Transaction Costs (TCs) Challenges in Delivering Green Building Projects: a case of Hong Kong

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ABSTRACT

The building industry is found to have borne the lion share of the world's total energy consumption. Green building (GB) has been promoted to address climate change, and yet the comparably higher initial costs and extra risks still cause stakeholders not to enter the GB market voluntarily. Green building (GB) project brings in extra tasks in the development process, which incur hidden costs that need to be systematically appreciated among the stakeholders. This research examines those extra tasks and develops a typology and chronology of the associated TCs along the real estate development process (REDP). Through in-depth interviews with representatives of developers in Hong Kong, this study shows that the more important TCs impacts occur during the early project planning stage. Developers have major concern on "Consideration of extra legal liability risk of the GB product" as the practice and liabilities for GB are new. The result informs project managers to direct their efforts to the exact critical stages of REDP to cut down TCs incurred, and also provides references for government to design policy reducing the TCs. The TCs framework developed in this study also helps to advance the GB market by optimizing the societal costs.

KEYWORDS:

Green building (GB), transaction costs (TCs), uncertainty, real estate development process (REDP), Hong Kong

INTRODUCTION

The building industry is found to have borne the lion share of the world's total energy consumption (UNEP, 2007). Energy demand in Asia and the Pacific region is projected to grow by 2.75% a year, which is half of the global demand utill 2030 (Heyzer, 2008). In the building sector in Asia, energy demand is projected to grow in parallel with economic and population growth. In Hong Kong, buildings consume overall half of all energy and about 89% of electricity, mainly for air-conditioning which is the cause of roughly 17% of all Hong Kong's greenhouse gas emissions (CE, 2008; EB, 2008). Under the agenda of addressing climate change and environmental damages, there are amply literatures supporting the argument of the overall benefit to be brought to society by GB promotion in term of environmental and social benefits.

GB is often perceived as having higher initial design and construction costs than conventional building (OECD, 2003).It is argued that the extra costs will gradually be reduced as the new practices and technologies are further developed and more widely accepted by the market. OECD (2003) has already pointed out that given the current sophistication of technology, a better-designed policy package to promote GB could increase effectiveness and efficiency by 40% (Koeppel and Urge-Vorsatz, 2007).

To deliver GB, many actual costs such as extra construction costs and new material expenditure could be easily appraised. The problem comes from the hidden costs involved. A particular kind of hidden cost is "unintended consequence", as byproducts, or repercussions after embarking on a course of action. Compared to conventional building, the barrier to the GB market is higher due to uncertainties, such as greater capital costs, new information, new technology, financial risks, risk of delay with government approvals, and so forth. If there is asymmetric information about quality standards or requirements that are not mandatorily imposed onto the market by legislation, the opportunistic behavior of market players may lead them to continue producing conventional buildings (Akerlof, 1970). Although the net benefit of GB for society in theory is known for a long time, not enough action has been taken to effectively promote energy efficiency (Koeppel and Urge-Vorsatz, 2007).

Some new procurement processes and extra tasks involved in GB require the support of new institutions, which cause extra transaction costs (TCs). Cheung (1992) defined TCs as

any costs that arise due to the existence of institutions. From the new institutional economics perspective, when TCs are too large, they inhibit exchange, production, and economic growth. The functioning of TCs under different institutional arrangements is also crucial to the workings of markets (Cheung, 1998; Coase, 1998; Benham & Benham, 1997; North, 1990, 1991). Government could play an important role by looking into the stakeholders' concerns and designing the appropriate policy/institution to address the related issues. Greater potential of cost reductions during the whole real estate development process (REDP) of GB exists; however, the concerns due to its extra tasks caused by GB are often ignored. A better understanding of the nature of real estate transactions and structure of the REDP, and the TCs incurred in each stage is essential to improve the market mechanisms for GB investment. TCs in comparison with actual costs are relatively obscured and how they are incurred in each stage of REPD are not well-understood and are difficult to quantify. This study sets a concept in terms of "uncertainty" to be addressed by practitioners in a development project in order to envisage the magnitude of TCs and by borrowing framework of the established Architect's Plan of Work, the study identifies the TCs incurred in each stage of REDP. This view also emphasizes that policy interventions and different institutional structures may lower TCs and provide net social benefits (Golove and Eto, 1996; Levine et al., 1995; Koeppel and Urge-Vorsatz, 2007).

Much research has acknowledged the important role of technology in improving energy efficiency in buildings. However, this research focuses on the project management process and looks into the hidden costs incurred by uncertainty. A better understanding of the nature and structure of TCs is necessary to change the market mechanisms for GB investment. The situation calls for a thorough study focusing on how to smooth transactions for market stakeholders in REDP of GB, with the aim of lessening the TCs involved in GB transactions. It studies the stakeholders' concerns in each transaction and different stages of REDP that affect their GB investment, and analyzes the extra tasks, in terms of TCs that cause the concerns to the GB decision-makings during the REDP, using Hong Kong as the case study.

LITERATURE REVIEW

Green Building (GB) in Hong Kong

In the past two decades, the construction industry in Asia has grown dramatically and is poised to continue to do so (Bon and Crosthwaite 2000; Raftery et al., 2004).The construction boom illuminates the simultaneous waste and good use of resources. Studying the fast-growing economic regions in Asia is thus important. Just as Asia's economic growth is far exceeding the rest of the world, the region's demand for energy has become a formidable fact of the worldwide energy demand. There is an urgent call for Asia to raise their awareness and contribute their efforts on BEE development so as to combat the climate change and address the environmental concerns (Qian, 2012). To avoid, as far as possible, the study being tainted by side issues, such as unreliable legal systems, rigid centrally planned economies, corruption, and unfair competition, Hong Kong is deemed suitable choices as a representative city for this study of promotion of GB development.

