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Transaction Costs (TCs) in Building Regulations and Control for Green Buildings: Case Study of Hong Kong

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Abstract

About 40% of global energy consumption and nearly one-third of global CO2 emissions are on account of buildings. In Hong Kong, buildings consume up to 90% of electricity during construction and operation, where all the design and construction of private developments is subject to control under the Buildings Ordinance. The way building regulations are applied and the arrangement of supporting systems can affect the effectiveness of building energy consumptions and the corresponding costs induced. Among all the incentives and regulatory instruments, Gross Floor Area (GFA) concession becomes a popular scheme to promote green building (GB), which grant bonus GFA to the developers who comply with the Sustainable Building Design Guidelines (SBDGs) and achieving at least the minimum level of BEAM Plus certification. Transaction costs (TCs) have been debated over the past decades that affect the effectiveness of the policy implementation. This study applies the lens of transaction costs theory to explore the TCs inventories of implementing GFA concession practice in Hong Kong. This paper aims to analyze how the GFA Concession Scheme induces TCs among various stakeholders in practice, and how in turn it affects the effectiveness of building control for GB. Interviews are conducted to identify the TCs determinants regarding the GFA Concession Scheme. Examples are provided from the real practice to illustrate the nature of TCs. Policy implications to reduce TCs are proposed accordingly.

Keywords: Transaction costs (TCs), building regulations and control, Hong Kong, Gross Floor Area (GFA) concession scheme, green building (GB)

1. Introduction

Building energy consumption accounts for over 40% of global energy use, contributing to one-third of global greenhouse gas emissions (UNEP, 2009). In Hong Kong, buildings consume almost half of all energy and about 90% of electricity (Environmental Bureau, 2008). Apart from energy consumption, building sector influences environment in ways, such as solid waster generation, resource depletion, and environmental damage. Therefore, green building (GB) as a solution of environmental issues gains its popularity and governments' support. Various building standards and design guidelines have been released to regulate the design and construction of GB, such as Building Environmental Assessment Method (BEAM) Plus, and Leadership in Energy and Environmental Design (LEED).

The Gross Floor Area (GFA) Concession Scheme earns its popularity amongst all the incentive and regulatory instruments. The GFA Concession Scheme is developed from the notion of "make developers pay" (Tang and Tang, 1999). Government grants the developers extra GFA bonus in exchange for their contributions to the public amenities so that government can save the public investments (Tang and Tang, 1999). In Hong Kong, it is designed to facilitate the adoption of BEAM Plus and Sustainable Building Design Guidelines (SBDGs). As Hong Kong has restricted land provision each year, extra GFA is very much attractive to developers (Qian, 2010; Fan et al, 2015). After implementing the first GFA Concession Scheme in 2011, the registered GB increased around 30% within one year (Liu and Lau, 2013). In the following years, the registered GB kept increasing, but the percentage of GB is still very small. From 2011 to 2013, only around 30% of total real estate projects participated in the GFA Concession Scheme (Building Department, 2014). It is claimed that transaction costs (TCs) affect the effectiveness of the policy implementation (McCann et al, 2005, Qian, 2012), and hinder developers entering energy efficiency market (Qian, 2012; Qian et al, 2013; Qian et al, 2015a; Qian 2015b,). Therefore, analyzing the TCs amongst the stakeholders induced by the GFA Concession Scheme are essential to understand the low participation rate and ultimately reduce TCs.

This paper aims to analyze how the GFA Concession Scheme induces TCs and therefore affects various stakeholders in practice, and the effectiveness of building control for GB. The section 2 presents the applications of TC theory to the environmental programs that form a foundation for the analysis. The details of GFA Concession Scheme are described in the section 3. The section 4 explains how the three determinants influence the TCs of implementing GFA Concession Scheme. Discussion and conclusion were presented in the section 5.

2. Transaction costs (TCs) in the context of environmental issues

Transaction cost (TCs) has been defined by a lot of researchers (Coase, 1937; Arrow, 1969; Williamson, 1985;). In the area of environmental policy, TCs is defined as the cost to create and use a policy (Coggan et al, 2013; Garrick et al, 2013). When it comes to implementing an environmental regulation from the private sectors' perspective, TCs refers to the cost to comply with the regulation (Wong et al, 2011). When analyzing the technology change in building sector, TCs is understood as the cost of technology

arrangement and implementation occurring ex-ante and the cost of monitoring and enforcement occurring ex-post (Qian 2012, Qian et al, 2013, Kiss, 2016). In this paper, TCs is defined as the extra costs to fulfil the requirement of building regulation and control.

The existing literature has studied TC typologies, which are slightly different, associated with implementing the environmental policy and energy efficiency project. For energy efficiency project, TCs include information searching cost, negotiation cost, monitoring and verification cost, trading cost, and decision making cost (Qian, 2012, Mundaca et al, 2013). In the respect of implementing environmental policy, TCs consist of searching cost, negotiation cost, approval cost, validation cost, monitoring costs, verification cost, certification cost, enforcement cost, transfer cost, and contracting cost (Dudek and Wiener, 1996; Ofei-Mensah and Bennett, 2004; McCann et al, 2005; Qian, 2012; Coggan et al, 2013; Qian et al, 2016). Some of these costs are overlapping and it is difficult to divide them clearly. Even if a lot of literature has studied TC types, only a few of them have identified stakeholders who bear the TCs accordingly (see e.g. McCann et al, 2005; Coggan et al, 2013;).

