity result was 224.694 ($p < .01$), KMO was .814, and the reliability coefficient α was .822. For organizational performance success, the Bartlett Test of Sphericity result was 390.872 ($p < .01$), KMO was .824, and the reliability coefficient α was .878. These results indicated that the data were appropriate for factor analysis.

From the mail survey data under this study, factor analysis can then be conducted to confirm GMP and OPS groupings. The maximum likelihood technique was executed to extract the factors following the varimax rotation. Application of Kaiser Criterion (eigenvalues >1) was used to estimate the scree plots. Pursuant to the initial eigenvalue and scree tests' findings, two meaningful factors for both GMP and OPS were retained. The two factors for GMP are green marketing strategy (GMS) and green technologies development (GTD) while the two factors for OPS are green performance success (GPS) and financial performance success (FPS). These confirmed the original groupings under this study for the measure items of GMP and OPS. The two GMP clarified 81.4% of the intrinsic variance in their items. The Cronbach's α values for reliability assessment were .86 and .73 for GMS and GTD, respectively. Thus, the two factors GMS and GTD, were reserved. The two OPS factors clarified 82.4% of the intrinsic variance in their items by the same token. The Cronbach's α values for the reliability assessment were .82 and .84 for GPS and FPS, respectively. In this case, the two factors GPS and FPS, were also reserved.

In **Table 14**, the inter-construct correlation matrix and descriptive statistics among key variables are reported.

Table 14. Correlation matrix of variables (Pearson correlation coefficients)

	1	2	3	4	5	6	7
1. GMS	–						
2. GTD	.304*	–					
3. SCO	.352**	.302*	–				
4. GBU	.207**	.201*	.365*	–			
5. GPS	.167**	.177***	.216**	.147	–		
6. FPS	.198**	.100**	.144**	.167**	.354**	–	
7. Company size	.289	.253	.161	.088	.119	.051*	–

Note: GMS = green marketing strategy; GTD = green technologies development; SCO = supplier cooperation; GBU = green building uncertainty; GPS = green performance success; FPS = financial performance success.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 15. Measurements, composite reliability and confirmatory factor analysis, and model fit summary results

Code	Constructs and measures	SFL
	Green Management Practices Degree of importance: 1 = *no effect at all*, 2 = *fairly important*, 3 = *important*, 4 = *very important*, 5 = *critically significant*	
GMS	Green marketing strategy (∂ = .85)	
GMS1	Align the green marketing strategy with owner strategies for green building development.	.81*
GMS2	Focus the marketing promotion on green performance rewards.	.80*
GMS3	Lay down the vital choices in green products, marketing activities and resources to the customers' satisfaction.	.78*
GMS4	Lay down an information platform to include all the green suppliers and green products with a good performance record.	.83*
GTD	Green technologies development (∂ = .88)	
GTD1	Design the green building products for reuse, recycle, and recovery of material, component parts.	.86*
GTD2	Design green building technologies to avoid or reduce hazardous product and their manufacturing process.	.80*
GTD3	Dedicate to pursue new and reliable energy development from natural resources and environmental services with the target to reduce the GHG emission and global warming.	.83*
	Moderators Degree of agreement: 1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*	
SCO	Supplier cooperation (∂ = .82)	
SCO1	Supply management capabilities of the building firms enabled supplier cooperation.	.71*
SCO2	Supplier cooperation is a measure to increase the supplier corporate social responsibility compliance and the building firms' social value.	.78*
SCO3	Supplier cooperation enabled the improvement of suppliers' environmental capabilities as well as those of the building firms.	.69*
SCO4	Supplier cooperation is especially pursued by building firms with a comprehensive green marketing supply strategy and green technologies development.	.79*
SCO5	Supplier cooperation leads to better delivery manufacturing performance as well as the building firms logistic and site storage/housekeeping performance.	.72*
SCO6	High level of technological and logistical integration, as well as reduction of the supplier base, lead to higher levels of environmental collaboration and performance of the building firms.	.78*
SCO7	Supplier cooperation leads to the better environmental and economic-financial performance of the building firms.	.78*
SCO8	Supplier cooperation has positive quality, delivery, flexibility performance, and environmental performance impact on the building firms.	.80*
GBU	Green building uncertainties (∂ = .85)	
GBU1	The demand and supply of green building projects has faced with uncertainty.	.80*
GBU2	The development of green materials and green technologies are still in its infancy and are uncertain in their environmental performance.	.82*
GBU3	Uncertain if the project team has green construction practice and know-how of standards that are not within their expertise and competence.	.81*
	Organizational Performance Success Degree of performance achieved: 1 = *none at all*, 2 = *mild*, 3 = *moderate*, 4 = *relatively significant*, 5 = *significant*	
GPS	Green performance success (∂ = .83)	
GPS1	The project team has established engineering systems to reduce the waste emission compared with last year.	.77*
GPS2	The project team has decreased the consumption of hazardous/harmful/toxic materials compared with last year.	.76*
GPS3	The project team has decreased in frequency the environmental accidents compared with last year.	.79*
GPS4	The project team has improved the company's environmental situation and prestige compared with last year.	.81*
GPS5	The project team has achieved the green certification award under BEAM Society[212] compared with last year.	.81*
FPS	Financial performance success (∂ = .86)	
FPS1	The company has decreased its average operating costs compared with last year.	.77*
FPS2	The company has increased the average building values compared with last year.	.80*
FPS3	The company has improved the average return on investment compared with last year.	.81*
FPS4	The company has increased its average occupancy compared with last year.	.82*
FPS5	The company has increased the average rental charge compared with last year.	.83*

Note: N = 83. ∂ = composite reliability; SFL = standardized factor loading.
*p < .001 (two-tailed t test).

In **Table 15**, the constructs, the measurement items, the composite reliabilities (CR) and model fit indices are summarized. All the reliability values are greater than .80; according to reference [218], it suggests acceptable levels and supports the research's convergent validity.

In **Table 15**, the constructs, the measurement items, and the composite reliabilities (CR) and model fit indices are summarized. All the reliability values are greater than .80; according to reference [218], it suggests acceptable levels and supports the research's convergent validity.

5.4 Model fit summary

As recommended by Kline[219], for model fit, the model chi-square p value should be >.05; the root mean square error of approximation should be <.08 and comparative fit index should be ≥.90. The indicated values under this study indicated that the model chi-square p value was .053 (>.05); the root mean square error approximation was .05 (<.08) and the comparative fit index was .972 (≥.90). It can thus be concluded that the model was a good fit and the model proposed under this study was plausible.

Table 16. Model chi-square p values

Model	NPAR	CMIN	DF	*p*	CMIN/DF
Default model	99	609.675	335	.053	1.820
Saturated model	434	–	–	–	–
Independence model	28	1,560.606	406	–	3.844

Note: NPAR = Nonparametric test; CMIN = Chi-square minimum; DF = Degree of freedom.

Table 17. Root mean square error approximation

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.050	.031	.079	.418
Independence model	.234	.224	.237	.000

Table 18. Comparative fit index

Model	NFI Delta$_1$	RFI rho1	IFI Delta$_2$	TLI rho$_2$	CFI
Default model	.930	.887	.972	.954	.972
Saturated model	1.000	–	1.000	–	1.000
Independence model	.000	.000	.000	.000	.000

5.5 Moderators estimating method

To identify the moderator variables and relationship clarification, the hierarchical regression method was applied to the various hypotheses under this study. This technique is appropriate as moderator estimating method with complemented procedures to elucidate the relationships[220]. H3a/H3b–H6a/H6b postulate that the association between GMP and OPS is moderated by SCO and GBU. A moderated regression analysis using four models of regression was conducted to verify the moderating effects of SCO and GBU on the association between GMP and OPS. Model 1 uses the company size as the control variable; Model 2, with input of GMS and GTD; Model 3, with the two moderators, SCO and GBU; and Model 4, the interactive terms of GMS/GTD with moderators, SCO and GBU. All comments were achieved using IBM SPSS Statistics 26.0.

To support a significant moderating effect of SCO and GBU, their relationship variation should be statistically significant. In this case, the incremental variance was evaluated[221]. If the moderating effects account for significant total variance in the dependent variable, the value of beta values and total F-statistic values would respectively indicate the considerable impact individually and collectively (see **Table 19**[222]).

5.6 Main effects and control variable relationship

The analyses of the one-tailed hierarchical moderated regression were presented in **Table 19**. The results show that the company size where $p > 0.05$ did not significantly associate with any one of the performance constructs. In other words, the additional resources made for GMS and GTD in larger companies have no association with their performance outcome.

Table 14 listing the Pearson correlation coefficients between GMP and OPS posits that GMP has a positive and significant association with OPS. Furthermore, the high values of F and R^2 in Model 2 (**Table 19**), reveals the same correlation using multivariate regression analysis. It thus can be established that the analysis strongly supports hypotheses H1a/H1b–H2a/H2b.

5.7 Effects of moderators SCO and GBU

Both the moderators SCO and GBU in **Table 19** have a moderating effect on GMP and OPSs association.

Under Model 4 in **Table 19**, when the moderator SCO was input into the regressions, the F value

Table 19. Hierarchical regression according to the GMS/GTD, SCO and GBU interaction

	Dependent variable									
	Green performance success (GPS)					Financial performance success (FPS)				
Variables entered	**H**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**H**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Main effects										
GMS	H_{1a}	–	1.016**	.243**	.375**	H_{2a}	–	1.187***	1.098**	1.091**
GTD	H_{1b}	–	1.2***	.745**	.455**	H_{2b}	–	.648**	.377**	.280**
SCO		–	–	1.809***	1.371**		–	–	.255**	.516**
GBU		–	–	–.689**	–1.655***		–	–	.218**	–0.298**
Interactions										
GMS × SCO	H_{3a}	–	–	–	1.581**	H_{3b}	–	–	–	–.396**
GTD × SCO	H_{4a}	–	–	–	.265**	H_{4b}	–	–	–	1.355**
GMS × GBU	H_{5a}	–	–	–	.833***	H_{5b}	–	–	–	–0.418**
GTD × GBU	H_{6a}	–	–	–	.791**	H_{6b}	–	–	–	1.636**
Control variable										
Company size		.129	.201	–.198	–.151		.167	–.276	–.276	–.180
F for the regression		3.335	13.802***	11.100***	9.905***		4.370	7.887**	5.179**	4.709**
R^2		.040	.460	.647	.734		.052	.314	.373	.447

Note: Table contains standardized coefficient betas. H = hypothesis; GMS = green marketing strategy; SCO = supplier cooperation; GBU = green building uncertainty.
*p < .05. **p < .01. ***p < .001.

for the block of interaction was significant for GPS (9.905), FPS (4.709), and the R^2 was significant for GPS (.734) and for FPS (.447). The two interaction terms of GMS and SCO had positive significant beta values for GPS (β = 1.581, p < .05) but the beta value was nonsignificant for FPS (β = –.396, p < .05). On the other hand, when the moderator GBU was input into the regression, the interaction terms for GMS and GBU had significant beta values for GPS (β = 0.833, p < .01), but the beta value was nonsignificant for FPS (β = −.418, p < .01).

Model 4 in **Table 19** reveals the moderating effect of SCO and GBU on GTD. When the moderator SCO was entered into the regressions, the F value for the block of interactions was significant for GPS (9.905) and FPS (4.709), and the R^2 was significant for GPS (.734) and for FPS (.447). The interaction terms for GTD and SCO had slightly significant beta values for GPS (β = .265) and FPS (β = 1.355). When the moderator GBU was entered into the regression, the two interaction terms GTD and GBU had a significant beta value for GPS (β = .791, p < .01), FPS (β = 1.636, p < .01). The moderating effect of SCO and GBU for GMS and GTD on GPS and FPS can be summarized in **Table 20**.

Table 20. Moderation effect of SCO and GBU for GMS/GTD on GPS/FPS

Hypotheses	Moderator	β	*p*	Support
GMS→GPS	SCO			
H_{3a}		1.581	<.01	√
GMS→FPS				
H_{3b}		–396	<.01	×
GTD→GPS	SCO			
H_{4a}		265	<.01	√
GTD→FPS				
H_{4b}		1,355	<.01	√
GMS→GPS	GBU			
H_{5a}		.833	<.01	√
GMS→FPS				
H_{5b}		–.418	<.01	×
GTD→GPS	GBU			
H_{6a}		.791	<.01	√
GTD→FPS				
H_{6b}		1.636	<.01	√

Note: √ = hypothesis supported; × = hypothesis not supported.

5.8 Main effects of GMP on OPS

The empirical results advocate that the surveyed GMP is effective for GPS and FPS enhancement, as expected. The associations between GMP and OPS are positive signs, particularly in GTD. The exploration in **Table 15** verified that the composite reliability of GTD (.88) was more significant than that of GMS (.85). It can be expected that successfully engaging in GTD signifies a vital role in alleviating the hold-up when implementing GMP. The

results of the main effects are summed up in **Table 21**.

Table 21. Main effect of green management practices (GMS/GTD) on organizational performance success (GPS/FPS)

	Hypothesis for the effects of GMS/GTD on GPS/FPS	
√	H_{1a}	Firms step up GMS adoption promotes GPS of the building projects.
√	H_{1b}	Firms step up GTD adoption promotes GPS of the building projects.
√	H_{2a}	Firms step up GMS adoption promotes FPS of the building projects.
√	H_{2b}	Firms step up GTD adoption promotes FPS of the building projects.

Note: √ = hypothesis supported; × = hypothesis not supported.

5.9 Interaction effects

Interaction effects of SCO on GMS/GTD on GPS/FPS. The interaction effects of SCO places on GMS (β = 1.581, $p < 0.01$ for GMS × SCO on GMS) help strengthen the associations with customers and suppliers in the improvement of GPS but not for FPS (β = –.396, $p < .01$ for GMS × SCO on FPS). This effect may be due to the fact that GMS has diluted the impact of SCO on the FPS. In other words, the company has to pay double overheads to recruit their own GMS team to source the green products and to pay their supplier for their resource and delivery of the green products.

However, the moderating effect of SCO is powerful for GTD practices (β = .265, $p < .01$ for GTD × SCO on GPS) & (β = 1.355, $p < .01$ for GTD × SCO on FPS). This finding is significant because companies that pursue green product development often find it challenging to carry out this GTD management practice unless SCO is in place. In fact, SCO is an essential activator to many GTD practices.