Green building embraces building energy efficiency and promotion of which involves the study of local institutions, economy and government. Hong Kong is regarded as economically well-developed regions with free markets and well-educated professionals. It has comparable economic environments and is an international city. Construction as a share of total GDP has been in the range of 5-7% in Hong Kong in recent years (Raftery et al., 2004). Harnessing solar energy through solar cells, sun-shading devices, low-emissivity glass, energy-efficient air-conditioning systems, and building-space planning and orientation are common design considerations for GB in Hong Kong. Hong Kong relies more on voluntary effort, and there are several green groups, such as the Professional Green Building Council and the Green Council, promoting the voluntary use of GB.

In Hong Kong, the government attaches great importance to creating a 'Quality City, Quality Life' for the people of Hong Kong. To achieve this, the Government recognizes the need to take a holistic view of the full life cycle of developments from planning, construction, commissioning, operation, refurbishment, renewal to decommissioning of buildings, where up to 50 per cent of all energy is consumed. The HK-BEAM and other green-label programs are accepted assessment tools promulgated by voluntary bodies in the past decade. In recent years, the Hong Kong government has begun to take an active part in driving GB initiatives (Chan, 2000; Chan and Lau, 2005). In September 2012, it has promulgated the Buildings Energy Efficiency Ordinance to regulate energy-saving

engineering solutions for newly constructed buildings. With land and building area in Hong Kong well known to be extremely scarce, the Hong Kong government has introduced in April 2011 an incentive scheme linking the element of bonus floor area of a development project to promote GB design. Developer has to incorporate certain green building features in their development projects and to meet green building certification requirements in order to gain the of extra bonus building floor area (known as "granting GFA concessions") (BD, 2011). It has pushed many developers seriously consider any institutional hurdles and the development process carefully to deliver GB in order enjoy the inventive scheme. However, the hidden costs and barriers of GB are still to be fully assessed in future studies.

Framework for Reviewing the Barriers to GB

A framework is developed in Figure 1 to look into the existing barriers in the GB market from two perspectives: the market (real estate developers and end-users), and the government, with its institutional considerations. The overall plan is to identify the impediments to getting the GB market working efficiently at a substantial size. When this happens, homeowners should have the information needed to make rational decisions about whether, how, and how much they want to pay for better energy performance. At the same time, real estate developers should know government policies well and be able to respond to consumer demands for energy- efficient buildings with consistent, efficient, and affordable solutions. Only with a good understanding of the problems can there be an appropriate approach to developing valid resolutions to current problems. The literature review's framework of barriers to GB is as shown in **Figure 1**.

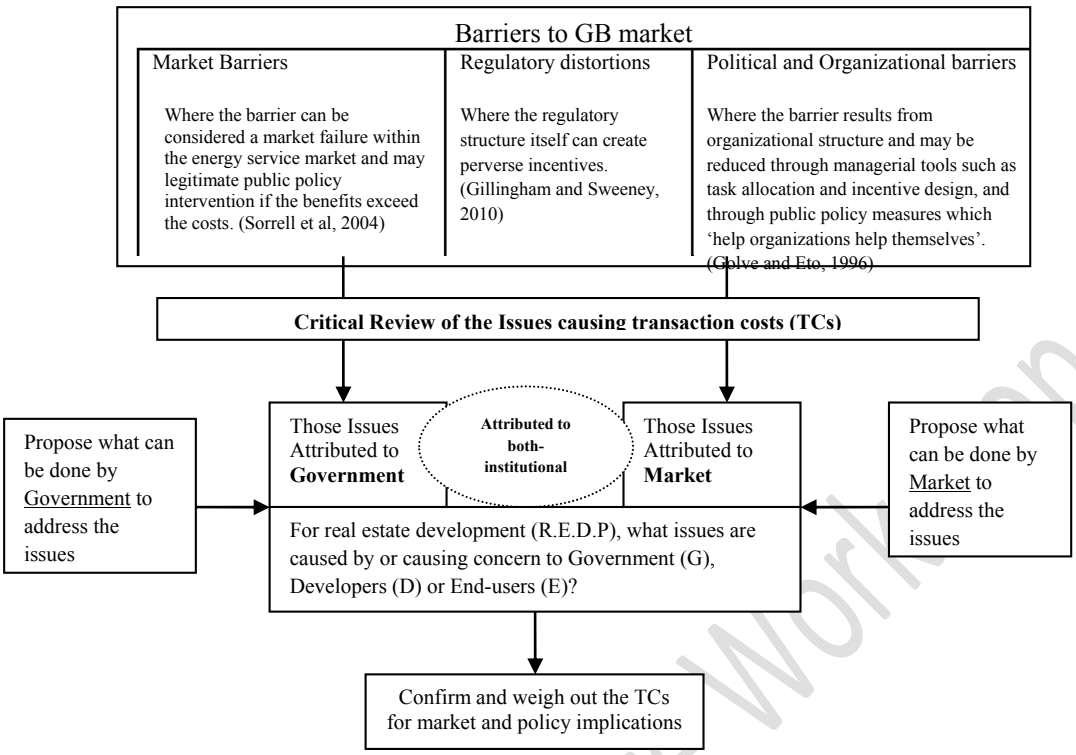

Figure 1 Framework for Reviewing the Barriers to GB

Many studies and articles on policy measures discuss barriers to energy efficiency, either to illustrate the need for policy measures or to explain why policy tools are not as successful as expected (e.g., Deringer et al. 2004, Westling et al. 2003, Vine, 2005). Market failures prevent the consistent translation of specific energy-efficient investments into energy-savings benefits (Carbon Trust, 2005). The number of barriers is enormous – according to some estimates, they are higher in the building sector than in any other sectors (IPCC, 2007, Koeppel and Urge-Vorsatz, 2007). The barriers debate has been important for policy discussions about energy efficiency for two reasons. First, evidence of market failures provides a necessary condition for government intervention to improve overall social welfare, although this justification is not necessary for interventions aimed at the separable objective of improving social equity. Second, the analysis of particular market failures provides us with a much deeper understanding of how decisions to invest in energy efficiency are actually made in certain market sectors. This understanding is critical to a more comprehensive assessment of the efficacy of any particular public policy, which the

author believes should be treated with specific reference to the particular market failures they seek to reduce or remove.

