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Transaction costs (TCs) in green building (GB) incentive schemes: Gross Floor Area (GFA) Concession Scheme in Hong Kong

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ABSTRACT

It is claimed that transaction costs (TCs) affect the effectiveness of any green building (GB) policy. However, few studies have empirically applied TC analysis to GB incentives, which normally should have analyzed the TCs borne by different stakeholders. These include TC typology and determinants during the implementation process, especially the extra administration process where TCs possibly may be incurred. The lack of such in-depth analysis tends to make incentive-design ignore efficiency and fairness amongst the stakeholders. This study aims to improve the efficiency of GB incentives through analyzing TCs borne by the private sector stakeholders. It would identify TC typologies and determinants, and TCs measurement and allocation to different stakeholders. As TCs are policy context-specific, this paper takes a popular GB incentive scheme, Gross Floor Area (GFA) Concession Scheme, as an example. Interviews were conducted with 20 industry experts to validate TCs types and determinants, and to gauge the magnitude of TCs borne by different stakeholders. These empirical evidences are helpful for policy-makers and practitioners to better understand the impacts of TCs, so as to improve the effectiveness of future incentive schemes. In addition, GB policy recommendations for Hong Kong are proposed and many of which are relevant to other countries.

1. Introduction

Worldwide, building energy consumption accounts for over 40% of global energy use and one-third of global greenhouse gas emissions (UNEP, 2009). However, in Hong Kong, residential and commercial buildings consumed around 64% of all energy and 92% of electricity in 2014 (Electrical and Mechanical Services Department, 2016). Apart from energy consumption, the building sector influences the environment in many other ways, such as in solid waste generation, resource depletion, and environmental damage. Therefore, GB, as a solution to environmental issues, gains in its popularity. Various standards and design guidelines, such as the Building Environmental Assessment Method (BEAM) Plus in Hong Kong, and Leadership in Energy and Environmental Design (LEED) in the US, etc., have been released to regulate the design and construction of GBs. These measures of a voluntary basis need to be buttressed with some quasi-regulatory instructions to make them more effective.

Among all the incentive and regulatory instruments, the GFA Concession Scheme, as a planning instrument, has gained wide popularity. The GFA concession is developed from the notion of "make developers pay" in UK (Tang and Tang, 1999). It works such that government grants developers extra GFA in exchange for their contributions to the public amenities, so that government can save money to invest in public facilities. This incentive instrument has a long history of being applied to affordable housing programmes in the USA, Australia and UK (Fox and Davis, 1975; Gurran et al., 2008), as well as to renewable energy of buildings in Japan, France and New Zealand (Paetz and Pinto-Delas, 2007). In recent years, it has been used to promote GBs in many countries and regions, such as the USA, Singapore and Hong Kong (Fan et al., 2015). In Hong Kong, the GFA Concession Scheme is designed to facilitate the adoption of BEAM Plus and the Sustainable Building Design Guidelines (SBDGs), as well as certain building design features to improve the sustainability in the built environment. As Hong Kong has extremely high land prices, extra GFA as incentive is very attractive for the developers to deliver GBs (Fan et al., 2015). After the implementation of the GFA Concession Scheme in 2011, the number of registered GBs increased by around 30% within one year (Liu and Lau, 2013), which demonstrates that the GFA concession is attractive to developers in Hong Kong.

However, implementing GB incentives means imposing extra responsibilities on stakeholders, which would incur extra transaction costs (TCs). It is claimed that TC affects the effectiveness of the policy

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implementation (McCann et al., 2005; Qian et al., 2016), and hinders developers from entering the energy efficiency market (Qian et al., 2013). TCs include searching cost, approval cost, validation cost, negotiation cost, certification cost, monitoring costs, verification cost, transfer cost, enforcement cost, and contracting cost (Coggan et al., 2013; Dudek and Wiener, 1996; McCann et al., 2005; Ofei-Mensah and Bennett, 2013). For example, TCs accounted for 9–19% of project costs in the Green House Gas offset initiatives (Sathaye, 2005). However, few studies have empirically applied TC analysis to GB incentives, which should have analyzed TCs borne by different stakeholders, including TC typology and determinants, during the implementation process, especially the extra administration process and the uncertainties involved. Lacking such in-depth analysis makes incentive-design ignore efficiency and the fairness between the stakeholders. Indeed, Marker et al. (2014) believed that the additional costs of consultants and paper work relevant to GB certification are significant barriers of GB development. For example, apart from developers, there are many other stakeholders conducting extra work under the GFA Concession Scheme, yet only the developers obtain the direct benefits from GB incentives, in terms of getting extra GFA for the project. Consequently, this study aims to improve the efficiency of GB incentives through analyzing TCs borne by the private sector. Although government also bears TCs in the process, it has not been included in this study due to its limited scope and resources.

This paper focuses, particularly, on the GFA Concession Scheme for the following reasons:

1) Internationally, the GFA Concession Scheme turns out to be an effective incentive instrument after years in practice, and has been implemented in many countries, such as the US, Japan, and Singapore (Fan et al., 2015);
2) Worldwide, up to 10% GFA Concession is very much valued by developers, due to the high land price in dense cities. However, in the past 5 years in Hong Kong, less than 40% of the developers adopted the GFA concession. This indicates that the growth of the participation rate of the scheme is too slow;
3) If the GFA concession fails to work efficiently in Hong Kong, it would be even more difficult to be implemented in other less-dense cities, where GFA is not a critical issue.

In this study, the extra administration procedure of applying for GFA concession and the uncertainties involved in the approval process were presented and analyzed. The results provide a more holistic picture of where TCs were possibly incurred, and so this provides better basis for future studies on institutional analysis, such as comparative mechanisms of the GFA Concession Scheme in Hong Kong and Singapore. Too little is known about TCs under GB incentives at an empirical level. This study also provides interesting insights through expert interviews, such as the types of TCs and determinants of TCs under the GFA Concession Scheme. Such empirical evidence is helpful for policy-makers and practitioners alike, to better understand the impacts of TCs, so as to improve the effectiveness of future incentive schemes.