Interaction Effects of GBU on GMS/GTD on GPS/FPS. The moderating effect of GBU has weakened the association between GMS and FPS (β = –.418, $p < .01$ for GMS × GBU on FPS), but not for GPS (β = .833, $p < .01$ for GMS × GBU on GPS. This result did not support H5b such that GBU will weaken the effect of GMS on FPS, but strengthen the effect on GPS under H5a. It further indicates the GMS's defective role under uncertainty, signifying that firms should be aware that the uncertainty in such situations must be measured when assessing the payoff from GMS application efforts. An implication for this negative moderating effect of GBU is that the comparatively high degree of the competitive environment in GMS impels the construction firms to start more operative cross-functional collaboration. It also effectuates more green marketing knowledge transfer strategies; strengthens the top management support, and articulates unique expertise to manage the uncertainty, thereby decreasing FPS. However, in this context, GBU can be considered as an enabler instead of a deactivator to effectuate FPS. However, the market uncertainties will exacerbate the applicability of green marketing strategy (GMS) in pursuing green performance success (GPS) of the firm.

On the other hand, the moderating effect of GBU for GTD is powerful for GTD management practices (β = .791, $p < .01$ for GTD × GBU on GPS) & (β = 1.636, $p < .01$ for GTD × GBU on FPS). The results agree with the hypotheses H6a and H6b such that the GBU did moderate positively the effect of GTD on both GPS and FPS. The uncertainties in the market will exacerbate the applicability of the green technology development in pursuing green building development. The interactive effects of moderators SCO and GBU are summed up in **Table 22**.

Table 22. The moderating effect of SCO and GBU for green management practices (GMS/GTD) and organizational performance success (GPS/FPS)

	Hypotheses for the moderators SCO and GBU	
√	H_{3a}	Supplier cooperation (SCO) moderates positively the relationship between the firm's green marketing strategy (GMS) and green performance success (GPS).
×	H_{3b}	Supplier cooperation (SCO) moderates positively the relationship between the firm's green marketing strategy (GMS) and financial performance success (FPS).
√	H_{4a}	Supplier cooperation (SCO) moderates positively the relationship between the firm's green technologies development (GTD) and green performance success (GPS).
√	H_{4b}	Supplier cooperation (SCO) moderates positively the relationship between the firm's green technologies development (GTD) and financial performance success (FPS).
√	H_{5a}	Green building uncertainty (GBU) moderates positively the relationship between the firm's green marketing strategy (GMS) and green performance success (GPS).
×	H_{5b}	Green building uncertainty (GBU) moderates positively the relationship between the firm's green marketing strategy (GMS) and financial performance success (FPS).
√	H_{6a}	Green building uncertainty (GBU) moderates positively the relationship between the firm's green technologies development (GTD) and green performance success (GPS).
√	H_{6b}	Green building uncertainty (GBU) moderates positively the relationship between the firm's green technologies development (GID) and financial performance success (FPS).

Note: √ = hypothesis supported; × = hypothesis not supported.

5.10 The post-survey interview

Ten respondents randomly selected from the mail survey obtained. They were all taken the role of project management role. Two were registered architectural architects, two were qualified building service engineers, four were building surveyors and two were landscape architects. Among them, four got the BEAM–Pro qualification accredited under the HKGBC.

The green project involved by the interviewees in the sample averages 24 months with 23 members in the company. Considering the contract sum, there is a widespread distribution average of HK$330 million. The interviewees, on average, have 12 to 13 years of experience in green project management. Ten percent of the sample has a professional certification in project management or, a Master's degree in the field. Compared with the conventional buildings, the sample identified that the green buildings have contributed to the following percentage change on average:

- increase in construction cost: 4.9%
- increase in the project period: 3.2%
- decrease in operating costs: 6.5%
- increase in building values: 6.4%
- increase in return on an asset: 5.1%
- increase in occupancy: 4.2%
- increase in the rental charge: 4.1%

6. The case studies findings and results

6.1 The case studies

It was posited that four to 10 case studies would be sufficient to adopt multiple case studies as a research survey for this study[223]. This study uses 10 case studies under the context, as illustrated in **Table 12**. The choice of the cases reviews is based on the following criteria, as mentioned in the methodology:

- Ten completed green-certified buildings under different developers are randomly selected among the following buildings: one for a public building, two for industrial building and institutional building, and five for the private ones.
- Post-case-studies interviews are arranged with the above projects' working team selected to complete the survey questions under this study. These post-case-studies interviews with the project team to complete the survey questions designed under this study is valuable as a cross-check with the mail survey. The project team comprises the developer, the architect, the green consultant, and the main contractor, who all participated in the case study.

The 10 project case studies are recorded in **Table 23**.

Table 23. Scope of the case studies

		Number of projects	
Project type	**Code**	**Selected**	**Number of associated developers**
1. Public	PU	1	1
2. Industrial	ID	2	2
3. Institutional	IS	2	2
4. Private	PR	5	5
Total		10	10

The projects randomly chosen are put in **Table 24**.

The following **Table 25** displays the reference model guiding the case study analysis with each practice grouped within the GMP (GMS/GTD).

Table 24. The projects randomly chosen associated with their developers

Code	Project	Developer
PU1	The Trade and Industry Tower	Architectural Services Department, HKSAR Government
ID1	Industrial Plant Development at Yuen Long for Vogue Laundry Service Limited Relocation Project	Vogue Laundry Service Limited
ID2	Towngas Headquarter	The Hong Kong and China Gas Company Limited
IS1	The New Campus for THEi	Vocational Training Council
IS2	Hang Seng Management College Block D (Lee Quo Wei Academic Building)	Hang Seng Management College
PR1	Hysan Place	Hysan Development Company Ltd.
PR2	Holiday Inn Express Hong Kong Soho	Million Wealth Enterprise Limited
PR3	Office Development at King Wah Road	Henderson Land Development Co., Ltd.
PR4	Mount Parker Residences	Swire Properties Ltd.
PR5	Jade Grove Residential Development	Citi-Sky Development Limited (a subsidiary of Chinachem Group)

Table 25. Groupings and practices

Groping	Practice
GMS	GMS1: Green marketing strategy
	GMS2: Green promotion
	GMS3: Green products
	GMS4: Green information platform
GTD	GTD1: Eco-design
	GTD2: Green environmental technology
	GTD3: Reliable renewable energy development
SCO	SCO1: Supply management capabilities
	SCO2: Supplier corporate social responsibility
	SCO3: Supplier environmental capabilities
	SCO4: Comprehensive GMS & GTD
	SCO5: Site delivery, logistics performance
	SCO6: Integration of technological and logistical level
	SCO7: Environmental and economic performance
	SCO8: Quality and flexibility performance
GBU	GBU1: Uncertain in the supply and demand of green building projects
	GBU2: Uncertain green materials and technologies performance
	GBU3: Uncertain know-how of the project participants
GPS	GPS1: Waste emission
	GPS2: Consumption of harmful/toxic materials
	GPS3: Environmental accidents frequency
	GPS4: Company's prestige
	GPS5: Green certification award
FPS	FPS1: Operating costs
	FPS2: Building value
	FPS3: Return of investment
	FPS4: Occupancy
	FPS5: Rental charge

Note: GMS = green marketing strategy; GTD = green technologies development; SCO = supplier cooperation; GBU = green building uncertainty; GPS = green performance success; FPS = financial performance success.

Moderators of supplier cooperation and green building uncertainty and green performance success and financial performance success are grouped under this table. The groupings formed the basis for the survey questionnaires.

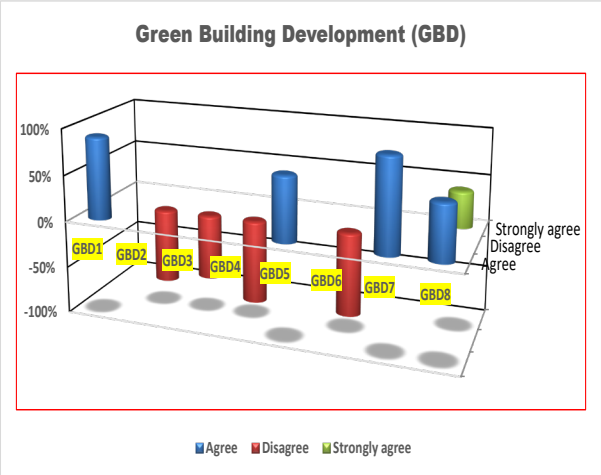
Each project's practices associated with those listed in **Table 25** are stipulated in the following figures, where PU is used for the public projects, ID for the industrial project, IS for the institutional projects, and PR for the private projects. For details of the case studies, please refer to the appendix.

6.2 Expert interviews (post-case-studies interviews)

6.2.1 The expert interviews

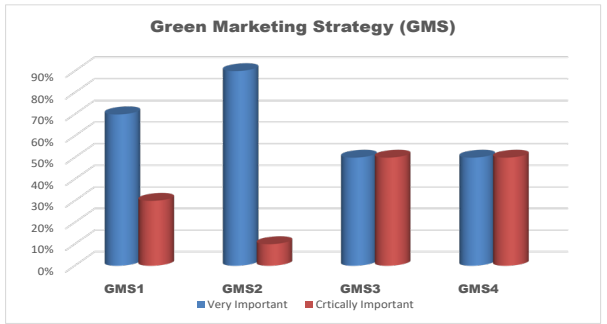
Post-cast-studies interviews are conducted with each of the project team participated in the projects above. Each project team comprises the developer, the architect, the green consultant, and the main contractor. The survey questions are asked, and the answers in consensus are recorded as follows under **Figure 11**.

Practices		The post-case-studies interview results									
		Projects									
		PU1	ID1	ID2	IS1	IS2	PR1	PR2	PR3	PR4	PR5
Green building development (GBD) Relative Agreement [low-high](1-5)											
GBD1	GBD specifications	5	4	4	4	4	4	4	4	4	4
		Almost all the participants (90%) agreed that the specifications should include GBD.									
GBD2	GBD guides available in HK	3	2	2	3	2	2	2	2	2	2
		Most participants (80%) disagreed that the guides for preparing GBD can be easily found in HK.									
GBD3	Sufficient GBD specifications in the public sector work	3	3	3	2	2	2	2	2	2	2
		Most participants (70%) disagreed that the current public sector specifications have sufficient GBD considerations.									
GBD4	Sufficient GBD specifications in the private sector work	2	2	2	3	2	2	2	2	2	2
		Almost all the participants (90%) disagreed that the current private sector specifications have sufficient GBD considerations.									
GBD5	GBD database available in the company	4	3	4	4	4	2	2	4	4	4
		Most participants (70%) agreed that the database of GBD is adequately available in their company.									
GBD6	GBD for mandatory requirements only	3	2	2	2	2	2	2	2	2	2
		Almost all the participants (90%) disagreed that the GBD is mainly for satisfying mandatory requirements.									
GBD7	Senior management fully support GBD	4	4	4	4	4	4	4	4	4	4
		All participants (100%) agreed that their senior management is fully supported GBD.									
GBD8	GBD should be obligatory	5	4	4	5	4	4	5	4	4	5
		All participants agreed (60%) and strongly agreed (40%) that adopting GBD should be obligatory.									



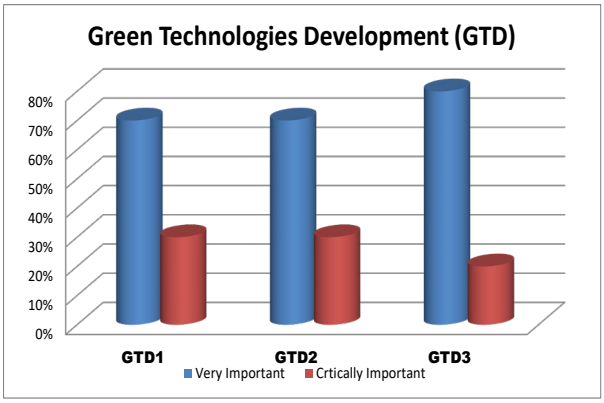
GBD post-case-study interview bar chart summary

Green marketing strategy (GMS) relative importance [low-high](1-5)											
GMS1	Green marketing strategy	4	4	5	5	4	4	4	4	4	5
		All participants considered that it is very important (70%) and critically significant (30%) to align the GMS with the owner strategies for GBD.									
GMS2	Green promotion	4	4	4	4	4	4	4	4	4	5
		All participants considered that it is very important (90%) and critically significant (10%) to focus the marketing promotion on green performance rewards.									
GMS3	Green products	5	5	4	4	4	4	5	5	5	4
		All participants considered that it is very important (50%) and critically significant (50%) to lay down the vital choices in green products, marketing activities and resources to the customers' satisfaction.									
GMS4	Green information platform	5	4	5	4	5	4	4	5	5	4
		All participants considered that it is very important (50%) and critically significant (50%) to lay down an information platform to include all the green suppliers, and green products with good performance record.									



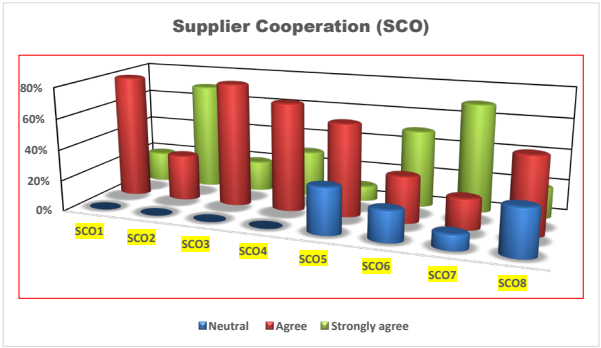
GMS Post-case-study interview bar chart summary

Green technologies development (GTD) relative importance [low-high](1-5)											
GTD1	Eco-design	5	4	5	4	5	4	4	4	4	4
		All participants considered that it is very important (70%) and critically significant (30%) to design the green building materials/products with reusable/recycling component parts.									
GTD2	Green environmental technology	4	4	4	4	4	4	5	4	5	5
		All participants considered that it is very important (70%) and critically significant (30%) to design green building technologies to eliminate any use of hazardous products in their manufacturing process.									
GTD3	Renewable energy development	4	4	5	4	4	4	4	5	4	4
		All participants considered that it is very important (80%) and critically significant (20%) to dedicate to pursue new and reliable energy development from natural resources and environmental services with the target to reduce the GHG emission and global warming.									