In GB context, a barrier refers to a mechanism that inhibits decisions or behavior that appear to be both energy efficient and economically efficient. In particular, barriers are claimed to prevent investment in cost-effective energy-efficient technologies (Sorrell et al., 2004). The terms "barrier" and "market barrier" were introduced by researchers using engineering-economic models to study the technical and economic potential for energy efficiency. The observation that there was often little interest in investments with very high rates of return led researchers to postulate that such investments were inhibited by various barriers and that this justified public intervention. Harris and Carmen (1983), Koomey (1990), and Jaff and Stavins (1994) have developed a framework for analyzing market barriers that has been adopted for this research. A comprehensive framework for understanding such barriers can facilitate and organize the analysis of the reasons for divergences from economic optimality.

Current regulations and incentive schemes could thus be expanded and improved to lower these barriers. In that sense, the author intends to initiate a comprehensive review of institutional barriers, including market barriers and regulatory distortions, their origins, and potential ways to overcome them. Such an approach will facilitate the implementation of energy-efficiency improvements involving a wide range of ever-changing energy end-users and a wide array of consumer preferences.

In essence, these barriers seem to be preventing this market's expansion from both the demand side and the supply side. First, on the demand side, the value of GB is not reflected in the market price of buildings, largely because of information imperfection. There is an externality factor in GB, and it cannot be easily and reliably measured and communicated to the market. Second, on the supply side, the GB product is not easily standardized and measured, nor is there a simple and uniform process for mass customization. As a result, the barriers within each transaction make the deal too cumbersome and increase uncertainty. No research has shown any harm from GB. However, the market seems to have an objection to accepting GB on its own merits. More can be done by the government, as it

has a unique ability to gather and publicize information, advocate GB, and educate the public about it.

How TCs plays its role in GB

> *North (1995, p. 68) concluded: "Transaction costs arise because of the costs of measuring the multiple valuable dimensions involved in exchange (broadly, information costs) and because of the costs of enforcing agreements. Information is not only costly but incomplete, and enforcement is not only costly but imperfect."*

Neoclassical economics shows that a perfectly functioning market will yield an economically efficient outcome in equilibrium. However, no real-world markets meet all the assumed attributes of perfection. From the new institutional economics perspective, transaction costs are huge, and market failures, which often occur, inhibit exchange, production, and economic growth. The power of transaction costs under alternative institutional arrangements is also crucial to the workings of markets (Cheung, 1998; Coase, 1998; Benham and Benham, 1997; North, 1990, 1991). From a transaction cost economics perspective, researchers regard energy efficiency as a co-ordination and incentive problem, rather than one of utility maximization, and they emphasize that policy intervention and different institutional structures may lower transaction costs and provide net social benefits (Golove and Eto, 1996; Levine et al., 1995). A better understanding of the nature and structure of barriers is necessary to understand the hidden TCs affecting the decision-makings of GB, and help design an incentive scheme that effectively promote the market mechanisms for GB investment. This study intends mainly to look at the barriers to the GB market from the transaction costs economics perspective.

With socio-economic progress, more market stakeholders are getting involved in the building sector and are dedicated to their own business interests. Real estate developers intend to do no more than obey the basic requirements of the law and regulatory policies to minimize the increasing costs engendered by the extra work entailed by GB or related mandatory energy regulations. Contractors also want to avoid these extra tasks, because

they require special expertise and specialized equipment that they do not typically possess. Manufacturers of GB products want regulations to be still stricter to create greater demand. Building-design institutes will not be greatly influenced by the new policies but are apt to succumb to the demands of developers because of the nature of their relationship with them. However, these interests have not yet been fully expressed by the stakeholders themselves, because most of them are still learning about how to participate in policy making. These conflicting interests are the main source of the risks of and barriers to GB development. Government could play an essential role by looking into the barriers and taking them into consideration in policy design. **Table 1** shows how TCs directly affecting decision-making in the market for green buildings amongst its stakeholders.

Table1 1 TCs directly affecting decision-making in the market for green buildings

	Transaction Cost Code						
Decision-maker	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Prospective Building Purchasers	×				×		
Prospective Occupants					×		
Developers	×		×	×	×		
Builders				×			
Architects / Designers	×	×	×	×	×		×
Construction Finance Organizations					×		
Take-Out Lenders					×		
Brokers			×		×		
Appraisers		×	×		×		
Local Government Officials						×	
Utility						×	
Suppliers of Efficient Devices						×	

Transaction Cost Codes (x = cost directly affects the decision-maker)
1 = cost of collecting information about efficiency measures or the credibility and reliability of new suppliers and subcontractors
2 = cost of developing expertise
3 = cost of calculating the costs and benefits of different efficiency levels
4 = cost of deciding how to alter established design and construction procedures
5 = cost of demonstrating in a credible way that a new building will reduce prospective tenants' or purchaser's energy costs
6 = cost of disseminating information about efficiency technologies
7 = cost of the architect / engineer incorporating new information about efficiency in his day to day work.