The paper is organized as follows: Section 2 reviews the definitions of TCs in different contexts, TC typologies, determinants and ways of measurement, as well as the existing studies on this topic. Section 3 analyses the GFA Concession Scheme in Hong Kong and develops a conceptual framework through applying TC determinants to the GFA Concession Scheme. Section 4 presents how this study conducts expert interviews and collects empirically contextualized data. The empirical findings are presented in Section 5. Based on the findings, Section 6 discusses what affects the efficiency of GFA Concession Scheme and whether the costs and benefits allocation is fair. The policy implications and conclusions are shown in Section 7.

2. TCs in the context of environmental issues

2.1. Definitions and boundaries

Arrow (1969), one of the early pioneers, defined TCs as the costs of running the system. Later, researchers found it necessary to define TCs in different contexts. For example, in the recent decade, in the field of environmental policy, TCs are defined as the cost to produce and implement a policy (Coggan et al., 2013; Garrick et al., 2013). In the context of enforcing environmental regulations from the private sector's perspective, TCs refer to the cost to comply with the regulations (Wong et al., 2011). Kiss and Mundaca (2013) defined TCs is to be understood as the cost of technology placement and implementation occurring ex-ante, and the cost of monitoring and enforcement occurring ex-post, in the analysis of technology innovation in the construction sector (Kiss and Mundaca, 2013).

Due to the different definitions of TCs, there are many applications at different transaction levels. For example, Hong et al. (2007) believed that TCs comprised the ex-ante and ex-post compared the costs of two project delivery systems and divided them into three types, namely ex-ante, construction cost, and ex-post. Buitelaar (2004), compared TCs of different institutional arrangements in the land development process, and concluded that TCs, i.e. institutional cost, vary with the mode of institutions. McCann et al. (2005) studied the boundary issues of TCs and divided them into three levels (Fig. 1). Areas A and B refer to TCs involved in the market transaction and resource allocation (institutions) respectively. Further, TCs rely on the broader institutional arrangements in place, such as the legal system (Area C in Fig. 1) (Easter et al., 1998; Saleth and Dinar, 2003). The TCs of implementing the GFA Concession Scheme of this study falls into the area A (Fig. 1).

2.2. TC typologies and determinants

2.2.1. TC typologies

The earlier studies have explored the typologies of TCs in regard to implementation of the energy efficiency projects and environmental policies. For energy efficiency projects, TCs include monitoring and verification cost, information searching cost, trading cost, negotiation cost, and decision making cost, etc., (Mundaca et al., 2013). With respect to implementing environmental policies, TCs include searching cost, approval cost, validation cost, negotiation cost, certification cost, monitoring costs, verification cost, transfer cost, enforcement cost, and contracting cost (Coggan et al., 2013; Dudek and Wiener, 1996; McCann et al., 2005; Ofei-Mensah and Bennett, 2013). It can be seen that some of these TCs appear to be overlapping because, by definition, it is difficult to separate them clearly.

2.2.2. TCs determinants

Williamson (1985) proposed three dimensions, namely asset specificity, frequency and uncertainty, all of which influence the amount of TCs, which are commonly used to analyse the decision-making of private sector stakeholders (Fill and Visser, 2000; Walker and Weber, 1984). If the asset specificity is huge, both sellers and buyers have to

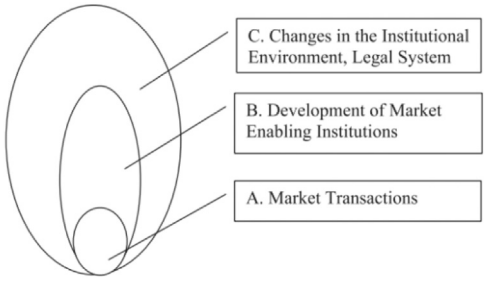

Fig. 1. Boundary issues related to TCs. (Source: McCann et al., 2005).

make special efforts to enable the exchange, hence TCs will increase (Williamson, 1981, 1985). Specific assets pose more hazards than non-specific ones because sellers cannot sell the product to the other buyers easily and buyers cannot turn to other alternatives without difficulties. There are also different types of asset specificity and uncertainty that determine different types of TC. These will be presented in detail in the Section 3.

2.3. TCs measurement

A number of sources have been used to identify the amount of TCs related to environmental issues, such as personal communications (Dudek and Wiener, 1996; Michaelowa and Jotzo, 2005), surveys (Grover and Malhotra, 2003), project reports (Kiss, 2016; Mundaca et al., 2013), and internal data of government and companies (Pannell et al., 2013; Thompson, 1998). For researchers, interviews or surveys are usually the best way to estimate TCs, which allows them to estimate different types of TCs (Laura et al., 2005). Moreover, the time spent on extra activities has been used by a number of researchers to measure TCs. For example, McCann and Easter (1999) interviewed civil servants in terms of the time spent on various activities, and so they used the standard value of time to measure TCs. Mettepenningen et al. (2009) conducted a mass survey to investigate the time spent on certain activities and used the mean values to calculate TCs. Weber (2015) conducted interviews to measure the working time allocation on each task relevant to TCs. In this study, 20 experts with specific knowledge of the GFA Concession Scheme were interviewed on the time spent on the extra activity needed, as the criteria to measure TCs.