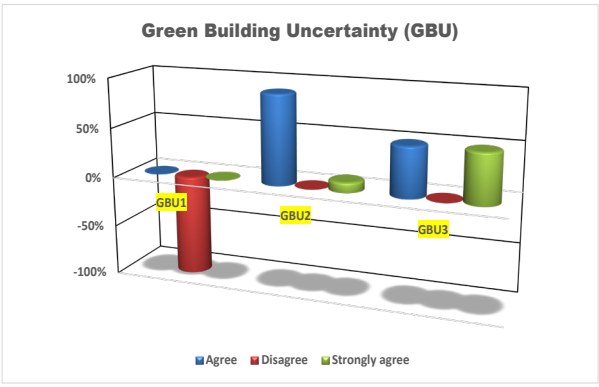
GTD Post-case-study interview bar chart summary

Supplier cooperation (SCO) relative agreement [low-high](1-5)											
SCO 1	Supply management capabilities	4	4	4	4	4	5	4	4	5	4
		All the participants agreed (80%) and strongly agreed (20%) that the supply management capabilities of the building firms enabled supplier cooperation.									
SCO 2	Supplier corporate social responsibility	4	5	5	5	4	5	5	5	5	4
		All the participants agreed (30%) and strongly agreed (70%) that the supplier cooperation is a measure to increase the supplier corporate social responsibility compliance and the building firms' social value.									
SCO3	Supplier environmental capabilities	4	4	4	5	5	4	4	4	4	4
		All the participants agreed (80%) and strongly agreed (20%) that the cooperation of the suppliers improved/enhanced their active involvement of environmental capabilities as well as those of the building firms.									
SCO4	Green marketing & green technologies development	5	4	4	4	5	4	4	5	4	4
		All participants agreed (70%) and strongly agreed (30%) that suppliers cooperation is exclusively followed by building firms who are adopting a comprehensive green marketing supply strategy and green technologies development.									
SCO5	Site delivery, logistics performance	4	4	5	4	4	3	3	4	3	4
		Most of the participants agreed (60%) and strongly agreed (10%) with 30% neutral that the cooperation of the suppliers ensured better logistics performance of manufacturers as well as the building firms logistic and site storage/housekeeping performance.									
SCO6	Integration of technological and logistical level	5	5	5	4	5	4	4	5	3	3
		Almost all participants agreed (30%) and strongly agreed (50%) with 20% neutral that the high integration of technologies and logistics, and supplier base reduction, led to stepping up the collaboration of environmental protection and organizational performance of the building firms.									
SCO7	Environmental and economic performance	5	3	5	5	5	5	5	5	4	4
		Almost all the participants agreed (20%) and strongly agreed (70%) with 10% neutral that the supplier cooperation leads to the better environmental and economic-financial performance of the building firms.									
SCO8	Quality and flexibility performance	3	3	4	4	4	5	3	5	4	4
		Most of the participants agreed (50%) and strongly agreed (20%) with 30% neutral that the supplier cooperation has positive quality, delivery, flexibility performance and environmental performance impact on the building firms.									



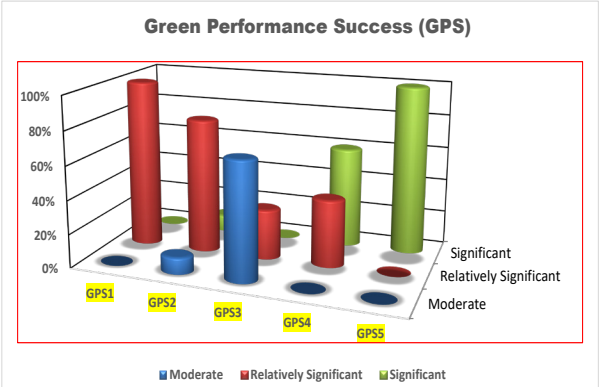
SCO post-case-study interview bar chart summary

Green building uncertainty (GBU) relative agreement [low-high](1-5)											
GBU1	Uncertain in the supply and demand for green building projects	2	2	2	2	2	2	2	2	2	2
		All the participants disagreed (100%) that the demand and supply of green building projects have faced uncertainty.									
GBU2	Uncertain green materials and technologies performance	4	4	4	4	4	4	4	5	4	4
		All the participants agreed (90%) and strongly agreed (10%) that the development of green materials and green technologies are still in its infancy and are uncertain in their environmental performance.									
GBU3	Uncertain project team's know-how	5	5	4	4	4	4	5	5	4	5
		All the participants agreed (50%) and strongly agreed (50%) that there will be GBU if the project team does not reach the standards of green construction practice and know-how that are prerequisites for the green success performance of the project.									



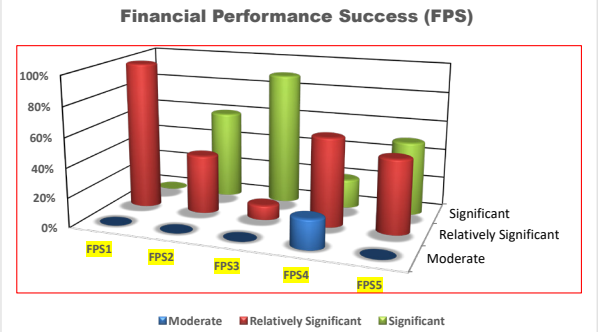
GBU post-case-study interview bar chart summary

Green performance success (GPS) relative performance achieved [low-high](1-5)											
GPS1	Waste emission	4	4	4	4	4	4	4	4	4	4
		The project team has established engineering systems to reduce waste emission relatively significantly (100%) compared with last year.									
GPS2	Harmful/toxic materials consumed	4	4	4	4	4	4	3	5	4	4
		The project team has decreased the consumption of hazardous, harmful, toxic materials moderately (10%), relatively significantly (80%), and significantly (10%) as compared with last year.									
GPS3	Environmental accidents frequency	4	3	4	3	4	3	3	3	3	3
		The project team has decreased the environmental accidents moderately (70%) and relatively significantly (30%) and compared with last year.									
GPS4	Company's prestige	5	5	5	4	5	4	4	5	4	5
		The project team has improved the company's environmental situation and prestige relatively significantly (40%) and significantly (60%) as compared with last year.									
GPS5	Green certification award	5	5	5	5	5	5	5	5	5	5
		The project team has achieved the green certification award under the BEAM Society (2019) significantly (100%) as compared with last year.									



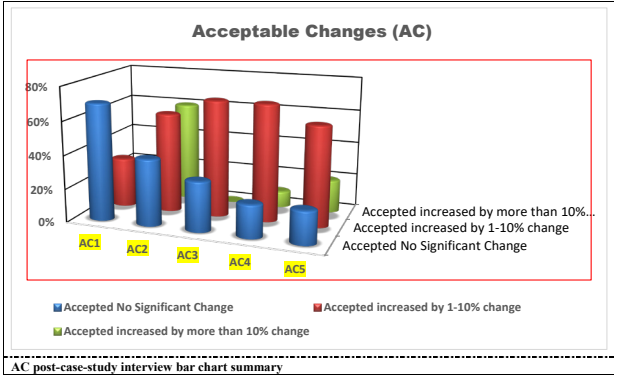
GPS post-case-study interview bar chart summary

Financial performance success (FPS) relative performance achieved [low-high](1-5)											
FPS1	Operating costs	4	4	4	4	4	4	4	4	4	4
		The company has decreased the average operating costs relatively significantly (100%) compared with last year.									
FPS2	Building value	5	5	4	5	5	4	4	5	5	4
		The company has increased the average building values relatively significantly (40%) and significantly (60%) compared with last year.									
FPS3	Return of investment	4	5	5	5	5	5	5	5	5	5
		The company has improved the average return on investment relatively significantly (10%) and significantly (90%) as compared with last year.									
FPS4	Occupancy	4	4	5	4	4	4	4	3	3	5
		The company has increased the average occupancy moderately (20%), relatively significantly (60%), and significantly (20%) as compared with last year.									
FPS5	Rental charge	4	4	4	5	5	5	5	5	4	4
		The company has increased the average rental charge relatively significantly (50%) and significantly (50%) as compared with last year.									



FPS post-case-study interview bar chart summary

Acceptable changes in pursuing GBD [AC] Acceptable changes [reduction-increase](1-5)											
AC1	Construction cost	4	3	3	4	4	3	3	3	3	3
		Only 30% of the participants accepted an increase in construction cost by 1% to 10% in pursuing GBD. Others (70%) did not take any significant change in construction cost in this respect.									
AC2	Maintenance cost	4	4	3	3	4	4	3	4	4	3
		60% of the participants accepted an increase in maintenance cost by 1% to 10% in pursuing GBD. Others (40%) did not take any significant change in maintenance cost in this respect.									
AC3	Durability	4	4	4	4	3	4	4	3	3	4
		70% of the participants accepted an increase in durability by 1% to 10% in pursuing GBD. Others (30%) did not take any significant change in durability in this respect.									
AC4	Buildability	3	4	3	4	4	5	4	4	4	4
		70% of the participants accepted an increase in buildability by 1% to 10% in pursuing GBD. 10% accepted a change of more than 10% Others (20%) did not take any significant change in buildability in this respect.									
AC5	Project period	4	4	4	3	4	4	5	5	4	3
		60% of the participants accepted an increase in the project period by 1% to 10% in pursuing GBD. 20% took a change of more than 10%. Others (20%) did not take any significant change in the project period in this respect.									



AC post-case-study interview bar chart summary

Figure 11. Results of the post-case-studies interviews.

Table 26. Sample descriptive statistics for the post-case-studies interviews

	Characteristics	*M*	*SD*
Interviewee project	Green PM experience (years)	13.1	1.287
	Green project contract sum (in a million HK$)	386.0	17.127
	Contract period (in months)	26.8	1.033
	Team size (number)	23.9	1.449
	Increase in construction cost (%)	6.4	1.647
	Increase in the project period (%)	4.6	1.174
Completed building	Decrease in operating costs (%)	6.8	1.317
	Increase in building values (%)	9.2	1.033
	Increase in return in an asset (%)	11.0	1.054
	Increase in occupancy (%)	8.9	1.912
	Increase in the rental charge (%)	12.6	2.221

The interviewees have taken the green project averages contract period of 27 months with a team size of 24 members. Considering the contract sum, there is a widespread distribution average of HK$330 million.

The interviewees, on average, have 13 years of experience in green project management. Ninety percent of the sample has a professional certification in project management or a Master's degree in the field. Compared with the conventional buildings, the sample identified that the green buildings have contributed to the following percent change on average:

- Increase in construction cost: 6.4%
- Increase in the project period: 4.6%
- Decrease in operating costs: 6.8%
- Increase in building values: 9.2%
- Increase in return on assets: 11%
- Increase in occupancy: 8.9%
- Increase in the rental charge: 12.6%

6.3 Recommendations from the expert interviews

The interviewees recommended public access to green materials, and product standards and specifications should be made available via a convenient website. Based on the green certification requirements, information about the source of green materials and their performance is still limited and insufficient. It is generally accepted that the green label scheme should be updated to have a universal standard of green construction materials for diversified categories and to include other types. More green guidelines should be established on green marketing and procurement for construction staff to have a more precise green construction concept. An in-house green marketing strategy and green technologies development list of effective and efficient energy-saving equipment, appliances, and devices should be compiled by developers, contractors, and suppliers to encourage and facilitate the implementation of GMP like GMS and GTD.

The government should take a leading role in promoting the industry to adopt GMP. The feed-in-tariff scheme to encourage the development of renewable energy is the first step. Under the scheme, any premise installing the solar photovoltaic or wind systems can sell the renewable energy to the power companies in Hong Kong at a rate as high as five times more than the normal electrical rate. Other means of competitive awards and incentive schemes should also be included and publicized in driving the industry to go green. Provisions of GMP in the landing bidding process are highly recommended. More initiatives should be considered to implement GMP in all public projects. For instance, subsidies and tax reductions/exemptions to a certain extent should be provided to the construction firms as incentives to adopt GMP. The government should also institute a registration scheme for all green materials and products as Green Label Scheme for private developers to follow. The existing green materials listed in the current Green Label Scheme are limited compared to similar schemes overseas. Enlarging the Green Label Scheme's diversity and performance liability standards in Hong Kong would entail a more comprehensive local code of practice for GMP to follow in the building industry. In this case, the government should require the contractors to procure those labeled green materials on the list as a prerequisite for the green certification under Hong Kong BEAM Plus.

To enhance the suppliers' cooperation, the suppliers should conduct research on green construction materials with cost-saving data to build up the developers' and contractors' confidence. They should incorporate Hong Kong Green Label Scheme to certify the construction green materials they supplied. The suppliers should always update and expand the categories and the ranges of green alternatives with green performance details for the clients to choose from. The active engagement of suppliers in enhancing GMP is also significant. It helps provide more options and details of the performance data of the green construction materials in the local market.