What is the "Transaction" in the GB Project-Development Scenario?

The unit of analysis in situations that Coase (1937, 1961 and 1988) describes is the transaction – the transaction between the regulatory agency and the private sector. The transaction in this study is the process involving the developers and the end-users who take part in the GB market. The purpose of choosing this transaction scenario for investigation is to examine the TCs incurred by the stakeholders upon choosing to invest in GB, as compared to its conventional counterpart. Some examples of the TCs include resources

used for information search, familiarising with the new measures and control systems, and establishing new networking etc. As there is much literature supporting the value of GB (Anthony and Rothkopf, 1989, Sutherland, 1991, Varone and Aebischer, 2000, Dennis, 2006, Qian and Chan, 2007), this study was not undertaken to find more evidence for the necessity of GB, or to provide further rationales for introducing incentive schemes. Instead, this study indeed is intended to determine the concerns of the market stakeholders, which have been ignored by current policies and research. The study is also intended to develop a theoretical framework by applying TCE to the study of business rationales and to find ways to improve the GB business by putting more precise and effective policies into place. It compares the extra efforts for GB investments versus standard ones (traditional buildings) in terms of TCs and emphasizes how TCs influence decisions about whether to invest in GB and to what extent. Hence, the transaction to be examined in this study is the REDP, from the time the developer decides to invest in a GB project until he delivers the GB products to the market's end-users.

Transaction stages in the REDP

This study follows the well-established stages of real estate development in the *RIBA Outline Plan of Work* (RIBA 2007) to establish the transaction's stages and study the TCs involved. A copy of the adapted *RIBA Outline Plan of Work* is shown in Table 1with the developers' key concerns regarding GB. The developers' key actions with reference to traditional buildings, as shown in column 2 (Tasks to be done) of Table 1, are developed from the *Architect's Job Book* (RIBA, 2008),*RIBA Chartered Practice Manual* (2010)[1], and *Architects Handbook of Practice Management* (Ostime and Stanford 2010).

The Plan of Work established by the Royal Institute of British Architects, England has been used for over a hundred year as a framework to guide all stakeholders to work in coordinated manner through each stages of the real estate development process. Hong Kong as an ex-colony of Britain has adopted the same plan of work for its architectural

[1]RIBA (2010) RIBA Chartered Practice Manual 2010-2011, by the Royal Institute of Architects, England. (http://www.architecture.com/Files/RIBAProfessionalServices/MembershipAndMarketing/General/CharteredPracticeManual/CharteredPracticeManualMay2010.pdf)

practice and Hong Kong Institute of Architects has included the same stages of work as professional services to be provided in their architect's standard engagement agreement with their developer clients. Table 1, adopted the established flow of development process in the Architect's Plan of Work. By referring to the tasks that stakeholders involved in a traditional project, the authors hypothesize in the left hand column the DEVELOPER'S KEY CONCERNS in GB development relating to the extra work with TCs incurred over and above that of a traditional project in each stage of the REPD.

According to the *Outline Plan of Work*, GB development projects require the developers to do extra work. Professional practice manuals and the literature on green-building design and construction (Kats, 2003; Wang et al., 2005; Chan and Lau, 2005; Meng et al., 2006; Lee and Chan, 2007; Wang et al., 2008; Kibert, 2008; GBRC, 2010; RIBA, 2010) suggest that the possible extra work to be conducted by developers of GB projects includes the followings.

Based on the literature review, brainstorming in the research team and pilot discussion with practitioners, we hypothesize a list of extra tasks (Not a conclusive list) that were used for interview. Some tasks have been removed and some are added after interviews. Those shown in right hand side column of the Table 3 are the extra tasks that interviews agree on their significance and that need detail consideration.

Integrating TCs caused by GB into different stages of the REDP

Each of the possible extra tasks may incur extra TCs which, based on the TCE literature, can be categorized as research costs, information costs, analysis costs, decision costs, institutional-arrangement costs, evaluation costs, and so forth. These possible extra tasks and TCs, as suggested by the *Architect's Outline Plan of Work,* contribute toward building a framework as presented in right-hand column (Extra work with TCs incurred in the context of GB in **Table 2**. They are summarized to help develop the research questions and hypotheses later. The proper incentive schemes with reference to the transaction stages could then be developed to suit the business rationale of the stakeholders.

Table 2: Outline Plan of Work in REDP with DEVELOPER'S KEY CONCERNS (with reference to traditional buildings and extra works from GB)