2.4. Existing studies on this topic and research gap

The application of TCs theory to GB and low-carbon technologies is relatively new. In the recent 10 years, there are only a few articles focusing particularly on this topic (Qian et al., 2015). Table 1 summarizes latest studies with TCs determinants, types and measurements. The TCs determinants are crucial in principle, because they provide clues how to reduce TCs. Three key findings about TCs have been identified with details justified shown in Table 1. They are that: 1) TCs cannot be ignored; 2) TCs affect effectiveness negatively; 3) TCs vary with the project elements. However, few studies have empirically applied TC analysis to GB incentives, which could analyse TCs borne by different stakeholders, during the implementation process, especially the extra administration process and the uncertainties involved. Without such systematic analysis, incentive policy-design overlooks the detailed roles and balance of fairness between the stakeholders, and thus this omission undermines the overall effectiveness of the incentive scheme. To enrich this research area, this study aims to develop a conceptual framework to analyse the TCs of implementing GB incentives, particularly focusing on the GFA Concession Scheme in Hong Kong. It would identify TC typologies and determinants, and the measurement and allocation of TCs to different stakeholders. Since TC changes with modification of the mechanism of policies, the approach of this research study could contribute to evaluating the implementation efficiency of other incentives. The research results are intended to help improve the existing GFA Concession Scheme to make it more fair and efficient.

3. GFA Concession Scheme and the TCs' perspective

To address climate change and promote GB, Hong Kong has implemented the GFA Concession Scheme since 2011. The GFA Concession Scheme is to grant GB developers the extra GFA (up to 10% allowable GFA bonus under the Building Regulations) to reward their contributions to the GB. This scheme is on a voluntary basis, and tailored for the Hong Kong built environment. However, it mandates the use of GB design and construction features (by requiring twelve building design features relevant to sustainability), SBDGs and BEAM Plus (GB labelling programme in Hong Kong). Developers who would like to acquire the extra GFA have to comply with the certain building features and SBDGs and BEAM Plus. In this way, environmental protection can be 'warranted' to address climate change, especially building energy efficiency. As BEAM Plus and SBDGs are compulsory requirements for participants taking part in the GFA Concession Scheme, additional responsibilities are assigned to the relevant GB stakeholders, who have to go through a new application procedure (Fig. 2).

Apart from the normal administration process, participants have to submit two additional applications, BEAM Plus certification (including provisional assessment and final assessment) and GFA concession, throughout the real estate development process. In order to apply for the GFA concession, architects need to integrate several of the twelve building features, five green features and seven amenity features, into the design scheme at the design stage according to the specific site context and building layout (Development Bureau, 2011). These features include balconies, wider common corridors and lift lobbies, utility platforms, non-structural prefabricated external walls, residential recreational facilities, covered walkways/trellis without provision of greenery, voids, management facilities, larger lift shaft areas, pipe ducts/air ducts/chimney shafts which are not part of the distribution network for mandatory services and environmentally-friendly features, prestigious entrance, and non-mandatory plant rooms. These features benefit a wide number of occupants, and include better personal and communal space, and balconies. Tam et al. (2013) argued that maintaining these facilities added value to buildings that, in turn, brings long-term economic benefits.

In the administrative process, building plans should also fulfil the SBDGs at the design stage and be submitted to the Buildings Department for approval (Fig. 2). The SBDGs have three basic elements of GB design, namely site coverage of greenery, building separation, and building setback. To be more specific, for different assessment zones, there are different design requirements for each of the above-mentioned three elements, i.e., size of site, building length, and building height. For example, with respect of building separation, in the site with area less than 20,000 m^2, with the building length no less than 60 m and building height no more than 60 m, the permeability of buildings should be no less than 20%. These requirements contribute to mitigating the heat island effect, enhancing the environmental quality of living space, and enabling better greenery and air ventilation around buildings. However, the complex requirements and dynamic project-based situation bring difficulties and uncertainties in order to meet the design scheme, given that no specific training is provided to the architects. This is important, since Buildings Department (2013) reported that from 2011 to 2013, about 25% of the total projects that had applied for GFA concession were not approved due to the failure to meet the SBDGs.

In order to receive the BEAM Plus certification, the project needs to pass both: (a) the provisional assessment at the design stage; and (b) the final assessment at the completion stage (Fig. 2). BEAM Plus has four levels of ratings, namely Platinum, Gold, Silver, and Bronze. It is designed to monitor the process of building construction and operation in terms of its indoor environmental quality, building site, energy use, material, and water use. However, the BEAM Plus only states the requirements of different rating levels, without explanation of how to achieve it. The Hong Kong Green Building Council (HKGBC) is the body to provide training, particularly to help professionals integrate GB standards and practices, and to advise the project team on how to achieve the credits. Professionals who complete the training of BEAM Plus and pass the exam can receive the BEAM Pro certification for such practice. The training guarantees professionals' sufficient knowledge and experience when constructing GB. These professional stakeholders are, therefore, selected as the appropriate target interviewees for this study.

Table 1
Review of TC applications on the projects and policies related to green building and low-carbon technology.