2.1 Determinates of Transaction Costs

2.1.1 Asset specificity

Williamson (1985) stated that there are three dimensions, namely asset specificity, frequency and uncertainty, influence TCs. To be more specific, there are four types of asset specificity, including site specificity, human asset specificity, physical asset specificity and dedicated assets. Table 1 illustrates the definition of four kinds of asset.

Table 1: Definition and measurement of three dimensions of TCs (Source: adapted from Williamson, 1985)

TC determinants		*Definition*
Asset specificity	*Site specificity*	*Site specificity will arise when specific investments have to be located in 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 capacity to selling number of products to particular buyers, such as expanding the existing plant for a specific customer*

Specifically, site specificity, physical asset specificity and human asset specificity exist for the environmental goods for the reasons that the transaction value of an environmental good largely depends on the site (site specificity) and inputs (physical asset specificity), and the transaction needs investment in specific knowledge (human asset specificity) (Coggan et al, 2010).

2.1.2 Uncertainty

Three types of uncertainties surrounding the transactions are extracted from Williamson (1985) and explained in the context of agri-environmental scheme by Mettepenningen and Van Huylenbroeck (2009). The uncertainty of future state of nature is primary, which means that the environmental outcome of certain transactions could have high uncertainty because of the uncertain physical and natural environment. The secondary uncertainty arises due to lack of communications between contracting partners. This type of uncertainty is understood as the uncertainties resulted from implementing poorly specified contract. The third type of uncertainty refers to behavioral uncertainty attributable to opportunism. In the context of environmental scheme, it concerns the trust between contracting partners.

2.1.3 Frequency

Frequency refers to the frequency of transactions, which influences TCs by recovering the costs of specialized governance structures (Williamson, 1985). TCs could be reduced by repeated transactions because of fewer efforts on information collection and learning (Mettepenningen and Van Huylenbroeck, 2009). However, it is important to notice that only if the past experience is transferable to new experience, TCs can be reduced (Coggan et al, 2015). Therefore, TCs are essentially reduced by the transferable past experience developed in the transactions, such as transferable knowledge, skills, information, etc. In this sense, an incentive scheme should contain more transferable knowledge or skills to reduce TCs.

3. GFA Concession Scheme to control building design and construction

Since 2011, Hong Kong has implemented Gross Floor Area (GFA) Concession Scheme to promote GB development and address climate change, which grants GB developers additional GFA (up to 10%) to reward their contributions on the built environment. This scheme is voluntary basis, but regulates the GB design and construction by the twelve green and innovative features, Sustainable Building Design Guidelines (SBDGs) and Building Environmental Assessment Method (BEAM) Plus that are tailored for the Hong Kong built environment. Developers who would like to acquire extra GFA have to comply with SBDGs and BEAM Plus and the certain green or innovative building. In this way, environmental protection could be guaranteed, especially building energy efficiency addressing climate change.

The SBDGs have three basic elements for GB design, namely building separation, building setback and site coverage of greenery, which contributes to better air ventilation, enhancing the environmental quality of living space, and providing more greenery and mitigating the heat island effect. Specifically, for different sizes of sites, building height, building length, and assessment zone, there are different design requirements for each of three elements. For example, in terms of building separation, in the site area less than 20,000 m^2 and with building length no less than 60m and building height no more than 60m, the permeability of buildings should not be less than 20%. The complicated requirements bring a lot of difficulties to the architects to make the design scheme, especially in the situation that no specific training is provided. According to the Environmental Report (Building Department, 2014), from 2011 to 2013, around 25% of total projects applying for GFA concession get disapproval due to failing to fulfil the SBDGs.

BEAM Plus has four ratings, namely Platinum, Gold, Silver, and Bronze. It is designed to control the process of building construction and operation in the aspects of building site, material, energy use, water use, and indoor environmental quality, which respectively have the total credits of 22, 22, 42, and 32 to achieve. Each credit has specific requirements illustrated in the BEAM Plus, but without implementation measures. However, Hong Kong Green Building Council (HKGBC) provides trainings particularly to help professionals integrate GB standards and practices, and advise project team on how to achieve the credits. Professionals who take the training of BEAM Plus and pass the exam can get the certification of BEAM Pro. Nevertheless, it is not mandatory to employ BEAM Pro to do GB project, but BEAM Pro's involvement can get the project one credit bonus.