	Stage	Tasks to be done (for traditional projects) in different stages	DEVELOPER'S KEY CONCERNS Extra work with TCs incurred (in concern of GB)
Briefing	A :Inception	Set up client organization for briefing. Consider requirements, appoint architect. **Developer's Key Actions:** Identify opportunities (property/need/use/idea); Assemble co-developer; Identify and review information ; Identify seed money; Evaluate investment climate	1. Set up extra organization for briefing in relating with GB, e.g., new offices, new staffs 2. Consider extra GB related market and policy requirements: market study in GB; policy study in GB 3. Appoint special architect and involve special stakeholders relating to GB. 4. Need JV or Co-developer for such special project? 5. Carry out extra studies of market requirements and expectation on GB (considering local community need/supply/competitiveness) 6. Extra GB planning, design, and cost, etc., as necessary to reach decisions. 7. Extra effort to identify potential users 8. Study the extra financial risk 9. Consideration of extra legal liability risk of the GB product 10. More careful review of available information on GB. 11. Others
	B:Feasibility	Carry out studies of user requirements, site conditions, planning, design, and cost, etc., as necessary to reach decisions. **Developer's Key Actions:** Preliminary market analysis (community/supply/competitive); Assemble technical team; Identify potential users; Consider alternative site; Preliminary financial plan; Formal analysis (site/building/market/design/financial/appraisal); Investment threshold; Legal issues; Public participation; Review available information; Review objectives	
Sketch Plans	C: Outline proposals	Develop the brief further. Carry out studies on user requirements, technical problems, planning, design and costs, as necessary to reach decisions. **Developer's Key Actions:** Obtain control of the land/property; Preliminary plans and specifications; Negotiation with government for approval	1. Special User Requirement study 2. Explore special technical solutions 3. Special concept/design that need negotiation with government for approval 4. Design leading to non-efficiency use of floor area 5. Special cost study for using new design features 6. Others
	D:Scheme Design	Final development of the brief, full design of the project by architect, preliminary design by engineers, preparation cost plan and full explanatory report. Submission of proposals for all approvals.	
Working Drawings	E: Detail Design	Full design of every part and component of the building by collaboration of all concerned. Completer cost checking of designs. **Developer's Key Actions:** Finalize plans and specifications; Revise financial projections; Financial negotiations (Mortgage/loan/construction loan); Tax consideration	1. Financial negotiations for new design feature (consideration of mortgage/Loan/construction loan) 2. Search for a list of contractor with special expertise 3. Limited no. of contractor available reduce competition 4. Others
	F:Production Information	Preparation of final production information i.e. drawings, schedules and specifications.	
	G: Bills of Quantities	Preparation of Bill of Quantities and tender documents.	
	H: Tender Action	*Compile a list of tenders; Issue tender documents; Check and open tenders*	
Site Operation	J: Project Planning	*Notify acceptance of tender; Check all contract document are in order; Brief all project personnel of the project requirement and procedure for administer the project ; Check approvals and site condition to ensure the project can be carried out on site* **Developer's Key Actions:** Acquire property; Select construction Co; Marketing and leasing; Initial financing; Assemble construction Management team; Tennant involvement	1. Extra effort to brief all project personnel of the project requirement and procedure for administer the project 2. Special promotion strategy and materials for Marketing and Leasing 3. Additional consideration of tenant for GB products 4. Extra requirement on Testing and Commissioning of service installations to obtain Green Labeling etc 5. Special effort to prepare maintenance manual 6. Extra fee for certificates involving Green items 7. Others
	K:Operations on Site	*Sitting out the building on site ; Site meetings; Supervision and site visits; Financial monitoring of each construction stages; Testing and Commissioning of service installations; Prepare maintenance manual.*	
	L:Completion	*Check works ready for completion; Hand-over inspection; Rectify defects ; Final inspection and final certificate* **Developer's Key Actions:** Inspection; Certificate of occupancy; Permission to sell/rent	
Feedback & Maintenance	M: Feedback	Analysis of job records. Inspections of competed buildings. Studies of building in use. **Developer's Key Actions:** Prepare property management plan; Revise marketing plan; Oversee marketing or Leasing	1. Special property skill requirement for Property management plan 2. Special strategy and materials for Overseeing marketing or Leasing 3. To keep building running effectively and under good repair 4. Set up and manage ownership entity 5. More special green items to be taken care of for property improvement 6. Easy to sell or rent out property 7. Involve more guarantee certificates 8. Others
	N: Maintenance	**Developer's Key Actions:** Set up and Manage ownership entity; Property improvement; Property disposition; Closing ownership entity	

The transaction of concern in this study takes place between the developers and the end users, each of whom has to consider three things: the available incentive scheme and its foreseeable risk, their own resources, capital situation, their potential competitors and other available options, before they decide to carry out the transaction. The regulatory agency's primary purpose is to set up incentive schemes to attract the private sector to invest in GB businesses, whereas the developer's primary purpose is to evaluate its own cost-benefit ratios under different incentive schemes and make an optimal decision for its own sake. As the incentive schemes are mostly on a voluntary basis, the private developers only agree to meet the conditions set forth by the government in exchange for a benefit that more than just covers its loss after an overall evaluation. The developers' private situations vary, so it is not useful to discuss the TCs arising from different situations case by case. However, it is rational and meaningful to study the barriers that cause extra concerns and corresponding TCs that the private sector developers face at various stages of the process during the REDP when they invest in GB. Hence, the study aims to address the following **research questions**:

Q1: What extra work arises at different stages of the GB development comparing with its counterpart of traditional development in real practice?

Q2: What are the corresponding TCs specific to different stages of GB- development in real practice?

The underlying issues of these questions will be incorporated into the interview questions as presented in the following section.

METHODOLOGY

Interview with the real estate developers – case study in Hong Kong

Real estate developers are the dominant force in the building market. As most incentive schemes for GB promotion are market-based and voluntary, the stakeholders involved are free to accept or reject them. There are two major reasons that real estate developers are not motivated by most of the existing incentive schemes. First, the extra TCs involved are too heavy and the developers would rather give up potential benefits to avoid the attendant difficulties; second, the benefits from the schemes are not enough, which means that the incentive itself is not a sufficient inducement for the potential investors to become involved. Therefore, it is important to understand their priority concerns on their GB transaction, so that the policy –makers could be able to address incentives much effectively for the healthy development of GB market in the long run.

A framework (see **table 3**) showing the possible extra tasks and related TCs to be considered under the *Architect's Outline Plan of Work* is established for interview-data collection. The interviewees were asked to identify the additional concerns and tasks caused by GB, in terms of the TCs, during each stage of the REDP, and to rank them by levels of uncertainty. Based on those possible extra tasks involved at different stages of the REDP, key senior professionals of real estate development companies and their representative were interviewed to seek their views of the significance of TCs considerations for each of the extra tasks, by judging the levels of the uncertainty it arises. The purpose was to get the first hand opinions of real estate developers to rank the uncertainty of the extra tasks proposed, and to understand its impact on the GB transaction. This study also provides a better picture of GB market development relating to a specific institution in the case of Hong Kong, and gives a reference for designing rational policy for GB promotion.