Year	Author	Research topics	TCs Boundaries	TCs Determinates	TCs Types	TCs Measurement Method	Key Findings
2016	Kiss	Passive house-oriented retrofitting	A	• Extended pre-study; Searching for form of collaboration; Preparation of call for developer; Assessing developers' application; Assessment of subcontractors; Searching for assessment methods; Project formulation; Target setting; Preparation for the main call; Subcontracting under partnering; Monitoring	• Cost of due diligence • Cost of negotiation • Cost of monitoring	Estimating time spent on each TCs	• TCs is not negligible. • For individual case, the TC scale can account for 200% of traditional renovation.
2015	Qian et al.	Green building project	A	NA	• Ex ante: negotiating and establishing contract • Ex post: growth in prices	NA	• Negative relationship between TC and demand and supply of GB • False GB products or less trustworthy developers would lead to more TCs for end-users
2014	Joas and Flachsland	Climate policy	B	NA	• Assembling information on cost-effective abatement at the facility level • Monitoring, reporting and verification • Application for free allocation • Legal expenses • Trading permits	• Case studies, government reports, and consultant reports, • Interview and the authors' calculation • Estimate monetary value of TC in Euro	• Little differences of TC across policy instruments • Lower TC of standards than that of market-based instruments
2013	Qian et al.	Building energy efficiency	A	• Bounded rationality • Opportunism • Contractual hazards • Asymmetrical information	• Costs for dealing with uncertainties in the process of developing BEE • Cost for searching information	NA	• TC would undermine BEE's advantage • A rational developer will develop a smaller amount of BEE due to TC
2013	Mundaca et al.	Project of low-carbon technologies	A	NA	• Cost of searching for information • Negotiation cost • Approval and certification cost • Monitoring and verification cost • Trading cost	• Second data from literature review to estimate monetary value of TC in percentage	• TC is highly specific to policy tools and technology project. • The source and scale of TC vary with technology size and performance, regulatory policy framework, quantification techniques • A common method is needed
2012	Qian	Building energy efficiency	A	• Economic Uncertainty • Market Uncertainty • Policy Uncertainty	N/A	N/A	• Government policies are needed to provide a positive investment environment and improve stakeholders expectations and confidence.
2011	Mundaca et al.	Low-carbon technology and policy	A & B	• Planning process • Implementation process • Monitoring and verification process	Cost of searching for information; negotiation cost; approval and certification cost; monitoring and verification cost; trading cost		• TCs are highly project- and context-specific • Scale and burden of TCs relevant to low-carbon technology are likely to differ due to the internal, external and intrinsic determinants.
2005	Michaelowa and Jotzo	Clean Development Mechanism	B	NA	Searching cost; Negotiation costs; Project documentation cost; Approval cost; Validation cost; Registration cost; Monitoring cost; Verification cost; Certification cost; Enforcement cost; Transfer cost; Registry cost	• Interview • Project reports • Online brokerages	• TC accounts for a large proportion of the total cost in CDM projects. • TC tends to increase with implementation costs. • There is trade-off between cost efficiency and development benefits in terms of CDM implementation.

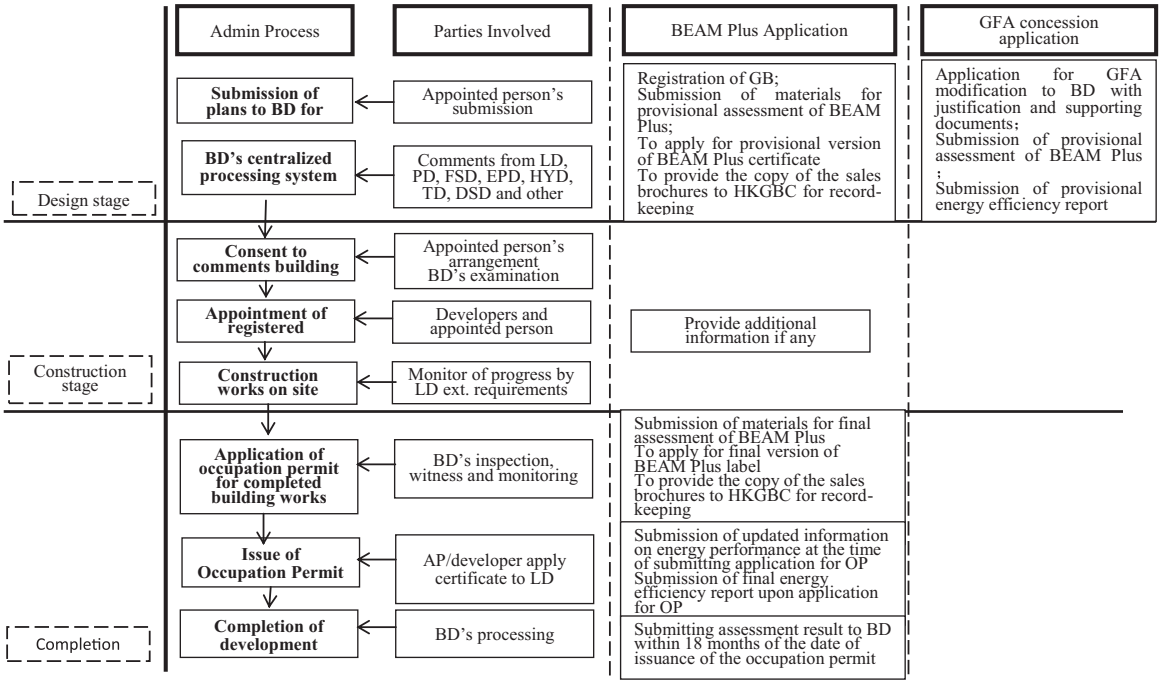

Fig. 2. The procedure for processing applications of GFA concession and BEAM Plus. *Note: BD-Buildings Department; PD-Planning Department; FSD-Fire Services Department; EPD-Environmental Protection Department; HYD: Highways Department; TD: Transport Department; DSD: Drainage Services Department BO: Building Ordinances; OP: Occupation Permit; LD: Land Department. (Source: constructed by author).

3.1. Conceptual framework

3.1.1. Asset specificity

Asset specificity has four types, including site specificity, physical asset specificity, human asset specificity, and dedicated assets (Coggan et al., 2010). Table 2 shows the definition of these four types. To be more specific, site specificity, human asset specificity, and physical asset specificity exist for the environmental goods, in that their transaction value largely relies on the inputs (physical asset specificity) and the site (site specificity), and the transactions need investment in specific knowledge (human asset specificity).