Table 27. Green management practices recommendations

GMP stakeholders	Stages	Recommendations undertook in all stages of building life cycle
HK Government	Briefing	Promote using "Hong Kong Green Label Scheme" (HKGLS).
		Lay down GMP and procurement of the green labelled materials under HKGLS a mandatory requirement for all tenders.
		Build up the guidelines/authorized persons, and contractors practice notes of GMP for the building industry for all construction projects.
		Stipulate green materials/products in the environmental regulations.
		Expand the list of green materials database registered under HKGLS in collaboration and cooperation with the Hong Kong Green Building Council (HKGBC) and the suppliers.
		Incentivize the GMP scheme with gross floor area exemption complying with specified criteria.
	Design	Implement the GMP in all the public projects run by the Hong Kong Housing Authority and the Architectural Services Department.
	Tendering	Laid down as much as possible all the registered green materials under HKGLS.
HK Green Building Council	Briefing	Cooperate with HK Government to expand the categories and performance standards of green materials under the HKGLS.
		Raise green building awareness offering practical green solutions to the industry.
		Devise guidelines to introduce the best green practices in building design, construction, and operation.
		Offer green training, education, and qualifications (e.g., BEAM Prequalification) to promote and encourage green building development.
		Cooperate and link with the world green building council to expand the diversities of green materials, products, and technologies into the Hong Kong building industry.
Developers	Briefing	Adopt the GMP as a mandatory requirement under the construction contract.
		Take the lead to input various green materials as listed in the HKGLS in the specification.
		Pursue green certification for all projects under Hong Kong BEAM Plus.
		Lay down incentive scheme for obtaining green certified project by the contractors (e.g., a lump sum award if the project is awarded a green certification score of platinum).
		Target to achieve harmonization effect in the design between the people, the environment, and the city community.
		Focus the design on green construction by reducing carbon emissions, using highly energy-efficient appliances and devices, recycling materials, and improving the interior environmental conditions of thermal, audial, and visual comfort.
	Design	Stipulate the GMP requirements in the tender specifications and conditions of the tender to encourage the use of green technologies and green materials in the project.
		Lay down the green technologies to be adopted in the tender specifications (e.g., using chilled ceiling, solar energy stacking system, green roofing, and wastewater recycling and reuse system).
		Foster "Green City" icon in the development area with renewal and conservation of energy (e.g., using a vertical green planting wall like a green belt formed through all the vertical balconies on the external facade with 40% green cover).
		Use recycled materials/products with a prefabricated element in the main area of the development.
		Form a green feature learning walkway to enhance the eco-friendly design concept for the public.
Consultants	Briefing	Lay down the environmental practice codes in the specifications (e.g., ISO 14001/14004) the Environmental Management systems to be followed in the GMP and to strictly abide BS8900 the management systems for green development.
		Introduce using StarfonTM as an interior and exterior building material produced from recycled low-carbon concrete of a non-toxic nature.
		Dedicate to pursue new and reliable energy development from natural resources and environmental services with the target to reduce the greenhouse gas emission and global warming.
	Design	Advise the developers to adopt energy-efficient systems and choice of HKGLS registered green materials suitable for the project (e.g., the reusable pavement blocks, and introduce the use of intelligent Fan Coil Units [iFCUTM] to save the energy consumed for cooling air ventilation and distribution, which in practice can save energy as much as 80%).

Table 27. (*Continued*)

GMP stakeholders	Stages	Recommendations undertook in all stages of building life cycle
		Use of advanced information technology like BIM to integrate the green architectural design and the building services energy-saving design to eliminate the drawing discrepancies to void rework and waste.
		Incorporate web-based smart system to facilitate and re-define green practices, such as a weather station integrated with the BMS backbone for localized control and monitoring of the built environment of humidity, temperature, daylight, wind direction, and air quality, so that the building system can respond accordingly.
		Adopt the development of renewable energy technologies (e.g., solar-activated photovoltaic panels, solar energy driving hot water and chimney system, solar driving optic fiber piping and daylight piping system, lift regenerative power system).
		Design green building technologies to avoid or reduce the use of hazardous products and their manufacturing process.
		Design the green building products for reuse, recycle and recovery of material and component parts.
Contractors	Tendering	Propose in the tender method statement to adopt just-in-time site delivery and logistic system thus enhancing the supplier good cooperation for the better delivery and site housekeeping performance for the project implementation.
		Use GMP to incorporate green technologies and materials into the tender preliminaries.
		Stipulated the green materials to be used in the project like low VOC products and timber sourced from those certified by the FSC and do not use harmful and toxic materials.
	Construction	Take precautions during construction to ensure public safety and minimize inconvenience to the community (e.g., install a CCTV system on the trolley of the tower crane and in the designated lifting area at ground level, set up a traffic control team to coordinate traffic flow near the site area, control the hot works strictly with designated worker and permission obtained from the site management prior to working).
		Select suitable subcontractors and suppliers to use right green performance building materials and good site environmental control of pollution.
		Use the construction materials that were produced dose to the site to reduce the carbon footprint further. This project also introduced StarfonTM as an interior and exterior building material produced from recycled low-carbon concrete of a non-toxic nature.
		Work closely with the consultants to strictly follow the design criteria for implementing green technologies and green materials registered under HK green label system.
		Align the GMS with that of the developer for green building development.
		Lay down an information platform to include all the green suppliers and green products and utilities with a good performance record.
		Implement measures to improve the interior air quality of the site, including good housekeeping, use of adequate fans to ventilate the working area and low emitting paints and coatings.
Suppliers	Briefing	Ensure testing and rese arching materials supplied are green with good quality performance to build up the confidence of the developers.
		Categorize the supplied green materials into registered materials under HK GLS with performance data and job references.
	Tendering	Furnish as much information as possible for the green materials proposed, including the green performance standard and testing data and job references.
		Offer factory investigation trip to audit the green quality of the materials proposed.
		Perform performance test for the green facilities.
		Determine the green alternatives for the developer to choose with competitive price and good quality property.
		Apply storm water recycling system and waste management program to demonstrate waste enhancement and social responsibility.
		Integrate technological and logistical to increase the supplier cooperation and collaboration performance into the tender proposal, such as a waste audit to check recycling and disposal.
Customers	Operation	Follow strictly the manufacturing procedure to implement the energy-efficient appliances.
		Accept the price premium to adopt green products and utilities to reduce carbon footprint.
		Cooperate with the building management to sort out the waste into recycled bins for waste disposal and reuse.
		Convert the households lighting system into LED energy-saving appliances.
		Save water usage by installing water reducing faucets/WC units.

At the project level, the contract specifications or conditions of the contract should stipulate more reliable reusable materials as part of the bidding requirements. Adoption of building information modeling (BIM) should be improvised at the design stage to eliminate any drawing discrepancies to avoid rework and construction waste. Emphasis on the environmental consultants should be placed on their responsibilities to advise green technologies and green products and facilities for energy-efficient application in the project. The environmental consultants should help audit the project's green performance status while implementing the testing and commissioning of all the green facilities installed to ascertain the green performance of these devices. Last but not least, introducing a full and effective green market platform as a green database would definitely help promote the concept of green procurements in GMP and progressively lower the green material costs. The GMP recommendations are summed up in **Table 27**.

7. Discussions

7.1 Strengths and weakness of the study

7.1.1 The strengths

In this study, the SCO and the GBU that support or hinder the relationship between green management practices (GMS/GTD) and organization performance success (GPS/FPS) can be evaluated quantitatively in Study 2 allowing data to be testified in Study 3 in real green-certified buildings. This will broaden the perspective development of the research questions, thus conducive to the results' generalization possibility. The strengths of this mixed-methods research design can be identified as follows.

(1) Available research tools.

All of the available research tools can be used to gather more comprehensive data. This research approach will result in a broader and deeper perspective of the research questions.

(2) Observations and statistical analyses.

Both observations and statistical analyses are included in one study, enhancing the evidential support for the findings.

(3) Two types of research.

Using both the word (qualitative research) and numbers (quantitative research) as a means for communication and inductive/deductive analytical reasoning will most likely appeal to and be capable of drawing in many audiences.

Offsetting weaknesses in research designs. Quantitative research is weak to interpret the data context while qualitative research may include biases devoid of statistical analysis and generalization. Mixed method strategies can offset the weaknesses embedded either in one of the above research designs, allowing both assessment and statistical analysis in this one study.

(4) Data comparison.

Cross comparisons of the data obtained from the combined quantitative and qualitative research design are especially valuable in understanding contradictions between the research designs' findings. GMS/GTD as the management practices' impact on the GPS and FPS got from the post-survey interview may be different from the data obtained from the mail survey. In this case, data that caused contradictions should call for further evaluations.

(5) Expert experience.

The combined research design enabled the experts to have a chance to express their point of view of their actual work experience, thus offering valuable information that is solid and supportive of the findings in the study.

(6) Flexibility in research methodology.

Both studies using observations and interviews (qualitative design) and randomized trials (quantitative design) can be integrated to avoid bias and contribute to mutual support and evaluations. All kinds of construction professionals like building surveyors, architects, building services engineers, and building engineers can be catered for their experience in GMS/GTD together with the effects on GPS and FPS.

(7) More comprehensive data.

For instance, GPS and FPS often combined the data collected quantitatively (i.e., financial return value) and qualitatively (i.e., descriptions and images of green highlights) to deliver more comprehensive green performance data than anyone method taken individually.

7.1.2 The weaknesses

The study may suffer from the following

weaknesses.

(1) Applicability of GMS and GTD to building activities.

The GMS and GTD are both new concept in the implementation of building activities. In-depth literature reviews should be sought if these two organization strategies can be applied effectively in the construction sector, which possesses unique characteristics of one-off duration. All the subcontractors, suppliers, and even the consultants will meet only to complete the project only where a long-term relationship is hard to foster. The collaboration and communications required for green project delivery success will be difficult to effectively implement for both GMS and GTD.

(2) Potential bias.

The investigation may be restricted, which may bias the findings. Either GMS or GTD is not the only available organizational strategy to give the green building activities. Other strategies like green procurement, logistic management, and total quality management should be explored and included in the study to conform to the building activities' one-off nature.

(3) Deficiency of case studies.

Ten case studies may not be capable of generalizing the findings. More as-built green projects that should be investigated in different countries may be required.

7.2 Theoretical and practical contributions

7.2.1 Theoretical contributions

The integration of GMS and GTD as green management practices is a new perspective that limited studies can be found as revealed in the systematic literature review in Appendix 1. The study will give a new theoretical development of a novel perspective to offer green environmental advantage and a brand image for the company in pursuing green-certified buildings as a GPS and FPS. Additionally, a transformation of green management with GTD into green management model and marketing strategy to GMS will introduce a new theoretical development of green organization strategy and green model in the green building studies.

The study will also create and expand a green market and manufacturing philosophy in aligning the "lean and green" synthesis model of the application to green building activities to encourage green products and green technologies to improve environmental performance.

7.2.2 Managerial contributions

The study will help the top management set up good recommendations and stipulations to inculcate green culture in the company. The top executives can introduce green vision and mission statement to retrieve the green economic value in return. GMS and GTD or other green organizational strategies can be set up as long-term management implementation goal for green building activities. Several practical and managerial implications and recommendations are put forward by the papers reviewed. The integration of GMS and GTD as green management practices will credit the project owners, shareholders, consumers, and the community alike. The green building certification status will give brand prestige to the company and generate an appealing publication to the community, thus retaining more loyal customers[224]. A linkage of quality branding icons and social responsibility image at the corporate level will ultimately escalate the sales and stock prices. They may trigger a "GTD consumption" campaign effect, which is valuable to the marketing manager[225]. After all, for the success of GMS and GTD, full commitments of top executives are considered essential for GPS and FPS. Without the top management's commitments, the green management team will not be supported adequately and in time facilities and financial back up to realize the desired green project outcomes.

The SCO is the next vital moderating force to enable the green project team to be empowered to propose innovative green solutions for the projects' success[226]. Under the SCO's impetus and support, green managers should keep a green building development perspective for the whole building lifecycle environmental benefits and economic value establishment.

A framework to implement the stakeholders' expectations can be exemplified as follows:

- The supplier should establish in line with the firm a capable green professional team with green technical know-how and experience for GPS.
- The project team is short of green knowledge. The building project is very sophisticated; the

supplier can supplement the information required so that environmental performance can comply. This supplier cooperation will allow flexibility for the ecological performance impact on the building teams.

- The building firm should establish its GMS and GTD comprehensively to step up its supplier cooperation.
- The building firm should document its specific green features and vision statements at the start so that every supplier can be clearly and precisely followed the directions to enhance the SCO.

The SCO is crucial to effectuate the green management practices in terms of GMS and GTD and encourage top management and the whole organization to put up the required resources capacity and ability to pursue GPS and FPS for green building delivery.

7.3 Limitations

Combined methods of using quantitative and qualitative research studies are challenging to implement when they are intervened with studying the effects of two management practices involving GMS and GTD on the GPS and the FPS. Below are some of the critical issues to be aware of:

- It is difficult to evaluate the data. The combined research designs are complex to plan and execute but also, they require a more detailed planning procedure, to integrate all phases of the research. This integration includes developing the research data for qualitative and quantitative portions, their sequence to timing the qualitative and quantitative research, and the scheduled plan to integrate them. Combining these data for analysis from each design method is often a difficult task for many researchers.
- The combined GMS and GTD studies require a multi-team of researchers who may not be familiar with the methods they are acquainted with. Expertise in marketing strategies may not acquaint with the construction industry's green working procedures and vice versa. Finding researchers who are comfortable with both quantitative and qualitative research analysis methods and vice versa can be challenging, if not difficult, not to mention the standards each method may involve[227]. For example, the analyses of GMS and GTD quantitatively require much larger sample sizes to obtain statistical significance than the other qualitative analysis method, which requires drawing the experiences and expert advice from the green leaders.
- Much more resources are required. Combined design methods necessitate much more resources involving more workforce and time. Apart from the resources required to conduct the interviews of many informants, a heavy mail survey is also needed for quantitative analyses to strengthen/make the qualitative data collected more vital and robust.

Either GMS or GTD may have been used in other manufacturing industries as GMP. However, applicability in the construction industry is still rare as the construction industry has its own unique features. Further investigations should be placed if these factors apply to the construction industry. All the construction projects are set in at one-off format without any long-term relationship probability with all subcontractors, suppliers and even manufacturers. GMS and GTD are not the only tools to drive GPS and FPS to the construction firm. Other elements like green leadership style, management for supply chain and total quality should be sought to see how these can also be adopted to resolve the peculiar features of the construction industry as it is devoid of any building of long-term relationship with all the building partners of subcontractors, suppliers and/or even manufacturers. Other knowledge of GMS and GTD techniques and their applicability in the construction industry should be fully evaluated. The mail survey may not be able to cover all the aspects of the whole construction industry. Case studies should be further evaluated before a realistic research model can be built up. After all, it is worth noting that both the mail survey and case studies are carried out in Hong Kong and may not be generalizable to other countries.

The as-built project studies cannot accommodate the exploration of the GMS & GTD in other building lifecycle stages, and it may offer another worthwhile study. Additionally, the perspectives of the project building stakeholders are also vital for the GPS. Multi perspectives can shed light on the research relating to the conflicts that may be encountered in this aspect. Critical analysis of the success factors of GMS and GTD may give further insight into practical applications to step up the green management for GPS and FPS.