Table 3.Weighed extra tasks to be done in REDP from the interview case in Hong Kong

	Extra Tasks by GB	Highest frequency	Overall grading& Remarks
Briefing stage	1. Set up extra organization for briefing in relating with GB.	S (61.5%)	S: Consistently standard risk
	2. Consider extra GB related market and policy requirements.	U (53.8%)	U: Consistently High risk
	3. Appoint special architect and involve special stakeholders in relating to GB.	S (84.6%)	S: Very consistently standard risk
	4. Need JV or Co-developer for such special project?	X (84.6%)	X: Very consistently not applicable
	5. Carry out extra studies of market requirements and expectation on GB (considering local community need/supply/competitiveness).	U (61.5%)	U: Very consistently High risk
	6. Extra GB planning, design, and cost, etc., as necessary to reach decisions.	S (61.5%)	S: consistently standard risk
	7. Extra effort to identify potential users.	U (61.5%)	U: consistently High risk
	8. Study the extra financial risk.	S (46.1%)	S: Diverse opinion but tends to be standard risk
	9. Consideration of extra legal liability risk of the GB product.	V (30.7%) S (30.7%)	V: Very diverse opinion but ,tends to be high and Very High risk

	10. More careful review of available information on GB products.	U (61.5%)	U: Consistently High risk
Sketch Plans stage	11. Special User Requirement study	S (61.5%)	S: Consistently standard risk
	12. Explore special technical solutions.	U (53.8%)	U: Consistently High risk
	13. Special concept/design that need negotiation with government for approval.	S (84.6%)	S: Very consistently standard risk
	14. Design leading to non-efficiency use of floor area.	X (84.6%)	X: Very consistently not applicable
	15. Special cost study for using new design features.	U (61.5%)	U: Very consistently High risk
Working drawing	16. Financial negotiations for new design feature (Mortgage/Loan/construction loan).	S (61.5%)	S: consistently standard risk
	17. Search for a list of contractors with special expertise.	U (61.5%)	U: consistently High risk
	18. Limited no. of contractors available that reduce competition.	S (46.1%)	S: Diverse opinion but tends to be standard risk
Site operation stage	19. Extra effort to brief all project personnel of the project requirement and procedure for administer the project.	S (76.9%)	S: Very Consistently standard risk
	20. Special promotion strategy and materials for Marketing and Leasing.	U (46.1%) V (23%)	U: diverse opinion , tends to be High risk
	21. Additional consideration of tenant for GB products.	S (54.5%) U (38.5%)	S/U: Very diverse opinion between High and Standard risk
	22. Extra requirement on Testing and Commissioning of service installations to obtain Green Labeling etc.	U (46.1%) S (30.7%)	U: diverse opinion , tends to be High risk
	23. Special effort to prepare maintenance manual	S (53.8%)	S: diverse opinion but tends to be standard risk
	24. Extra fee for certificates involving Green items	S (69.2%)	S: Very Consistently standard risk
Feedback & Maintenance stage	25. Special property skill requirement for Property management plan	U (38.5%) S (46.2%)	U/S: Very diverse opinion but , tends to be between high risk and Standard risk
	26. Special strategy and materials for overall marketing or leasing of the completed green/ GB building.	U (31%) V (31%) S (31%)	U/V: Very Diverse opinion but mostly between High and Very High risk
	27. To keep building running effectively and under good repair	S (53.8%)	S: Diverse opinion but tends to be standard risk
	28. Developer's Key Actions: Set up and manage ownership entity	X (53.8%) S (38.5%)	X: Diverse opinion, but mostly of not applicable
	29. More special green items to be taken care of for Property improvement	S (76.9%)	S: Very consistently standard risk
	30. Easy to sell or rent out Property (Involve more guarantee certificates?)	S (38.5%) U (38.5%)	U: Very diverse opinion but tends to be of High risk

Legends:

S: normal levels of risk that developers are not too concerned, and could easily be covered by an extra % expenses/fee (e.g., pay a specialist consultant to do the work);
U: uncertainties and developers are concerned, in terms of time, cost, risk, government requirements, sales, etc.);
V: high level of uncertainties that developers are very concerned, in terms of time, cost, risk, government requirements, sales, etc.)
X: Not applicable or so low that it can be ignored.
%: For each item, the ones (S, U, V or X) with the highest frequency and where appropriate the significant second highest frequency of the items being ticked by the interviewees are shown in the table. The rate in term of % is shown in the bracket (%).

Explanation of Remarks:

- Much More than half of them agree to the item to be as "consistently standard risk", e.g., S (61.5%) - S: Consistently standard risk.
- Half of them agree to the item to be as "Consistently High risk", e.g., U (53.8%) - U: Consistently High risk.
- Most of them agree to be as "Very consistently standard risk", e.g., S (84.6%) - S: Very consistently standard risk
- Less than half of them agree to be as "Diverse opinion but tends to be standard risk", e.g., S (46.1%) - S: Diverse opinion but tends to be standard risk

In this case study, the real estate developers and their professional representatives who took part in the interviews are cover the top six real estate development companies in Hong Kong, which undertake about 80% of the local real estate development. All the interviewees if not currently working directly for developers, have worked as the lead consultant for the developers. In-depth interviews with these representatives were conducted to solicit their views on issues regarding GB investment. As the decision-makings and strategic plans for the real estate development- whether invest in GB or not, and what are the market expectations/ concerns to GB, etc., are only done by people who are senior and stay high position. The 15 interviewees selected were either representatives of developers or top managers/directors of consultant firms who actively worked

for major real estate development companies. In addition, those people selected should definitely have the practical experience on GB, and could influence the market in a significant way. Therefore, the interviewees have been selected with the above considerations to ensure the sample is representative and the results are significant. Profiles of the interviewees are shown in the following:

Profiles of the interviewees:

1. VC: (Executive Director of E&M Engineering)
2. MT: (Executive Director of one of the top developers)
3. KS: (Sustainable development director for a leading architectural firm)
4. FC: (Associate Director of a world-class architectural firm)
5. PE: (Director of one of the top 2 QS firms)
6. SK: (Director, Campus Development of a Hong Kong university)
7. JP: (senior officer, Environmental Protection Department)
8. SM: (Director of a medium size QS firm)
9. SY: (Director, one of the top developers)
10. Q: (Director of one of the top developers)
11. NB: (Chairman of a leading property services company)
12. TM: (Director of an international property investment company)
13. WC: (Director, Science Park)
14. KC: (Surveyor, and past president of Professional Green Building Council)
15. EC: (Architect, and Honorary Secretary of Professional Green Building Council)

FINDINGS OF INTERVIEWS

Briefing stage

At the briefing stage, interviewees were asked about ten extra tasks, identified from the literature review. Four of them are regarded as representing normal levels of risk (S) at various levels of

development and could be covered by lump sum money. Developers are not too concerned about these. These four tasks, listed here from the most to the least acceptable, are: No. 3 “Appoint a special architect and involve special stakeholders in relation to GB” (S: 84.6%)”; No. 1“Set up extra organizational structures for briefings in relation to GB” (S: 61.5%); No. 6 “Extra GB planning, design, and cost, etc., as necessary to reach decisions” (S: 61.5%); and No. 8 “Study the extra financial risk” (S: 46.1%).

Four tasks are regarded as involving uncertainty (U), which means there is no readily available standardized practice in the market for the developers to refer to or to cover it with a lump sum without worrying about too much risk. These tasks are normally not standardized and cannot be predicted. These four tasks, listed from the most to the least acceptable, are: No.5 “Carry out extra studies of market requirements and expectations about GB (considering local community need/supply/competitiveness)” (U: 61.5%); No.7 “Extra effort to identify potential users” (U: 61.5%); No. 10 “More careful review of available information on GB products” (U: 61.5%); and No.2 “Consider extra GB-related market and policy requirements” (U: 53.8%). Here, the higher rate means that more people agree that the item should be rated as U.

One task, No.9: “The consideration of extra legal liability risks for the GB product” (V: 30.7%; S: 30.7%), is rated equally as “very uncertain” and “standard”. Opinions about this task are very diverse, and in the authors’ judgment through the interview, it appears to be of great uncertainty and very high risk (V). Another task, No. 4 “Need JV or co-developer for a special project?” is consistently considered to be not applicable as a GB special task.

Sketch-plan stage

Five tasks were confirmed as extra works at the sketch-plan stage. Two are considered to be of normal risk levels (S). These are: No. 13 “Special concepts/designs that need negotiation with government for approval” (S: 84.6%), and No.11 “Special User Requirement study” (S: 61.5%). Both of these tasks are generally considered to be of standard risk that will not cause extra concern besides the lump sum money input. No.15 “Special cost study for using new design features” (U: 61.5%), and No.12 “Explore special technical solutions” (U: 53.8%) are the two among the five tasks that are consistently rated to be of high risk to the developers, and which cause high concern in their decision-making about GB investment. No.14 “Design leading to non-efficiency use of

floor area" (X: 84.6%) is generally considered not to be an extra task for GB during the sketch-plan stage.

Working-drawing stage

Three tasks are confirmed for this stage. No.16 "Financial negotiations for new design feature (Mortgage/Loan/Construction loan)" is rated consistently as of standard risk (S: 61.5%). Another S-rated task is No. 18 "Limited number of contractors available, which reduces competition" (S: 46.1%which shows more diverse opinions about this task with a higher tendency to consider it as standard risk. No.17 "Search for a list of contractors with special expertise" (U: 61.5%) is consistently considered to be of high risk and concern to developers in Hong Kong.

Site-operation stage

Six extra tasks for GB were confirmed by the interviewees. Three of these are rated S (in decreasing order): No.19 "Extra effort to brief all project personnel of the project requirements and procedures for administering the project" (S: 76.9%); No.24 "Extra fees for certificates involving Green items" (S: 69.2%); and No.23 "Special efforts to prepare maintenance manuals" (S: 53.8%). These three are all rated as being of standard risk that lump sum money can cover without too much concern. The two tasks rated U are: No.20 "Special promotion strategy and materials for Marketing and Leasing" (U: 46.1%; V: 23%), and No.22 "Extra requirements of testing and commissioning of service installations to obtain green labeling" (U: 46.1%; S: 30.7%), both of which elicit high diverse opinions but are considered high risk. The task: No.21 "Additional consideration of tenants for GB products" (S: 54.5%; U: 38.5%) is rated with very diverse opinions between high and standard risk.

Feedback and maintenance stage

There are six GB extra tasks for this stage. Two of them are generally agreed to be of standard risk (S). These are: No.29 "More special green items to be taken care of for property improvement" (S: 76.9%) and No.27 "To keep buildings running effectively and in good repair" (S: 53.8%).