In TC theory, asset specificity, refers to durable investments that are undertaken in support of particular transactions. These specific investments represent sunk costs that have a much lower value outside of these particular transactions (Williamson, 1985), e.g. learning costs, incremental costs, and administration costs. In the context of the GFA Concession Scheme, it refers to the specific investments due to the application and specific set-ups for the GFA concession projects. According to Coggan et al. (2010), there are three types of asset specificity in the GFA Concession Scheme: site specificity, human (knowledge) asset specificity, and physical asset specificity. *Site specificity* refers to the GB design according to the specific site. According to the GFA Concession Scheme, the particular size, shape and surroundings, etc., of each site may restrict building design and construction differently. In order to adapt to the new rules, the traditional design pattern may be changed, which causes the extra research cost (usually borne by architects). *Human (knowledge) asset specificity* is understood as the specific knowledge and information required by the GFA Concession Scheme. The applicants of the GFA Concession Scheme have to learn the SBDGs, BEAM Plus and collect relevant information that induces learning cost and information searching cost. *Physical asset specificity* refers to the non-standard contract due to the application of the GFA Concession Scheme that the stakeholders need to develop, do research and negotiate during the GB development process, in order to clarify the responsibility, which induces the TCs.

3.1.2. Uncertainty

Williamson (1985) extracted an uncertainties typology, and Mettepenningen and Huylenbroeck (2009) further explained them in the context of an agri-environmental scheme. The primary type is the uncertainty due to the future state of nature. It means that the environmental outcome of certain transactions can have high uncertainty in the natural and physical environment. Lack of communications between contracting partners can result in the secondary uncertainty. This type of uncertainty is understood as the uncertainty resulting from implementing a poorly-specified contract. The third type of uncertainty refers to behavioural uncertainty attributed to opportunism. In the context of an environmental scheme, it concerns the trust between contracting partners.

In the context of a GFA Concession Scheme, uncertainty includes technological uncertainty; institutional uncertainty; and behavioural uncertainty. Technological uncertainty, exists mainly in the process of implementing BEAM Plus, due to the uncertain performance of green equipment. For example, in order to achieve the credits from energy

Table 2
Definitions and measurements of three dimensions of TCs. (Source: adapted from Williamson (1985)).

TCs determinants		Definition
Asset specificity	Site specificity	Site specificity will arise when specific investments have to be located on a particular site.
	Human asset specificity	The specialized skills, knowledge and learning-by-doing cannot be transferred to alternative transactions
	Physical asset specificity	The specialized instruments and equipment used in a particular transaction
	Dedicated asset	A discrete investment in generalized production for capacity to selling a number of products to particular buyers, such as expanding the existing plant for a specific customer

and water saving, it is necessary to provide evidence of energy efficiency rating, which generates verification costs. Institutional uncertainty arises due to the poorly-specified official documents, ambiguous contracts or other government documents, etc. For example, BEAM Plus does not specify how to achieve the credits in the handbook, leading to extra communications between practitioners. Behavioural uncertainty, due to opportunism, also causes more inefficiency in communication due to the mistrust or lack of common understanding in the new partnership between the GB consultant and architects, GB consultants and contractors, and/or contractors and new suppliers, etc.

3.1.3. Frequency

Frequency, refers to the frequency of transactions, that affects the TCs by recovering the costs of specialized governance structures (Williamson, 1985). TCs due to less effort on learning and collecting information can be cut down by repetitive transactions (Coggan et al., 2010; Mettepenningen and Huylenbroeck, 2009). However, TCs can be reduced only if the past experience is transferable to new experience (Coggan et al., 2015). Hence, TCs are essentially to be trimmed down due to the transferable past experience, such as transferable information, knowledge, skills and so forth. Incentive scheme design is required to contain more transferable knowledge or skills in order to reduce TCs. Therefore, transferability is employed to measure to what extent the TCs in the GFA Concession Scheme can be reduced.

4. Expert interviews

Usually, surveys or interviews are the only way to acquire estimations of implicit costs, which allows researchers to collect information on the types of costs (McCann, Laura et al., 2005). Since the GFA Concession Scheme requires much specific knowledge and experience, the conducting of in-depth interviews can yield more insightful and convincing views than doing a massive survey of people with little experience and knowledge of the scheme.

Interviews were conducted with 20 experts and practitioners from real-estate development firms, construction firms, and consultancy firms (including architects, building service engineers, and surveyors). Invitation letters for voluntary participation in our interviews were sent out to all members of the Professional Green Building Council, which is constituted by the Hong Kong Institute of Architects (HKIA), the Hong Kong Institution of Engineers (HKIE), the Hong Kong Institute of Planners (HKIP), the Hong Kong Institute of Landscape Architects (HKILA), and the Hong Kong Institute of Surveyors (HKIS). Individual members of the professional institutes interested in the interviews responded directly to our research team to line up (interviewees' profiles are shown in Table 3). All of the interviewees are professional members who have abundant experience in GB development and are familiar with the BEAM Plus and SBDGs. All are at the management level and have a good overview of the costs and benefits as they have been actively participating in the GFA Concession Scheme in practice.

Interviewees are grouped according to their roles in the real-estate development process. For example, if an architect works in a consultancy firm, his/her role is as a consultant to design buildings. If an architect works in a development firm, his/her role is as a developer (representative) to manage the building process and apply for government approval. The interviewees were asked to provide information on how much time each extra task was demanded as a result of applying to the GFA Concession Scheme. Each task was rated on a 5-point scale, ranging from "No time = 1" to "Considerable amount of time = 5". The interviewees were further asked to estimate the time, in percentage terms, that was consumed by each task of the individual stakeholder.

4.1. TCs analytical framework for GFA Concession Scheme

In the literature review on TC typology, TCs relevant to implementing environmental policies include searching cost, approval cost, validation cost, negotiation cost, certification cost, monitoring costs, verification cost, transfer cost, enforcement cost, and contracting cost (Coggan et al., 2013; Dudek and Wiener, 1996; McCann et al., 2005; Ofei-Mensah and Bennett, 2013). The GFA Concession Scheme is an environmental policy. Expert interviews would verify the TCs of implementing the GFA Concession Scheme on the basis of the above TCs.