The topmost significant factors that will be overlooked are the green stipulations by the statutory bodies and stakeholders tendering specifications and conditions for adoption of green building certification. Other factors may include "Green certification standards and green procurement requirements specified by the government", followed by "whole building life-cycle environmental considerations and green construction technology, attributes of green marketing strategies and green management," and "Project Building Stakeholders' commitments and requirements."

Advanced construction information technology (e.g., BIM), employing 2D and 3D modeling platforms, will help the designers and engineers to visualize the conflict of each trade to streamline the drawings divergences and discrepancies. This BIM will ensure the project can be constructed in one go without any rework waste.

Another establishment of information platform for green market and green suppliers with performance details is also worth investigating to lower the green costs and assure of GPS and FPS in the green building development.

8. Main findings & conclusive comments and future research and future research agenda

8.1 Main findings & conclusive comments

This study set out to answer two research questions (RQs):

RQ1: What effects will the green management practices (GMP) in terms of green marketing strategy (GMS) and green technologies development (GTD) be placed on the building organizational performance success (OPS) in terms of green performance success (GPS) and financial performance success (FPS)?

RQ2: Are there any moderating factors that will strengthen or weaken the effect of GMP on OPS?

For RQ1, this study provides new insights and contributions to the extant literature by putting forward a measurement research model for GMP on OPS using mail survey/post-survey interviews and case studies of 10 green-certified building blocks/ post case studies interview with these green success experts. The review uses five measurements for GMS, three for GTD as GMP to test OPS with five measurements for both GPS and FPS. The research model verified that GMP has an affirmative and substantial impact on OPS. The additional resources made for GMS and GTD in larger companies have no association with their performance outcome. It is also interesting to note from the analysis that the effect of GTD on OPS is much more significant than that of GMS, indicating that the engagement of GTD is more vital to have a better performance in both GPS and FPS. The case studies confirmed this positive and significant association of GMP with OPS.

Furthermore, both the post-survey and post-case study affirmed the financial performance achievement for implementing GMP as stated in the previous survey by McGraw Hill Construction and Urban Green Council[126]. Adjusting the inflation factor and variance in the market condition, FPS's achievement value in the Hong Kong building industry implementing GMP (see **Table 28**) has a higher percentage in the averaged increase in the rental charge, occupancy, the return of investment, and building values but the lower decrease of operating costs.

For RQ2, the two moderators identified in this study are SCO and GBU. The inclusion or exclusion of SCO and GBU will strengthen or weaken the effect of GMP on OPS. The study indicated that the OPS would be much improved if the companies strategically employed and integrated SCO's efficiency with that of the innovative GTD. However, the interplay of SCO with GMS on FPS is not significantly effective contrary to the positive support for the association of SCO on the OPS[138]. This may be due to the fact the GMS has diluted the effect of SCO on the FPS and the double overheads incurred for both GMS and SCO may weaken the FPS. In contrast, the analysis revealed that GBU, when interacting with GMS, weakens the firm FPS. In this connection, GBU acts as a barrier to FPS, concurs with the study made by the literature study[124]. However, a high degree of a competitive environment in GMS compels the building firms to step up the green marketing's strategies to effectuate the collaboration between all parties. In particular, more top management support and input from more green experts can be drawn to deter this uncertainty.

Table 28. The cross-comparison of the results of the post-survey interviews and post-case studies

	Characteristics	Post-survey interviews M	Post-case-studies interviews	Average	McGraw Hill Construction and Urban Green Council 2006 survey
Interviewee project	Green PM experience (years)	12.6	13.1	12.85	–
	Green project contract sum (in a million HK $)	330.0	386.0	358.0	–
	Contract period (in months)	24.4	26.8	25.6	–
	Team size (number)	22.8	23.9	23.35	–
	Increase in construction cost	4.9%	6.4%	5.65%	–
	Increase in the project period	3.2%	4.6%	3.90%	–
Completed building	Decrease in operating costs	6.5%	6.8%	6.65%	8.5%
	Increase in building values	6.4%	9.2%	7.80%	7.5%
	Increase in return in asset	5.1%	11.0%	8.05%	6.6%
	Increase in occupancy	4.2%	8.9%	6.55%	3.5%
	Increase in the rental charge	4.1%	12.6%	8.35%	3.0%

In this context, the GBU can be treated as an impetus to drive the development of GMP to turn these green pressures into a competitive edge to diversify the firms' risk into new market regions and increase their green performance success. However, this increase in management resources may weaken FPS.

Again, both the post-survey and post-case studies revealed that the green pressures are coming from:

• Green materials and green technologies. The development of green materials and green technologies is still in its infancy and is uncertain in their environmental performance.

• Project team know-how. The lacking of green management, construction practice, knowledge of green technologies, and green marketing strategy may deter the organizational performance success.

However, most of the interviewees did not accept that green building projects' demand and supply have caused uncertainty in this respect. This is understandable as the housing demand in Hong Kong is always greater than that of the supply. Pursuant to the Global Survey for Housing Affordability[228], Hong Kong ranked as the top most expensive city to live in. The living space per capita in Hong Kong in 2018 is 12 m². In 2016, the residents who lived in private and public houses were respectively 50% and 31%, and it takes an average 5.3 years to queue for public dwellings provided by the Housing Authority. Both the demand and rental charge for a home is escalating. The low supply and high demand for housing are crucial causes for the high housing costs in Hong Kong, with more than 7 million residents spreading across 1,106 square kilometers. Besides, there is very scarce developable land left in Hong Kong as the livable land is embraced between bodies of water and rising mountains. The bidding of the developed land by the mainland developers is another vital cause to raising the land's selling price to a record high, thus escalating the demand price of housing further.

It is interesting to note the results of the post-survey interviews and post-case-studies interviews. **Table 28** shows this cross-comparison.

Table 28 indicates that:

• The interviewees on average are more or less the same in their years of experience in green project management (4% higher in knowledge for the post case studies interviewees on average).

• The green project involved by the interviewees was higher for the post-case-studies interviewees in contract sum, contract period (17% and 10% respectively) while the team size both are more or less the same (5% higher for the post-case-studies interviewees).

Compared with the conventional buildings, the average combining the post-survey and the post-case-studies sample identified a moderate contribution to the following percentage achievement in **Table 29**:

Table 29. Post-survey and post-case-studies interview results

Item	Completed green buildings achievement	Average % achieved
1	Increase in construction cost	5.7%
2	Increase in the project period	3.9%
3	Decrease in operating costs	6.7%
4	Increase in building values	7.8%
5	Increase in return in asset	8.1%
6	Increase in occupancy	6.6%
7	Increase in the rental charge	8.4%

It can be established that those actual green projects can attribute more financial performance success while the decrease in operating costs is more or less the same (5% more in the operating costs decrease for the post case studies interviewees' green projects).

8.2 Future research agenda

Though the methodological approach used both probabilistic (mail survey) and non-probabilistic samples (post-survey and case studies and post-case studies interviews), the generalization of the study findings is still limited. The sample was not probabilistically arranged in various strata of the sector, country company size, and project complexity. Only the company size was used as the control variable, and other variables were not considered, making the hypotheses related to other control variables unknown. Thus, using a stratified sample with a more probabilistic approach should be put into the future research agenda.

The ex-post facto case study research design restricted the analysis to a certain building lifecycle phase neglecting the other phases in applying the GMP, which could be an interesting research direction. It should be pointed out that the OPS can be affected by the developer's perspectives, and so offering various and several outlooks in the research design can help clarify and understand the clashes in this GMP/OPS dimension in the future study.

Likewise, developers should take a leading and proactive role in pursuing green culture in the building industry. For example, a lump sum can be awarded to the consultants, contractors, sub-contractors, and even suppliers as encouragement and incentives if they can achieve the designated green milestone like reducing a certain percentage of waste emission. The developer can also take the initiative to specify green standard guidelines or green certification schemes acting as a warranty that the safety, green quality, and building value of the property can be ascertained to the highest standard. These findings may also help refine the GMP and stimulate the demand for GMP, green well-being and Hong Kong society's green awareness and attitudes.

Moreover, the GMP designed construct is one of the possible associations between GMS/GTD and GPS/FPS. There may also be another dimension like green procurement and partnership, operational performance success, social and environmental impact, and so on. These association possibilities can incorporate many theoretical bases in the green and environmental literature, corporate social responsibility, and cultural ethics that may consolidate the research model for future research studies. The current study can be extended in various directions with a larger sample size. In particular, more respondents from the supplier group should be sought. Besides, it could be interesting to investigate in the next study the effectiveness of the green label system and the type of practices of green management in motivating the adoption of GMS and green procurement in various types of construction like precast and modular construction. The other effect of different green management practices/policies and incentives in stepping up the development of the green buildings in Hong Kong is also worth exploring and evaluating.

To sum up, and based on the above arguments, the possible future research plan can be identified as follows:

(1) Impacts of information platform for the green markets and green suppliers with performance details to widen adoption of green development.

(2) Critical success factors of green marketing strategy and total green management to effectuate motivation of the green development for success.

(3) Indicators of project building stakeholder's commitment to escalate green development in development countries.

(4) Choosing the right green marketing strategy for green development.

(5) Systematic literature review on green building materials and green technologies to combat global warming.

(6) Managerial guidance to effectuate the communications and collaborations of the multi-disciplined green professionals and the construction

parties in green development.

Finally, further research should address the green cultural mind set build-up for green changes in the organizations; that is, the empirical studies of the organizational changes to go green.

Conflict of interest

The author declares that he has no conflicts of interest to disclose.

References

1. Global Alliance for Buildings and Construction, International Energy Agency and the United Nations Environment Program. Global status report for buildings and construction: Towards a zero-emission, efficient and resilient buildings and construction sector [Internet]. Paris: IEA; 2019. Available from: https://www.iea.org/reports/global-status-report-for-buildings-and-construction-2019.
2. EMSD (Electrical & Mechanical Services Department). Hong Kong energy end-use data 2013 [Internet]. Hong Kong: EMSD; 2013. Available from: https://www.emsd.gov.hk/filemanager/en/content_2/HKEEUD2013.pdf.
3. Yang C, Yang K, Peng S. Exploration strategies and key activities for the system of environmental management. Total Quality Management & Business Excellence 2011; 22(11): 1179–1194. doi: 10.1080/14783363.2011.603201.
4. Priyanka S, Rajendra S, Sanjay S. Emergence of green marketing strategies and sustainable development in India. Journal of Commerce & Management Thought 2016; 7(4): 693–710. doi: 10.5958/0976-478X.2016.00037.9.
5. de Toledo RF, Junior HM, Farias Filho JR, Costa HG. A scientometric review of global research on sustainability and project management dataset. Data in Brief 2019; 25: 104312. doi: 10.1016/j.dib.2019.104312.
6. Tam CM, Tam VW, Tsui WS. Green construction assessment for environmental management in the construction industry of Hong Kong. International Journal of Project Management 2004; 22(7): 563–571. doi: 10.1016/j.ijproman.2004.03.001.
7. U.S. Environmental Protection Agency. Why build green? [Internet]. Washington: EPA; 2010. Available from: https://archive.epa.gov/greenbuilding/web/html/whybuild.html.
8. U.S. Green Building Council. Building momentum: National trends and prospects for high performance green buildings. Washington: U.S. Green Building Council; 2003.
9. Kumar V, Rahman Z, Kazmi AA, Goyal P. Evolution of sustainability as marketing strategy: Beginning of new era. Social and Behavioral Sciences 2012; 37: 482–489. doi: 10.1016/j.sbspro.2012.03.313.
10. Charter M, Peattie K, Ottman J, Polonsky MJ. Marketing and sustainability. Cardiff: Centre for Business Relationships, Accountability, Sustainability and Society (BRASS); 2006.
11. Gough D, Oliver S, Thomas J. An introduction to systematic reviews. London: Sage Publications Ltd; 2017. p. 1–352.
12. Pulaski MH, Horman MJ, Riley DR. Constructability practices to manage sustainable building knowledge. Journal of Architectural Engineering 2006; 12(2): 83–92. doi: 10.1061/(ASCE)1076-0431(2006)12:2(83).
13. Lee SH, Thomas SR, Tucker RL. The relative impacts of selected practices on project cost and schedule. Construction Management and Economics 2005; 23(5): 545–553. doi: 10.1080/01446190500040232.
14. Robichaud LB, Anantatmula VS. Greening project management practices for sustainable construction. Journal of Management in Engineering 2011; 27(1): 48–57. doi: 10.1061/(ASCE)ME.1943-5479.0000030.
15. Ofori-Boadu A, Owusu-Manu DG, Edwards D, Holt G. Exploration of management practices for LEED projects: Lessons from successful green building contractors. Structural Survey 2012; 30(2): 145–162. doi: 10.1108/02630801211228743.
16. Sila I, Ebrahimpour M. Critical linkages among TQM factors and business results. International Journal of Operations & Production Management 2005; 25(11): 1123–1155. doi: 10.1108/01443570510626925.
17. Bovea MD, Pérez-Belis V. A taxonomy of eco-design tools for integrating environmental requirements into the product design process. Journal of Cleaner Production 2012; 20(1): 61–71. doi: 10.1016/j.jclepro.2011.07.012.
18. Perspectives GC, Economics O. Global construction 2030: A global forecast for the construction industry to 2030. London: Global Construction Perspectives and Oxford Economics; 2015.
19. Brundtland GH. Our common future: Report of the World Commission in environment and development. Oxford: Oxford University Press; 1987. p. 282.
20. Ali HH, Al Nsairat SF. Developing a green building assessment tool for developing countries—Case of Jordan. Building and Environment 2009; 44(5):