The other two extra tasks elicited diverse opinions. No.25 "Special property skills requirement for Property management plan" (U: 38.5%; S: 46.2%) is deemed to be between high risk and standard risk and No.26 "Special strategy and materials for overall marketing or leasing of the completed

GB" (U: 31%; V: 31%; S: 31%) attracted split opinions, but is mainly judged as a high or very high risk. The authors feel from the interview thatNo.30 "Easy to sell or rent out property (Involving more guarantee certificates?)" (S: 38.5%; U: 38.5%) is of high risk. Finally, the task: No.28 "Developer's Key Actions: Setting up and managing ownership entity" (X: 53.8%; S: 38.5%) is generally considered by the respondents to be not applicable.

IMPLICATIONS AND RECOMMENDATIONS

Major Extra Tasks with TCs caused by GB project at different stages of the REDP

The objectives of this paper aiming to identify the concerns specific to GB projects, have been addressed more explicitly by dividing the transactions of the entire REDP into smaller established stages. This would help the developers and government to better understand the market and to develop policies with a more focused emphasis on the different stages of transactions, thus promoting GB more efficiently with appropriate policies. Based on the analysis in the previous section, **Table 4** summarizes the concluding findings from the interview questions. It helps to address the above-mentioned two research questions for this study. Q1: What extra work arises at different stages of the GB development comparing with its counterpart of traditional development in real practice? Q2: What are the corresponding TCs specific to different stages of GB-development in real practice?

Table 4 Major Extra Tasks with TCs (risks) caused by GB at different stages of the REDP

	Extra tasks arising from GB	Remarks
Briefing stage	1. Consideration of extra legal liability arising from the GB product.	Very diverse opinions, but tends to be seen as high and very high risk.
	2. Carrying out extra studies of market requirements and expectations for GB (considering local community needs/supply/competitiveness).	Very consistently high risk.
	3. More careful review of the available information on GB products.	Consistently high risk.
	4. Considering extra GB-related market and policy requirements.	Consistently high risk.
	5. Extra effort to identify potential users.	Consistently high risk.
Sk etc h pl	6. Special cost studies for using new design features.	Very consistently high risk.
	7. Exploring special technical solutions.	Consistently high risk.

	8. Searching for a list of contractors with special expertise.	Consistently high risk.
Site operation stage	9. Extra requirements for testing and commissioning service installations to obtain Green Labeling, etc.	Diverse opinions tend toward high risk.
	10. Special promotional strategies and materials for marketing and leasing.	Diverse opinions tend toward high risk
	11. Additional consideration of tenants for GB products.	Very diverse opinions between high and standard risk.
Feedback and Maintenance	12. Special strategies and materials for overall marketing or leasing of the completed GB.	Very diverse opinions, but mostly between high and very high risk.
	13. Ease of selling or renting property (e.g., will it involve more guarantee certificates?).	Very diverse opinions tending toward high risk.
	14. Special property skill requirement for property management plan.	Very diverse opinions, tending to be between high risk and standard risk.

Based on the findings presented in the previous section, the key conclusions of this study are that additional tasks are more likely to arise during the early period (briefing stages) of a GB project than at other stages. The area of greatest concern is the possibility of extra legal liability in relation to the GB product due to uncertainties about the market, consumers, and available technical information. The other significant risk items mainly relate to extra study and knowledge about the market. At the sketch-plan stage, the task with the highest risk is the cost of study involved in incorporating new design features and exploring special technical solutions for GB projects. At the working-drawing stage, the high-risk task is looking for suitable contractors to construct the GB project. During the site-operation stage, there are fewer concerns and opinions are diverse. "Extra requirements for testing and commissioning," which again deals with new knowledge, is the top risk item. During the feedback and maintenance stage, the risks are general, and views about them very diverse. The highest concerns for risk (TCs) mostly relate to marketing and leasing, which is already a major uncertainty concern during the Briefing stage. Generally, the latter half of a GB project development process does not involve too many extra tasks or concerns about risk, but the high risk ones are still identified to help practitioners. The findings inform developers to direct their efforts to the exact critical stages of REDP to cut down TCs incurred, and provide references to government for policy design to overcome the TCs concerns to better promote GB. For a concise summary and overall view**, Table 4** extracts only those extra tasks that really pose TCs concern to the practitioners and they need to be seriously addressed by policy design.

The most important support provided recently by the Hong Kong government for promoting GB is introducing a voluntary incentive scheme where developers can get extra bonus floor area (plat

ratio) if their project designs that compile with Green Building certification and follow the published sustainable building design guidelines. Under the incentive scheme, developers have to pay even more effort to the project planning and design stage in order to gain extra bonus floor area, which is very expensive item in Hong Kong. The situation explains why the above study result highlights the extreme importance of some of the major extra tasks in the early project planning stage in terms of TCs concerns. Once the developers option to take up the voluntary scheme, any non-compliance with the new requirements will lead to building plans disapproval from government departments and not getting the bonus floor area. One may argue that with such an incentive scheme, the resources and effort of the developers in GB delivering process have been skewed so much that they undermine the significant contribution of on-site contractors and operational processes toward GB development.

CONCLUSIONS

In this paper, in-depth interviews are conducted with professionals who can represent views of major real estate development companies in Hong Kong. It applies the theory from TCE to study the underlying reasons of reluctance from the GB market penetration in the view of the real estate developers. It cuts the GB transactions into smaller established stages of real estate development process by referring to *RIBA Outline Plan of Work,* and it focuses on how to smooth GB transactions and lessen TCs involved. The paper provides a framework to understand GB extra works in general and the TCs concerns of a particular stakeholder in particular. It has identified those extra tasks with high risk concerns in term of TCs at the critical stages of real estate development process. It contributes to the argument that TCs can be the key factors impeding GB market penetration, and provides references to design a governance structure as well as to design policy packages to promote GB. The results also establish groundwork for future studies on governance structure or policy package and government's roles to solve the existing problems in the GB development process.

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