A list of TCs borne by different stakeholders due to GFA Concession Scheme application was prepared, and this has been consolidated according to the TCs determinants and validated by the 20 interviewees, shown in Table 4.

5. Findings

Table 5 illustrates how much time each extra task demands from the stakeholders in the GFA Concession Scheme application. Table 5 reveals the TCs borne by each stakeholder in detail. It explains (1) how different types of TCs affect each stakeholder differently (the column of specific tasks under each TCs determinant); (2) which task(s) take(s) them more time comparing the others (the column of ranking); and (3) who spend more time on each specific tasks (the first three columns from the left).

The finding shows that, the commonly agreed top 3 tasks that consume the most time of the stakeholders, are: - 1) Extra work to verify or revise the documents due to unclear and incomplete instructions of BEAM Plus or SBDGs; 2) Extra coordination between participants to fulfil the contract; and 3) On site monitoring and reporting the execution of the contract or instructions. These tasks are highly relevant to the negotiation cost, approval cost and monitoring cost. In particular, consultants spend much more time, therefore bear more TCs, on these three tasks than developers and contractors. The 3 tasks that cost stakeholders the least time, are 1) Carefully selecting partners who are capable of doing green projects; 2) Learning SBDGs, BEAM Plus, and building features granted GFA concession; 3) Searching information to fulfil the BEAM Plus and SBDGs, which are closely related to the information searching cost and research/learning cost. The data also show that for most of the transactions, the consultants spend over 50% of their time, more than developers and contractors.

6. Discussion

Based on the findings in Table 5, this section discusses what affects the efficiency of the GFA Concession Scheme and whether the costs and benefits allocation is fair to all stakeholders. Based on the discussion, the following recommendations for improvement of incentive design are made.

6.1. Transferable knowledge and experience reducing searching and learning costs

Frequency influences the transferable experience (information and knowledge gained in previous transactions) by reducing the time and effort spent on collecting information and learning knowledge from the repeated transactions that therefore reduces TCs. For example, the time and effort spent on searching for green materials could be evidently reduced with frequent practice in using the GFA Concession Scheme. On contrast, the time and effort on the design scheme has less potential to reduce TCs, due to the site and project specificity. Therefore, transferability can be employed to measure the potential of reducing TCs of the GFA Concession Scheme. This indicates the eventual efficiency of the GFA Concession Scheme implementation when the market becomes mature.

The empirical findings show that the learning/research cost and information searching cost concern stakeholders less than other TCs. The accumulated knowledge and experience from the previous projects are applicable to the new projects. The more frequent one participates

Table 3
Interviewees' profile.

Profession	Their Qualification and Position
10 nos Architect	Authorized person; More than 20 years working experience; Director of Architectural firm
	Registered architects; Chairman of architectural firm
	Authorized person; The Hong Kong Institute of Architects Fellow Member
	Senior architect; Working in leading architecture firm for 5 years in Hong Kong; All the projects the architect has joined are GBs.
	Manager, working in leading architecture firm that all the projects it did are GBs.
	Registered architects; Member of The Hong Kong Institute of Architects; Working in leading architectural firm
	Registered architects; Director of sustainable design in leading architectural firm
	Director of sustainable design in leading architectural firm; Over 20 years working experience
	Senior associate architect; member of Hong Kong Green Building Council; Member of The Hong Kong Institute of Architects
	CEO in one of leading real estate development firms in Hong Kong
4 Nos. Building service engineer	Manager in one of leading real estate development firms in Hong Kong; BEAM Professional (Pro)
	Director in one of leading real estate development firms in Hong Kong; BEAM Pro; Authorized Person; over 25 years development experience
	Manager, BEAM Pro, working in leading contractor company in Hong Kong
	Manager, BEAM Pro, working in leading contractor company in Hong Kong
6 Nos. Surveyor	GB professional, environmental officer working in leading construction firm. Familiar with LEED and BEAM Plus.
	Authorized person; Project director of consultancy firm
	Director of consultancy firm
	BEAM Pro, working in leading contractor company in Hong Kong
	Government officer, building surveying specialist; Over 30 years working experience
	Project manager in one of leading real estate development firms in Hong Kong; BEAM Pro; Authorized Person

in the GFA Concession Scheme, the more familiar one becomes with the relevant knowledge and information. Interviewees mentioned that after 5 years of implementing the GFA Concession Scheme, the industry knows the GB requirements and application information much better. The Buildings Department (Fig. 3) shows that as experience was gained over the period from 2011 to 2014, more projects were granted with GFA concession and fewer were disapproved. After several years' practice, the industry has learned better about this scheme and has accepted it widely. In 2014, the number of projects applying for GFA concession had reached to 50% of total development proposals, which indicated the GFA Concession Scheme has been accepted by the private sector.

6.2. Unfair distribution of costs and benefits

Policy design often ignores TCs incurred in the implementation process. Table 5 clearly illustrates the TCs distribution to each group of stakeholders. All the stakeholders bear a certain amount of extra TCs. Given that the current GFA Concession Scheme is designed to reward developers only, with the maximum of 10% GFA added to the project, the incentive scheme seems not fair to other stakeholders, especially consultants, who absorb more TCs than developers or contractors (Table 5). An interesting example, by contrast, is the GFA Concession Scheme in Singapore, which particularly set aside funding to reward consultants for their contribution on GB design and construction (Building and Construction Authority, 2005a, 2005b).