1053–1064. doi: 10.1016/j.buildenv.2008.07.015.
21. Golić K, Kosorić V, Furundžić AK. General model of solar water heating system integration in residential building refurbishment—Potential energy savings and environmental impact. Renewable and Sustainable Energy Reviews 2011; 15(3): 1533–1544. doi: 10.1016/j.rser.2010.11.052.
22. Rahman SM, Khondaker AN. Mitigation measures to reduce greenhouse gas emissions and enhance carbon capture and storage in Saudi Arabia. Renewable and Sustainable Energy Reviews 2012; 16(5): 2446–2460. doi: 10.1016/j.rser.2011.12.003.
23. Drochytka R, Zach J, Korjenic A, Hroudov J. Improving the energy efficiency in buildings while reducing the waste using autoclaved aerated concrete made from power industry waste. Energy and Buildings 2012; 58: 319–323. doi: 10.1016/j.enbuild.2012.10.029.
24. Danatzko JM, Sezen H, Chen Q. Sustainable design and energy consumption analysis for structural components. Journal of Green Building 2013; 8(1): 120–135. doi: 10.3992/jgb.8.1.120.
25. Jaillon L, Poon CS, Chiang YH. Quantifying the waste reduction potential of using prefabrication in building construction in Hong Kong. Waste Management 2009; 29(1): 309–320. doi: 10.1016/j.wasman.2008.02.015.
26. Abowitz DA, Toole TM. Mixed method research: Fundamental issues of design, validity, and reliability in construction research. Journal of Construction Engineering and Management 2010; 136(1): 108–116. doi: 10.1061/(ASCE)CO.1943-7862.0000026.
27. Petrovic-Lazarevic S. The development of corporate social responsibility in the Australian construction industry. Construction Management and Economics 2008; 26 (2): 93–101. doi: 10.1080/01446190701819079.
28. Zuo J, Jin X, Flynn L. Social sustainability in construction—An explorative study. International Journal of Construction Management 2012; 12(2): 51–62. doi: 10.1080/15623599.2012.10773190.
29. Wong KD, Fan Q. Building information modelling (BIM) for sustainable building design. Facilities 2013; 31(3/4): 138–157. doi: 10.1108/02632771311299412.
30. Valdes-Vasquez R, Klotz LE. Social sustainability considerations during planning and design: Framework of processes for construction projects. Journal of Construction Engineering and Management 2013; 139(1): 80–89. doi: 10.1061/(ASCE)CO.1943-7862.0000566.
31. Ruano MA, Cruzado MG. Use of education asocial indicator in the assessment of sustainability throughout the life cycle of a building. European Journal of Engineering Education 2012; 37(4): 416–425. doi: 10.1080/03043797.2012.708719.
32. Yuan X, Zuo J. A critical assessment of the higher education for sustainable development from students' perspectives—A Chinese study. Journal of Cleaner Production 2013; 48: 108–115. doi: 10.1016/j.jclepro.2012.10.041.
33. Mateus R, Bragança L. Sustainability assessment and rating of buildings: Developing the methodology SB ToolPT–H. Building and Environment 2011; 46(10): 1962–1971. doi: 10.1016/j.buildenv.2011.04.023.
34. Berardi U. Clarifying the new interpretations of the concept of sustainable building. Sustainable Cities and Society 2013; 8: 72–78. doi: 10.1016/j.scs.2013.01.008.
35. Popescu D, Bienert S, Schutzenhofer C, Boazu R. Impact of energy efficiency measures on the economic value of buildings. Applied Energy 2012; 89(1): 454–463. doi: 10.1016/j.apenergy.2011.08.015.
36. Wu Y, Yan H, Huang Z. Elementary introduction to the green management of the construction in whole process. Physics Procedia 2012; 24: 1081–1085. doi: 10.1016/j.phpro.2012.02.161.
37. Hwang BG, Tan JS. Sustainable project management for green construction: Challenges, impact and solutions. In: Hawang B, Tan J (editors). Proceedings of CIOB Construction Conference; Jun 28–30; Colombo. Colombo: Ceylon Institute of Builders; 2012. p. 171–179.
38. Jung Y, Mills TH. A survey of construction managerial leadership styles. In: Proceedings of the 48th ASC Annual International Conference; 2012 Apr 11–14; Birmingham. Birmingham: Associated Schools of Construction; 2012. p. 1–9.
39. Garg C, Sharma A, Goyal G. A hybrid decision model to evaluate critical factors for successful adoption of GSCM practices under fuzzy environment. Uncertain Supply Chain Management 2017: 5(1): 59–70. doi: 10.5267/j.uscm.2016.7.002.
40. Sellitto M, Bittencourt S, Reckziegel. Evaluating the implementation of GSCM in industrial supply chains: Two cases in the automotive industry. Chemical Engineering Transactions 2015; 43(1): 1315–1320. doi: 10.3303/CET1543220.
41. Sellitto M, Murakami F. Industrial symbiosis: A case study involving a steelmaking, a cement manufacturing, and a zinc smelting plant. Chemical Engineering Transactions 2018; 70(1): 211–216. doi: 10.3303/CET1870036.
42. Darko A, Chan APC. Critical analysis of green

building research trend in construction journals. Habitat International 2016; 57: 53–63. doi: 10.1016/j.habitatint.2016.07.001.
43. Laustsen J. Energy efficiency requirements in building codes: Policies for new buildings [Internet]. Paris: IEA; 2008. Available from: https://www.iea.org/reports/energy-efficiency-requirements-in-building-codes-policies-for-new-buildings.
44. Paul WL, Taylor PA. A comparison of occupant comfort and satisfaction between a green building and a conventional building. Building and Environment 2008; 43(11): 1858–1870. doi: 10.1016/j.buildenv.2007.11.006.
45. Li Q, Long R, Chen H, *et al*. Chinese urban resident willingness to pay for green housing based on double-entry mental accounting theory. Natural Hazards 2019; 95: 129–153. doi: 10.1007/s11069-018-3435-4.
46. Khoshbakht M, Gou Z, Lu Y, *et al*. Are green buildings more satisfactory? A review of global evidence. Habitat International 2018; 74: 57–65. doi: 10.1016/j.habitatint.2018.02.005.
47. Pulaski MH, Horman MJ. Continuous value enhancement process. Journal of Construction Engineering and Management 2005; 131(12): 1274–1282. doi: 10.1061/(ASCE)0733-9364(2005)131:12(1274).
48. Olanipekun AO, Xia B, Hon C, Darko A. Effect of motivation and owner commitment on the delivery performance of green building projects. Journal of Management in Engineering 2018; 34(1). doi: 10.1061/(ASCE)ME.1943-5479.0000559.
49. Nalewaik A, Venters V. Cost benefits of building green. IEEE Engineering Management Review 2010; 38(2): 77–87. doi: 10.1109/EMR.2010.5497026.
50. Hwang BG, Leong LP. Comparison of schedule delay and causal factors between traditional and green construction projects. Technological and Economic Development of Economy 2013; 19(2): 310–330. doi: 10.3846/20294913.2013.798596.
51. Hwang BG, Zhu L, Ming J. Factors affecting productivity in green building construction projects: The case of Singapore. Journal of Management in Engineering 2017; 33(3). doi: 10.1061/(ASCE)ME.1943-5479.0000559.
52. Isik Z, Arditi D, Dikmen I, Birgonul MT. Impact of corporate strengths/weaknesses on project management competencies. International Journal of Project Management 2009; 27(6): 629–637. doi: 10.1016/j.ijproman.2008.10.002.
53. Buildings Department (HK). Modular integrated construction. Practice note for authorized persons, registered structural engineers and registered geotechnical engineers 2019 [Internet]. Hong Kong: Buildings Department; 2013. Available from: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnap/ADV/ADV036.pdf.
54. Parkin S. Context and drivers for operationalizing sustainable development. Civil Engineering 2000; 138(6): 9–15. doi: 10.1680/cien.2000.138.6.9.
55. Leiper Q, Fagan N, Engstrom S, Fenn G. A strategy for sustainability. Engineering Sustainability 2003; 156(1): 59–66. doi: 10.1680/ensu.2003.156.1.59.
56. Parkin S, Sommer F, Uren S. Sustainable development: Understanding the concept and practical challenge. Engineering Sustainability 2003; 156(1): 19–26. doi: 10.1680/ensu.2003.156.1.19.
57. Kumar V, Rahman Z, Kazmi AA, Goyal P. Evolution of sustainability as marketing strategy: Beginning of new era. Procedia–Social and Behavioural Sciences 2012; 37: 482–489. doi: 10.1016/j.sbspro.2012.03.313.
58. Varadarajan R. Strategic marketing and marketing strategy: Domain, definition, fundamental issues and foundational premises. Journal of Academy of Marketing Science 2009; 38(2): 119–140. doi:10.1007/s11747-009-0176-7.
59. Obermiller C, Burke C, Atwood A. Sustainable business as marketing strategy. Innovative Marketing 2008; 4(3): 20–27.
60. Jones P, Hill CC, Comfort D, Hillier D. Viewpoint: Marketing and sustainability. Marketing Intelligence and Planning 2008; 26(2): 123–130. doi: 10.1108/02634500810860584.
61. Govindan K, Sarkis J, Jabbour C, *et al*. Eco-efficiency based green supply chain management: Current status and opportunities. European Journal of Operational Research 2014; 233(2): 293–298. doi: 10.1016/j.ejor.2013.10.058.
62. Govindan K, Azevedo S, Carvalho H, Machado V. Impact of supply chain management practices on sustainability. Journal of Cleaner Production 2014; 85(2): 212–225. doi: 10.1016/j.jclepro.2014.05.068.
63. Choi D, Hwang T. The impact of green supply chain management practices on firm performance: The role of collaborative capability. Operations Management Research 2015; 8: 69–83. doi: 10.1007/s12063-015-0100-x.
64. de Sousa Jabbour AB, Jabbour CJ, Latan H, *et al*. Quality management environmental management maturity, green supply chain practices and green performance of Brazilian companies with ISO 14001 certification: Direct and indirect effects. Transportation Research Part E: Logistics and

Transportation Review 2014; 74(1): 139–151. doi: 10.1016/j.tre.2014.03.005.
65. Zhu Q, Sarkis J, Lai K. Institutional-based antecedents and performance outcomes of internal and external green supply chain management practices. Journal of Purchasing and Supply Management 2013; 19(2): 106–117. doi: 10.1016/j.pursup.2012.12.001.
66. Genovese A, Acquaye AA, Figueroa A, Koh SL. Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications. Omega 2017; 66(B): 344–357. doi: 10.1016/j.omega.2015.05.015.
67. Testa F, Iraldo F. Shadows and lights of GSCM (green supply chain management): Determinants and effects of these practices based on a multi-national study. Journal of Cleaner Production 2010; 18(10–11): 953–962. doi: 10.1016/j.jclepro.2010.03.005.
68. Tseng ML, Chiu AS. Evaluating firm's green supply chain management in linguistic preferences. Journal of Cleaner Production 2013; 40(1): 22–31. doi: 10.1016/j.jclepro.2010.08.007.
69. Bose I, Pal R. Do green supply chain management initiatives impact stock prices of firms? Decision Support Systems 2012; 52(3): 624–634. doi: 10.1016/j.dss.2011.10.020.
70. Wang X. A comprehensive decision making model for the evaluation of green operations initiatives. Technological Forecasting and Social Change 2015; 95: 191–207. doi: 10.1016/j.techfore.2015.02.004.
71. Chuang YC, Hu SK, Liou JJ, Lo HW. Building a decision dashboard for improving green supply chain management. International Journal of Information Technology & Decision Making 2018; 17(5): 1363–1398. doi: 10.1142/S0219622018500281.
72. Ottaman J. Sometimes consumers will pay more to go green. Marketing News 1992; 26(6); 16.
73. Bhat V. Green marketing begins with green design. Journal of Business & Industrial Marketing 1993; 8(4): 26–31. doi: 10.1108/08858629310047243.
74. Polonsky MJ, Rosenberger III PJ. Re-evaluating green marketing: A strategic approach. Business Horizon 2001; 44(5): 21–30. doi: 10.1016/S0007-6813(01)80057-4.
75. Thogersen J. Promoting "green" consumer behaviour with eco-labels. In: Dietz T, Sterm P (editors). New tools for environmental protection: Education, information, and voluntary measures. Washington DC: National Academy Press; 2002. p. 83–104.
76. Shearer JW. Business and the new environmental imperatives. Business Quarterly 1990; 54(3): 48–52.
77. Davis JJ. Ethics and green marketing. Journal of Business Ethics 1992; 11: 81–87. doi: 10.1007/BF00872314.
78. National Association of Attorneys General (NAAG). The green report: Findings and preliminary recommendations for responsible environmental advertising [Internet]. Washington: NAAG; 1990. Available from: https://p2infohouse.org/ref/24/23677.pdf.
79. Azzone G, Raffaella M. Measuring strategic environmental performance. Business Strategy and the Environment 1994; 3(1): 1–14. doi: 10.1002/bse.3280030101.
80. American Marketing Association [online]. Chicago: AMA; 2014. Available from: https://www.ama.org/AboutAMA/Pages/About.asp.
81. Smola J. Stavba a užívání nízkoenergetických a pasivních domů (Czech) [Construction and use of low-energy and passive houses]. Prague: Grada Publishing A.S.; 2011. p. 352.
82. British Standard Institution. BS 8528–1: 2010 Greywater systems–Code of practice [Internet]. London: BSI; 2010. Available from: https://www.thenbs.com/PublicationIndex/documents/details?Pub=BSI&DocId=294669.
83. Porter TB. Managerial applications of corporate social responsibility and systems thinking for achieving sustainability outcomes. Systems Research and Behavioural Science 2008; 25(3): 397–411. doi: 10.1002/sres.902.
84. Bennett J, Crudgington A. Sustainable development: Recent thinking and practice in the UK. Engineering Sustainability 2003; 156(1): 27–32. doi: 10.1680/ensu.2003.156.1.27.
85. Woodall R, Cooper I, Crowhurst D, *et al*. MaSC: Managing sustainable companies. Engineering Sustainability 2004; 157(1): 15–21. doi: 10.1680/ensu.2004.157.1.15.
86. Holton I, Glass J, Price A. Developing a successful sector sustainability strategy: Six lessons from the UK construction products industry. Corporate Social Responsibility and Environmental Management 2008; 15(1): 29–42. doi: 10.1002/csr.135.
87. Williams K, Dair C. What is stopping sustainable building in England? Barriers experienced by stakeholders in delivering sustainable developments. Sustainable Development 2007; 15(3): 135–147. doi: 10.1002/sd.308.
88. Berns M, Townend A, Khayat Z, *et al*. The business of sustainability: Imperatives, advantages, and actions [Internet]. Boston: The Boston Consulting Group; 2009. Available from: https://www.e-education.psu.edu/ba850/sites/www.e-education.psu.edu.ba850/files/Lesson2/Boston%20Consulting%20