6.3. Negotiation and approval costs in the approval process

(1) The approval process of the BEAM Plus and GFA concession involves many uncertainties.
After the submission of BEAM Plus application, HKGBC would normally review the documents and provide feedback. In case the architects do not accept the decision from HKGBC, they would negotiate with HKGBC for several times to finally reach an agreement and resubmit the application. This process gives rise to lots of uncertainty and induces TCs. Interviewees mentioned that some developers hesitate to go for GFA concessions because the approval process would take them too much time and lead to the project delay. Instead, they prefer to construct traditional buildings to save construction cost and time (extra financing cost) as illustrated in Fig. 4.
(2) Qualitative assessment nature of BEAM Plus cause the subjective assessment result by different assessors

All the interviewees agreed that the assessment nature of the BEAM Plus is rather qualitative and the assessment results mainly depend on the individual assessors' preferences, which cause a lot of uncertainty in negotiation and approval time. Ng et al. (2013) stated that BEAM Plus (HK) is the most qualitative one among the popular GB assessment systems, including LEED (the US), Green Mark (Singapore), Green Star (Australia), CASBEE (Japan), and BREEAM (the UK). Interviewees who have been engaged in the BEAM Plus projects and LEED projects claimed that LEED is more standardized and much clearer in guidance than BEAM Plus. It is possible to follow the instruction of LEED and finish the project alone; however for BEAM Plus, they need to hire the consultants to acquire more information and do more coordinating communication work.

6.3.1. Incomplete SBDGs

(1) Specified contract will arouse uncertainties and further induce TCs. There are many uncertainties in the approval process due to incompleteness of the GFA Concession Scheme, particularly due to the ambiguity of BEAM Plus and lack of specifications in SBDGs. In Table 5, the extra work to verify or revise the application due to the unclear and incomplete instructions of BEAM Plus or SBDGs is what concerns the stakeholders most.
(2) There is a lack of detailed description in the SBDGs to explain the measurement method and standards.
There are too many described building features that can result in some floor area being exempted, which causes the measurement of floor area to be controversial and rather a 'work of art'. The applicants, i.e. Developers, of GFA concession usually have to negotiate with the Buildings Department to strive for more GFA concession, because even a little measurement difference would result in the loss of a large amount of profits in a building project due to the high property price.
(3) The baseline model in the SBDGs is more suitable for the residential buildings.

For the commercial building, such as shopping mall and hotel which normally required a large floor plate, it is unreasonable to separate the building to provide urban ventilation gap if the building length exceeds 60 m as required by the Guidelines. In such a situation, if developers would like to apply for the GFA concession, architects have to do much

Table 4
Analytical framework of TC in the GFA Concession Scheme. (Source: Interview).

Transactions' determinants	Sub-determinants regarding the GFA Concession Scheme	Specific transactions under each determinant	TCs generated by GFA Concession scheme implementation						Borne by Stakeholders		
			I	II	III	IV	V	VI	D	Cons	Cont
Asset Specificity	Specific knowledge	Learning the SBDGs, BEAM Plus, and building features granted GFA concession		✓					✓	✓	✓
	Specific information	Searching information to fulfil BEAM Plus and the SBDGs	✓						✓	✓	✓
	Specific contract	Developing contract documents, detailing the green specifications and elaborating contracting practice		✓					✓	✓	✓
		Extra coordination between participants to fulfil the contract;			✓				✓	✓	✓
		On site monitoring and reporting the execution of the contract or instructions					✓		✓	✓	✓
	Design for specific site	Compliance with different design requirements for specific land use, site shape and location		✓					✓	✓	✓
		Communicating with clients/consultants about site plan and building layout			✓				✓	✓	–
		Preparing or verifying documents for GFA concession approval and to demonstrate compliance with BEAM Plus						✓	✓	✓	✓
		Revision of building plan required by the Buildings Department or HKGBC if any				✓			✓	✓	–
Uncertainty	Behavioural uncertainty	More coordination between practitioners to avoid misinterpretation and get used to working pattern, such as coordination among architects, GB consultant, contractors and suppliers			✓				✓	✓	✓
		Carefully selecting partners who are capable of doing green projects	✓						✓	✓	✓
		Client's flexibility and ability to make decisions cause more negotiations, such as negotiating the amount of GFA concessions/designed green features, and the cost/time constrains			✓				✓	✓	✓
	Technology uncertainty	Extra testing of green equipment compliance with the BEAM Plus standards						✓	✓	✓	✓
	Institutional uncertainty	More coordination/negotiation between participants to clarify the requirements/standards			✓				✓	✓	✓
		Extra work to verify or revise the documents due to unclear and incomplete instructions of BEAM Plus or SBDGs				✓			✓	✓	✓

*Note: I: Information searching cost; II: Research/learning cost; III: Coordination/Negotiation cost; IV: Approval cost; V: Monitoring cost; VI: Verification cost; D: developers; Cons: consultants; Cont: contractors

Table 5
Interview results.

Transaction cost	Specific transactions under each determinant	Weighted Average	Ranking	Developers	Consultants	Constractors
I	Searching information to fulfil BEAM Plus and the SBDGs	2.87	12	30%	50%	20%
	Carefully selecting partners who are capable of doing green projects	2.47	14	80%	10%	10%
II	Learning the SBDGs, BEAM Plus, and building features granted GFA concession	2.73	13	30%	60%	10%
	Developing contract documents, detailing the green specifications and elaborating contracting practice	2.93	11	20%	70%	10%
	Compliance with different design requirements for specific land use, site shape and location	3.2	9	20%	70%	10%
III	**Extra coordination between participants to fulfil the contract**	**3.67**	**2**	**20%**	**60%**	**20%**
	Communicating with clients/consultants about site plan and building layout	3.33	6	30%	70%	–
	More coordination between practitioners to avoid misinterpretation and get used to working pattern, such as coordination among architects, GB consultant, contractors and suppliers	3.47	4	30%	50%	20%
	Client's flexibility and ability to make decisions cause more negotiations, such as negotiating the amount of GFA concessions/designed green features, and the cost/time constrains	3.33	6	40%	50%	10%
IV	Revision of building plan required by Buildings Department or HKGBC if any	3.4	5	30%	70%	–
	Extra work to verify or revise the documents due to unclear and incomplete instructions of BEAM Plus or SBDGs	**3.8**	**1**	**30%**	**60%**	**10%**
V	**On site monitoring and reporting the execution of the contract or instructions**	**3.53**	**3**	**10%**	**40%**	**50%**
VI	Preparing or verifying documents for GFA concession approval and to demonstrate compliance with BEAM Plus	3.2	9	20%	70%	10%
	Extra testing of green equipment compliance with the BEAM Plus standards	3.27	8	20%	40%	40%