The%20Business%20of%20Sustainability.pdf.
89. Benson K. Quantifying the benefits of sustainable buildings. AACE International Transactions 2004; 101–106. doi: 10.1109/EMR.2010.5497223.
90. Kats G, Alevantis L. The costs and financial benefits of green building—A report to California's sustainable building task force [Internet]. Sacramento CA: State and Consumer Services Agency, Sustainable Building Task Force; 2003. Available from: https://noharm-uscanada.org/sites/default/files/documents-files/34/Building_Green_Costs_Benefits.pdf.
91. RS Means Company. Green building: Project planning and cost estimating. Greenville: RS Means Company; 2002.
92. Lockwood C. Building the green way. Harvard Business Review 2006; 84(6): 129–137.
93. Wilson A. Making the case for green building. Environmental Building News 2005; 14(4).
94. Gottfried DA. Sustainable building technical manual: Green building design, construction and operations. San Francisco: Public Technology Inc., US Green Building Council; 1996. p.12.
95. Koga JE, Lehman T. The value of sustainability. Dayton: SAVE International; 2008.
96. Krane HP, Olsson NO, Rolstadås A. How project manager–project owner interaction can work within and influence project risk management. Project Management Journal 2012; 43(2): 54–67. doi: 10.1002/pmj.20284.
97. Rekola M, Mäkeläinen T Häkkinen T. The role of design management in the sustainable building process. Architectural Engineering and Design Management 2012; 8(2): 78–96. doi: 10.1080/17452007.2012.659503.
98. Korkmaz S, Riley D, Horman M. Assessing project delivery for sustainable, high-performance buildings through mixed methods. Architectural Engineering and Design Management 2011; 7(4): 266–274. doi: 10.1080/17452007.2011.618675.
99. Gultekin P, Mollaoglu-Korkmaz S, Riley DR, Leicht RM. Process indicators to track effectiveness of high-performance green building projects. Journal of Construction Engineering and Management 2013; 139(12). doi: 10.1061/(ASCE)CO.1943-7862.0000771.
100. Bilec MM, Ries RJ, Needy KL, *et al*. Analysis of the design process of green children's hospitals: Focus on process modeling and lessons learned. Journal of Green Building 2009; 4(1): 121–134. doi: 10.3992/jgb.4.1.121.
101. Enache-Pommer E, Horman M. Greening of healthcare facilities: Case studies of children's hospitals. In: Proceedings of Architectural Engineering Conference (AEI) 2008; 2008 Sep 24–27; Denver. Reston: American Society of Civil Engineers; 2008. p. 1–10.
102. Gransberg D, Korkmaz S, McCuen T, *et al*. Influence of project delivery on sustainable, high performance buildings. Journal of Management in Engineering 2010; 29(1). doi: 10.1061/(ASCE)ME.1943-5479.0000114.
103. Holmlin RM. Development of a LEED certified building—A case study. In: Boone T, Jayaraman V, Ganeshan R (editors). Sustainable supply chains: Models, methods, and public policy implications. New York: Springer; 2012. p. 97–106.
104. Korkmaz S, Riley D, Horman M. Assessing project delivery for sustainable high-performance buildings through mixed methods. Architectural Engineering and Design Management 2011; 7(4): 266–274. doi: 10.1080/17452007.2011.618675.
105. Schaufelberger J, Cloud J. LEED certification: A constructor's perspective. In: Proceedings of Construction Research Congress 2009; 2009 Apr 5–7; Seattle. Reston: American Society of Civil Engineers; 2009. p. 598–607.
106. Robichaud LB, Anantatmula VS. Greening project management practices for sustainable construction. Journal of Management in Engineering 2011; 27(1): 48–57. doi: 10.1061/(ASCE)ME.1943-5479.0000030.
107. Bornais C. Exploring the diversity of green buildings. Journal of Green Building 2016; 7(3): 49–64. doi: 10.3992/jgb.7.3.49.
108. Palanisamy P, Klotz L. Delivery process attributes, common to India and the US, for more sustainable buildings. Journal of Green Building 2011; 6(4): 146–157. doi: 10.3992/jgb.6.4.146.
109. Nofera W, Korkmaz S. Design process integration for sustainable, high performance buildings. In: Taylor JE, Chinowsky P (editors). Proceedings of Engineering Project Organizations Conference; 2010 Nov 4–7; South Lake Tahoe: EPOS; 2010.
110. Li Y, Chen P, Chew DAS, *et al*. Exploration of critical external partners of architecture/engineering/construction (AEC) firms for delivering green building projects in Singapore. Journal of Green Building 2012; 7(3): 193–209. doi: 10.3992/1943-4618-7.3.193.
111. Bilec M, Ries R. Preliminary study of green design and project delivery methods in the public sector. Journal of Green Building 2007; 2(2): 151–160. doi: 10.3992/jgb.2.2.151.
112. Zhang J, Li H, Olanipekun AO, Bai L. A successful delivery process of green buildings: The project owners' view, motivation and commitment. Re-

newable Energy 2019; 138: 651–658. doi: 10.1016/j.renene.2019.02.002.
113. Elforgani MS, Alnawawi A, Rahmat IB. The association between client qualities and design team attributes of green building projects. Journal of Engineering and Applied Sciences 2014; 9(2): 160–172.
114. Bon-Gang H. Performance and improvement of green construction projects. Management strategies and innovations. Oxford: Butterworth-Heinemann; 2018. p. 45–59.
115. Zhang X, Shen L, Tam VWY, Lee WWY. Barriers to implement extensive green roof systems: A Hong Kong study. Renewable and Sustainable Energy Reviews 2012; 16(1); 314–319. doi: 10.1016/j.rser.2011.07.157.
116. Shen L, Zhang Z, Zhang X. Key factors affecting green procurement in real estate development: A China study. Journal of Cleaner Production 2017; 153(1): 372–383. doi: 10.1016/j.jclepro.2016.02.021.
117. Ageron B, Gunasekaran A, Spalanzani A. Sustainable supply management: An empirical study. International Journal of Production Economics 2012; 140(1): 168–182. doi: 10.1016/j.ijpe.2011.04.007.
118. Zhang X, Platten A, Shen L. Green property development practice in China: Costs and barriers. Building and Environment 2011; 46(11): 2153–2160. doi: 10.1016/j.buildenv.2011.04.031.
119. Commission for Environmental Cooperation (CEC). Green building in North America: Opportunities and challenges. Montreal: CEC; 2008.
120. UNEP-SBCI. Greening the building supply chain [Internet]. Nairobi: United Nations Environmental Programme; 2014. Available from: https://www.oew.kit.edu/img/greening_the_supply_chain_report.pdf.
121. Murphy DF, Bendell J. Do-it-yourself or do-it-together?: The implementation of sustainable timber purchasing policies by DIY retailers in the UK. Greener purchasing. Oxfordshire: Routledge; 1998. p. 118–134.
122. Akadiri PO. Understanding barriers affecting the selection of sustainable materials in building projects. Journal of Building Engineering 2015; 4: 86–93. doi: 10.1016/j.jobe.2015.08.006.
123. Shen L, Zhang Z, Longa Z. Significant barriers to green procurement in real estate development. Resources, Conservation and Recycling 2017; 116: 160–168. doi: 10.1016/j.resconrec.2016.10.004.
124. Wong CY, Boon-itt S, Wong CWY. The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance. Journal of Operations Management 2011; 29(6): 604–615. doi: 10.1016/j.jom.2011.01.003.
125. Green Building Council of Australia (GBCA). Sustainable building pathway [Internet]. Sydney: GBCA; 2006. Available from: https://www.gbca.org.au/uploads/64/1088/Sustainable%20Building%20Pathway_Report.pdf.
126. McGraw Hill Construction, Urban Green Council. Green Building SmartMarket report. New York: McGraw Hill Construction, Urban Green Council; 2006.
127. Madew R. The dollars and sense of green buildings: Building the business case for green commercial buildings in Australia [Internet]. Canberra: Green Building Council of Australia; 2006. Available from: https://www.gbca.org.au/uploads/234/1002/Dollars%20and%20Sense%20of%20Green%20Buildings%202006.pdf.
128. Chiang YH. Subcontracting and its ramifications: A survey of the building industry in Hong Kong. International Journal of Project Management 2009; 27(1): 80–88. doi: 10.1016/j.ijproman.2008.01.005.
129. Chen G, Zhang G, Xie Y, Jin X. Overview of alliancing research and practice in the construction industry. Architectural Engineering and Design Management 2012; 8(2): 103–119. doi: 10.1080/17452007.2012.659505.
130. Carter CR, Rogers DS. A framework of sustainable supply chain management: Moving toward new theory. International Journal of Physical Distribution Logistics Management 2008; 38(5): 360–387. doi: 10.1108/09600030810882816.
131. Pagell M, Wu Z. Building a more complete theory of sustainable supply chain management using case studies of 10 exemplars. Journal of Supply Chain Management 2009; 45(2): 37–56. doi: 10.1111/j.1745-493X.2009.03162.x.
132. Amit R, Schoemaker PJH. Strategic assets and organizational rent. Strategic Management Journal 1993; 14(1): 33–46. doi: 10.1002/smj.4250140105.
133. Barney J. Firm resources and sustained competitive advantage. Journal of Management 1991; 17(1): 99–120. doi:10.1177/014920639101700108.
134. Markley MJ, Davis L. Exploring future competitive advantage through sustainable supply chains. International Journal of Physical Distribution & Logistics Management 2007; 39(9): 763–774. doi: 10.1108/09600030710840859.
135. Hillman AJ, Withers MC, Collings BJ. Resource dependence theory: A review. Journal of Management 2009; 35(6): 1404–1427. doi: 10.1177/0149206309343469.

136. Aiken M, Hage J. Organizational interdependence and intra-organizational structure. American Sociological Review 1968; 33(6): 912–930. doi: 10.2307/2092683.
137. Pfeffer J, Salancik GR. The external control of organizations: A resource dependence perspective. New York: Harper and Row; 1978.
138. Cousins PD, Lawson B, Squire B. An empirical taxonomy of purchasing functions. International Journal of Operations and Production Management 2006; 26(7): 775–794. doi: 10.1108/01443570610672239.
139. González-Benito J. A theory of purchasing's contribution to business performance. Journal of Operations Management 2007; 25(4): 901–917. doi: 10.1016/j.jom.2007.02.001.
140. Narasimhan R, Kim SW. Effect of supply chain integration on the relationship between diversification and performance: Evidence from Japanese and Korean firms. Journal of Operations Management 2002; 20(3): 303–323. doi: 10.1016/S0272-6963(02)00008-6.
141. Coglianese MP. Construction's legal risks in the new green paradigm. Construction Law 2009; 9(12): 43.
142. Gürgün AP, Arditi D, Vilar PC. Impacts of construction risks on costs in leed-certified projects. Journal of Green Building 2016; 11(4): 163–181. doi: 10.3992/jgb.11.4.163.1.
143. Hwang BG, Shan M, Phua H, Chi S. An exploratory analysis of risks in green residential building construction projects: The case of Singapore. Sustainability 2017; 9: 1116. doi: 10.3390/su9071116.
144. BCCA (British Columbia Construction Association). A study on the risks and liabilities of green building [Internet]. Victoria: BCCA; 2011. Available from: https://bccassn.com/wp-content/uploads/2021/05/bcca-report-study-on-risks-liabilities-green-building-2011.pdf.
145. Zhang L, Wu J, Liu H. Turning green into gold: A review on the economics of green buildings. Journal of Cleaner Production 2018; 172(20): 2234–2245. doi: 10.1016/j.jclepro.2017.11.188.
146. Kok N, Jennen M. The impact of energy labels and accessibility on office rents. Energy Policy 2012; 46: 489–497. doi: 10.1016/j.enpol.2012.04.015.
147. Institute for Market Transformation, Appraisal Institute. Green building and property value: A primer for building owners and developers [Internet]. Washington: IMT, AI; 2013. Available from: https://www.appraisalinstitute.org/assets/1/7/Green-Building-and-Property-Value.pdf.
148. Lee CH, Huang S, Barnes FB, Kao L. Business performance and customer relationship management: The effect of IT, organizational contingency and business process on Taiwanese manufacturers. Total Quality Management & Business Excellence 2010; 21(1): 43–65. doi: 10.1080/14783360903492595.
149. Chung YC, Hsu YW. Research on the correlation between design for six sigma implementation activity levels, new product development strategies and new product development performance in Taiwan's high-tech manufacturers. Total Quality Management & Business Excellence 2010; 21(6): 603–616. doi: 10.1080/14783363.2010.483073.
150. Zhu Q, Sarkis J, Lai K. Examining the effects of green supply chain management practices and their mediations on performance improvements. International Journal of Production Research 2012; 50(5): 1377–1394. doi: 10.1080/00207543.2011.571937.
151. Lu Y, Cui Q, Le Y. Turning green to gold in the construction industry: Fable or fact? Journal of Construction Engineering and Management 2013; 139(8): 1026–1036. doi: 10.1061/(ASCE)CO.1943-7862.0000676.
152. Hwang YD, Wen Y, Chen M. A study on the relationship between the PDSA cycle of green purchasing and the performance of the SCOR model. Total Quality Management & Business Excellence 2010; 21(12): 1261–1278. doi: 10.1080/14783363.2010.529361
153. Pujari D, Wright G, Peattie K. Green and competitive: Influences on environmental new product development performance. Journal of Business Research 2003; 56(8): 657–671. doi: 10.1016/S0148-2963(01)00310-1.
154. Gemser G, Leenders MA. How integrating industrial design in the product development process impacts on company performance. Journal of Product Innovation Management 2001; 18(1): 28–38. doi: 10.1016/S0737-6782(00)00069-2.
155. Pujari D. Eco-innovation and new product development: Understanding the influences on market performance. Technovation 2006; 26(1): 76–85. doi: 10.1016/j.technovation.2004.07.006.
156. Bai C, Sarkis J. Green supplier development: Analytical evaluation using rough set theory. Journal of Cleaner Production 2010; 18(12): 1200–1210. doi: 10.1016/j.jclepro.2010.01.016.
157. Gil MÁ, Jiménez JB, Lorente JC. An analysis of environmental management, organizational context and performance of Spanish hotels. Omega 2001; 29(6): 457–471. doi: 10.1016/S0305-0483(01)00033-0.
158. Welford R. Environmental strategy and sustainable development: The corporate challenge for the 21st