*Note: I: Information searching cost; II: Research/learning cost; III: Coordination/Negotiation cost; IV: Approval cost; V: Monitoring cost; VI: Verification cost.

more modeling and prepare for extra documents to prove the environmental benefits in order to convince the Buildings Department for approval.

7. Conclusions and policy implications

The GFA Concession Scheme as a planning instrument is becoming more popular and has been implemented in many countries and regions. In theory, developers in Hong Kong ought to embrace the GFA concession due to the high profits from extra GFA, in particular with the high land price. However, less than 40% of developers chose to apply for GFA concession in the last 5 years. Besides, the efficiency level of BEAM Plus can be more reinforced by the GFA Concession Scheme, but this has not yet happened. Consequently, high TCs are shown to have affected the policy effectiveness. This study identified the TCs types and explained how each type of TCs affects policy effectiveness and who bears those costs. As TCs are context-specific, this study has developed a common approach to apply TC theory to policy analysis.

This study contributes to the theoretical discussion on TC analysis with its empirical application to the GFA Concession Scheme, a case study in Hong Kong. The policy recommendations for Hong Kong include:

1) Apart from developers, other participants of GFA Concession Scheme, such as architects and engineers, also bear TCs. However, only developers can receive direct benefit from the GFA Concession Scheme. This study suggests the GFA Concession Scheme should be reviewed, to more fairly allocate the benefits. For example, government can reward architects or engineers for their efforts on the BEAM Plus certification. With such reward, they would have more motivation to actively conduct extra work to facilitate GB development;
2) The approval process of the BEAM Plus and GFA concession involves many uncertainties. Government should review the current approval process, BEAM Plus and SBDGs to make them clear, more complete and certain. For example, SBDGs has few descriptions on commercial buildings. It is better to improve SBDGs to make them more applicable to commercial buildings, and perhaps by issuing several versions of SBDGs for different types of buildings.

It should be emphasised that there are other key points learned from this case study that can be turned into recommendations for future improvement of incentive schemes, even in other countries. First, the additional knowledge, information and project experience of implementing GB incentives should be transferable/shared so that the costs of learning/research and information searching can be reduced with the increasing frequency of practice. For example, in Hong Kong, after several years of practice, clients find it easier to select suppliers and find green materials. Secondly, policy design needs to take TCs into consideration to more fairly distribute benefits and allocate the costs amongst the involved stakeholders. The current unfair allocation of the costs and benefits may cause reluctance amongst some stakeholders due to the ones who absorb too many hidden TCs, but most the benefits may go to one particular stakeholder. Thirdly, policy-makers can reduce uncertainties of project approval by making the assessment criteria more specific, easy to comply with and/or complete with quantifiable criteria, so as to reduce approval cost and negotiation cost. Some standard modeling/assessment methods or practice can be shared with the whole building industry. Lastly, GFA Concession Scheme implementation requires specific investment from both the private sector and government. The uncertainties involved in the scheme implementation and application process increase the TCs. A well-intended policy design such as GFA scheme as currently operated may often ignore the uncertainties created for the market stakeholders, therefore cause their reluctance in participation due to the extra time and costs (TCs) induced.

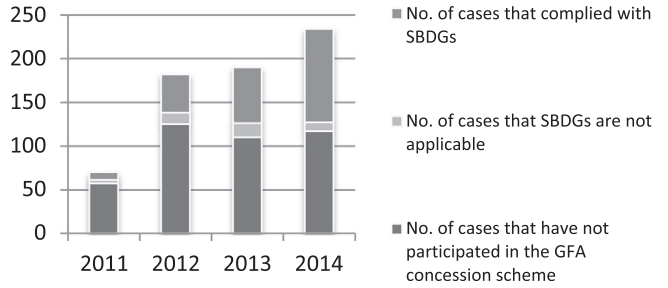

Fig. 3. Statistics on development proposal from 2011 to 2014 (Buildings Department, 2014).

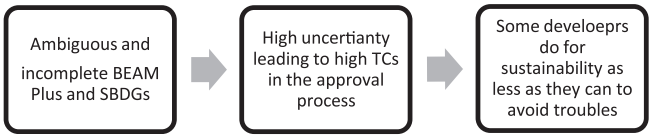

Fig. 4. How the guidelines induce TCs and affect stakeholders' decision-making.

The accumulated experience and knowledge through the self-learning from the practice may help reduce uncertainties, but in a rather slow process. For the construction industry in Hong Kong, any delay of the project due to the application of GFA Concession Scheme, may lead to a large amount of extra costs and financial risks. TC analysis of this study alike provides an efficient avenue to identify the time-consuming transactions, and policy remedies accordingly, to save stakeholders' time/uncertainties. This study focuses on improving the efficiency of GB incentives through analyzing TCs borne by private sector stakeholders. Although government costs should be part of the equation as well, we have not included these in this study, due to its limited scope and resources available. However, such facts should be acknowledged, and it will be an interesting extra perspective to be included in future studies.

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