century. London: Routledge; 1995.
159. Vachon S, Klassen RD. Extending green practices across the supply chain. International Journal of Operations & Production Management 2006; 26(7): 795–821. doi: 10.1108/01443570610672248.
160. Alhadid AY, As'ad HA. The impact of green innovation on organizational performance, environmental management behavior as a moderate variable: An analytical study on Nuqul group in Jordan. International Journal of Business and Management 2014; 9(7): 51–58. doi: 10.5539/ijbm.v9n7p51.
161. Chiou TY, Chan H, Lettice F, Chung SH. The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. Transportation Research Part E: Logistics and Transportation Review 2011; 47(6): 822–836. doi: 10.1016/j.tre.2011.05.016.
162. Harts SL. Beyond greening: Strategies for a sustainable world. Harvard Business Review 1997; 75(1): 66–67.
163. Song M, Xie J, Di Benedetto CA. Message and source factors, market uncertainty, and extra functional information processing: Hypotheses and empirical evidence. IEEE Transactions on Engineering Management 2001; 48(2): 223–238. doi: 10.1109/17.922480.
164. Aulakh PS, Kotabe M. Antecedents and performance implications of channel integration in foreign markets. Journal of International Business Studies 1997; 28: 145–175. doi: 10.1057/palgrave.jibs.8490096.
165. Cavusgil ST, Zou S. Marketing strategy performance relationship: An investigation of the empirical link in export market ventures. Journal of Marketing 1994; 58(1): 1–21. doi: 10.2307/1252247.
166. Selnes F, Sallis J. Promoting relationship learning. Journal of Marketing 2003; 67(3): 80–95. doi: 10.1509/jmkg.67.3.80.18656.
167. Silvius AJ, Schipper RP. Sustainability in project management: A literature review and impact analysis. Social Business 2014; 4(1): 63–96. doi: 10.1362/204440814X13948909253866.
168. Pulaski MH, Horman MJ. Continuous value enhancement process. Journal of Construction Engineering and Management 2005; 131(12): 1274–1282. doi: 10.1061/(ASCE)0733-9364(2005)131:12(1274).
169. Martens ML, Carvalho MM. Sustainability and success variables in the project management context: An expert panel. Project Management Journal 2016; 47(6): 24–43. doi: 10.1177/875697281604700603.
170. Carvalho MM, Rabechini R. Impact of risk management on project performance: The importance of soft skills. International Journal of Production Research 2015; 53(2): 321–340. doi: 10.1080/00207543.2014.919423.
171. Akadiri PO, Olomolaiye PO. Development of sustainable assessment criteria for building materials selection. Engineering, Construction and Architectural Management 2012; 19(6): 666–687. doi: 10.1108/09699981211277568.
172. Zsidisin GA, Siferd SP. Environmental purchasing: A framework for theory development. European Journal of Purchasing & Supply Management 2001; 7(1): E61–73. doi: 10.1016/S0969-7012(00)00007-1.
173. Balaras CA, Gaglia AG, Georgopoulou E, *et al*. European residential buildings and empirical assessment of the Hellenic building stock, energy consumption, emissions and potential energy savings. Building and Environment 2007; 42(3): 1298–1314. doi: 10.1016/j.buildenv.2005.11.001.
174. Galante A, Pasetti G. A methodology for evaluating the potential energy savings of retrofitting residential building stocks. Sustainable Cities and Society 2012; 4: 12–21. doi: 10.1016/j.scs.2012.01.004.
175. Ma M, Shen L, Ren H, *et al*. How to measure carbon emission reduction in China's public building sector: Retrospective decomposition analysis based on STIRPAT model in 2000–2015. Sustainability 2017; 9(10): 1744. doi: 10.3390/su9101744.
176. Fowler KM, Rauch EM. Assessing green building performance: A post occupancy evaluation of 12 GSA buildings. Richland: Pacific Northwest National Laboratory; 2008. p. 171.
177. United States Green Building Council (USGBC). Green building facts. Washington: USGBC; 2010.
178. Lee C, Hong T, Lee G, Jeong J. Life cycle cost analysis on glass type of high-rise buildings for increasing energy efficiency and reducing CO_2 emissions in Korea. Journal of Construction Engineering and Management 2012; 138(7): 897–904. doi: 10.1061/(ASCE)CO.1943-7862.0000502.
179. Oates D, Sullivan KT. Post occupancy energy consumption survey of Arizona's LEED new construction population. Journal of Construction Engineering and Management 2012; 138(6): 742–750. doi: 10.1061/(ASCE)CO.1943-7862.0000478.
180. Green Council. Report of the research study on the current status and direction for green purchasing in Hong Kong. Hong Kong: Green Council; 2010.
181. Ojo E, Mbowa C, Akinlabi ET. Barriers in implementing green supply chain management in construction industry. In: Proceedings of the 2014 International Conference on Industrial Engineering and Operations Management; 2014 Jan 7–9; Bali.

Bingley: Emerald Publishing; 2014. p. 1974–1981.
182. Varnas A, Balfors B, Faith-ell C. Environmental consideration in procurement of construction contracts: Current practice, problems and opportunities in green procurement in the Swedish construction industry. Journal of Cleaner Production 2009; 17(13): 1214–1222. doi: 10.1016/j.jclepro.2009.04.001.
183. Construction MH. Green outlook 2011: Green trends driving growth. Bedford: Construction MH; 2010.
184. Orlitzky M, Schmidt FL, Rynes SL. Corporate social and financial performance: A meta-analysis. Organization Studies 2003; 24(3): 403–441. doi: 10.1177/0170840603024003910.
185. Clarkson PM, Li Y, Richardson GD, Vasvari FP. Does it really pay to be green? Determinants and consequences of proactive environmental strategies. Journal of Accounting and Public Policy 2011; 30(2): 122–144. doi: 10.1016/j.jaccpubpol.2010.09.013.
186. Schaltegger S, Synnestvedt T. The link between 'green' and economic success: Environmental management as the crucial trigger between environmental and economic performance. Journal of Environmental Management 2002; 65(4): 339–346. doi: 10.1006/jema.2002.0555.
187. Cohen MA, Fenn SA, Konar S. Environmental and financial performance: Are they related? Washington: Investor Responsibility Research Center, Environmental Information Service; 1997.
188. Dowell G, Hart S, Yeung B. Do corporate global environmental standards create or destroy market value? Management Science 2000; 46(8): 1059–1074. doi: 10.1287/mnsc.46.8.1059.12030.
189. Shou Y, Che W, Dai J, Jia F. Inter-organizational fit and environmental innovation in supply chains: A configuration approach. International Journal of Operations & Production Management 2018; 38(8): 1683–1704. doi: 10.1108/IJOPM-08-2017-0470.
190. Lee VH, Ooi KB, Chong YL, Lin B. A structural analysis of greening the supplier, environmental performance and competitive advantage. Production Planning & Control 2015; 26(2): 116–130. doi: 10.1080/09537287.2013.859324.
191. Vachon S, Klassen RD. Environmental management and manufacturing performance: The role of collaboration in the supply chain. International Journal of Production Economics 2008; 111(2): 299–315. doi: 10.1016/j.ijpe.2006.11.030.
192. Roccaa AL, Perna A, Snehota I, Ciabuschi F. The role of supplier relationships in the development of new business ventures Industrial Marketing Management ventures. Industrial Marketing Management 2019; 80: 149–159. doi: 10.1016/j.indmarman.2017.12.008.
193. Jia F, Lamming R. Cultural adaptation in Chinese-western supply chain partnerships: Dyadic learning in an international context. International Journal of Operations & Production Management 2013; 33(5): 528–561. doi: 10.1108/01443571311322715.
194. Ackroyd S, Hughes JA. Data collection in context. Longdon: Longman; 1981.
195. Toor S, Ofori G. Grounded theory as an appropriate methodology for leadership research in construction. In: Haig R, Amaratunga D (editors). Proceedings of the CIB International Conference on Building Education and Research; 2008 Feb 11–15; Kandalama. Salford: University of Salford; 2008. p. 1816–1831.
196. Johnson RB, Onwuegbuzie AJ. Mixed methods research: A research paradigm whose time has come. Educational Researcher 2004; 33(7): 14–26. doi: 10.3102/0013189X033007014.
197. Jogulu UD, Pansiri J. Mixed methods: A research design for management doctoral dissertations. Management Research Review 2011; 34(6): 687–701. doi: 10.1108/01409171111136211.
198. Creswell JW, Creswell JD. Research design: Qualitative, quantitative, and mixed methods approach. Thousand Oaks: Sage; 2003.
199. Hirschman AO. Exit, voice, and loyalty: Responses to decline in firms, organizations, and states. Cambridge: Harvard University Press; 1970.
200. Dyne LV, LePine JA. Helping and voice extra role behaviours: Evidence of construct and predictive validity. The Academy of Management Journal 1998; 41(1): 108–119. doi: 10.2307/256902.
201. McGrath JE. Dilemmatics: The study of research choices and dilemmas. American Behavioral Scientist 1981: 25(2): 69–102. doi: 10.1177/000276428102500205.
202. Tangirala S, Ramanujam R. Exploring nonlinearity in employee voice: The effects of personal control and organizational identification. Academy of Management Journal 2008; 51(6): 1189–1203. doi: 10.5465/AMJ.2008.35732719.
203. Liu W, Zhu R, Yang Y. I warn you because I like you: Voice behavior, employee identifications and transformational leadership. The Leadership Quarterly 2010; 21(1): 189–202. doi: 10.1016/j.leaqua.2009.10.014.
204. Becker TE. Foci and bases of commitment: Are they distinctions worth making? Academy of Management Journal 1992; 35(1): 232–244. doi:

10.2307/256481.
205. Krause DR, Handfield RB, Tyler BB. The relationships between supplier development, commitment, social capital accumulation and performance improvement. Journal of Operations Management 2007; 25(2): 528–545. doi: 10.1016/j.jom.2006.05.007.
206. Zhu Q, Sarkis J. Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. Journal of Operations Management 2004; 22(3): 265–289. doi: 10.1016/j.jom.2004.01.005.
207. Lai K, Wong CW. Green logistics management and performance: Some empirical evidence from Chinese manufacturing exporters. Omega 2012; 40(3): 267–282. doi: 10.1016/j.omega.2011.07.002.
208. Chang H. An empirical evaluation of performance measurement systems for total quality management preview. Total Quality Management & Business Excellence 2007; 17(8): 1093–1109. doi: 10.1080/14783360600941795.
209. Fynes B, de Búrca S, Marshall D. Environmental uncertainty, supply chain relationship quality and performance. Journal of Purchasing & Supply Management 2004; 10(4–5): 179–190. doi: 10.1016/j.pursup.2004.11.003.
210. Bstiele L, Gross CW. Measuring the effect of environmental uncertainty on process activities, project team characteristics and new product success. Journal of Business & Industrial Marketing 2003; 18(2): 146–161. doi: 10.1108/08858620310463079.
211. Wagner SM, Bode C. An empirical examination of supply chain performance along several dimensions of risk. Journal of Business Logistics 2008; 29(1): 307–325. doi: 10.1002/jbl.2008.29.issue-1.
212. Beam Society Limited. BEAM plus new buildings version 2.0. Hong Kong: Beam Society Limited; 2019.
213. Shenhar AJ, Dvir D. Reinventing project management: The diamond approach to successful growth and innovation. Boston: Harvard Business School Press; 2007.
214. Polit DF, Beck C, Hungler BP. Essentials of nursing research: Methods, appraisal and utilization. Philadelphia: Lippincott Williams & Wilkins; 2001.
215. van Teijlingen E, Hundley V. The importance of pilot studies. Nursing Standard 2002; 16(40): 33–36. doi: 10.7748/ns2002.06.16.40.33.c3214.
216. Atkinson R, Flint J. Accessing hidden and hard-to-reach populations: Snowball research strategies. Social Research Update 2001; 33(1): 1–4.
217. Bartlett JE, Kotrlik JW, Higgins CC. Organizational research: Determining appropriate sample size in survey research. Learning & Performance Journal 2001; 19(1): 43–50.
218. Bagozzi RP, Yi Y, Phillips LW. Assessing construct validity in organizational research. Administrative Science Quarterly 1988; 36(3): 421–458. doi: 10.2307/2393203.
219. Kline RB. Principles and practice of structural equation modelling. New York: Guildford Press; 2015.
220. Anderson L, Stone-Romeo EF. Relative power of moderated multiple regression and the comparation of subgroup correlation coefficients for detecting moderating effects. Journal of Applied Psychology 1994; 79(3): 354–359. doi: 10.1037/0021-9010.79.3.354.
221. Hair JF, Anderson RE, Tatham RL, Black WC. Multivariate data analysis. New Jersey: Prentice Hall; 2005.
222. Dean JW, Snell SA. Integrated manufacturing and job design: Moderating effects of organizational inertia. Academy of Management Journal 1991; 34(4): 776–804. doi: 10.2307/256389.
223. Eisenhardt KM. Building theories from case study research. The Academy of Management Review 1989; 14(4): 532–550. doi: 10.2307/258557.
224. Ginsberg JM, Bloom PN. Choosing the right green marketing strategy. MIT Sloan Management review 2004; 46(1): 79–84.
225. Ko E, Hwang YK, Kim EY. Green marketing functions in building corporate image in the retail setting. Journal of Business Research 2012; 66(10): 1709–1715. doi: 10.1016/j.jbusres.2012.11.007.
226. Mavi RK, Standing C. Critical success factors of sustainable project management in construction: A fuzzy DEMATEL-ANP approach. Journal of Cleaner Production 2018; 194(1): 751–765. doi: 10.1016/j.jclepro.2018.05.120.
227. Wisdom JP, Cavaleri MC, Onwuegbuzie AT, Green CA. Methodological reporting in qualitative, quantitative, and mixed methods health services research articles. Health Services Research 2011; 47(2): 721–745. doi: 10.1111/j.1475-6773.2011.01344.x.
228. Bertaud A. The 15th annual demographia international housing affordability survey: 2019, rating middle-income housing affordability. Cambridge: MIT Press; 2018.