There are five green features and seven amenity features that can be granted GFA concession, subject to 10% overall cap. The architects would integrate several of these features into the design scheme depending on the site context and building layout (Development Bureau, 2011). Apart from the twelve features, other features beneficial to community with practical need or environmental friendly (e.g. communal sky gardens, covered walkway with provision of greenery) and other items (e.g. car parks, sunshades and reflectors) could be granted GFA concession as well with no overall cap of GFA concession. Therefore, the architects should be familiar with the SBDGs, BEAM Plus and the above building features in order to implement the GFA concession well.

4. Determinates of TCs in the GFA Concession Scheme

4.1 Asset Specificity

Applying the TCs theory to the GFA Concession Scheme, asset specificity means the specific investments to do the GFA concession projects. To be more specific, four types of asset specificity exist in the GFA Concession Scheme. Site specificity refers to the GB design for the specific site. Each site has its particular size, shape and surroundings that restrict building design and construction by the GFA Concession Scheme. Therefore, the traditional design pattern may be changed to adapt to the new rules, which causes research cost borne by architects. Human (knowledge) asset specificity is understood as the specific knowledge and information required by the GFA Concession Scheme. For example, participants of the GFA Concession Scheme have to learn the SBDGs, BEAM Plus and collect relevant information that causes learning cost and information searching cost. Physical asset specificity refers to the investment in the specific contract between stakeholders. Stakeholders need to negotiate and clarify the responsibility of each participant, and do some research to develop the non-standard contract particularly suitable for the GFA concession project, which generates TCs in the process like negotiation cost and research cost.

4.2 Uncertainty

Adapting three types of uncertainty to the GFA Concession Scheme, they refer to the technology uncertainty arising from uncertain performance of green equipment, the institutional uncertainty due to ambiguous contracting or government documents and behavioural uncertainty because of opportunism and bounded rationality. Technological uncertainty exists in the process of implementing BEAM Plus. To achieve the credits of energy and water saving, the applicants have to provide evidence as to the energy

efficiency rating, which generate verification costs. Institutional uncertainty arises due to the poorly specified official documents. For example, BEAM Plus does not specify how to achieve the credits in the handbook, which leads to extra communications between practitioners. Behavioural uncertainty also brings more communications due to lack of trust and common understanding in the new partnership, such as partnership of GB consultant and architects, GB consultants and contractors, and contractors and new suppliers.

4.3 Frequency

Frequency in the GFA Concession Scheme means how frequently the experience, such as knowledge, information, and partnership, gained in the previous GFA concession project could be used in the later projects. In other words, it is the transferability of experience that influences TCs. Therefore, transferability is employed to measure to which extent the TCs in the GFA Concession Scheme could be reduced. For example, the communication costs could be saved if architects and contractors keep working with the same group of GB consultants as they have developed common language and working pattern.

5. TCs analytical framework

Starting with the TCs determinants in the GFA Concession Scheme, through literature review a preliminary list of TCs are identified, and mapped on the stakeholders who bear them (Table 2). 10 interviewees (Appendix 1), including architects, developers, contractors and BEAM consultants have been interviewed to verify the list in the Table. According to Table 2, information searching cost, research/learning cost, coordination/negotiation cost, approval cost, monitoring cost, and verification cost exist in the process of the GFA Concession Scheme implementation due to the specific knowledge, specific information, specific contract, design for specific site, behavioural uncertainty, institutional uncertainty, and technological uncertainty embedded in the GFA Concession Scheme design. All the stakeholders have borne the extra TCs. Specifically, professionals bear the TCs most frequently in the transactions, followed by contractors. Developers ranked 3nd, followed by suppliers. However, this frequency does not mean that professionals bear the highest TCs because each type of TCs may cost different in time and efforts. In Table 2, we will derive a set of specific transactions under each of the sub-determinants to conduct interviews with experts later to extract the more detailed TCs incurred.

As discussed before, frequency influences TCs by reducing the time and efforts spent on the information collection and learning in the repeated transactions, but only the transferable experience gained in previous transactions, can reduce TCs. Therefore, transferability should be employed to measure the potential of the GFA Concession Scheme to reduce TCs. It indicates how efficient the GFA Concession Scheme able to be implemented when the market progresses mature.

Table 2: Analytical framework of transaction costs in the GFA Concession Scheme (Source: Interview)

TCs determinants	***Sub-determinants regarding the GFA Concession Scheme***	***TCs caused by GFA Concession Scheme***						***Stakeholders:***
		Information searching cost	*Research/learning cost*	*Coordination/Negotiation cost*	*Approval cost*	*Monitoring cost*	*Verification cost*	
Asset Specificity	*Specific knowledge*		ü					*P, C, S*
	Specific information	ü						*P, D, C*
	Specific contract		ü	ü		ü		*P, D, C, S*
	Design for specific site		ü	ü			ü	*P, D*
Uncertainty	*Behavioural uncertainty*	ü		ü				*P, C, S, D*
	Technology						ü	*C*
	Institutional uncertainty			ü		ü		*P, C*

Note: P: Professionals, C: Contractors, S: Suppliers, D: Developers

6. Discussions and Conclusions

6.1 Other private sectors bearing extra TCs with no evident benefits except for developers

All the key stakeholders in private sectors have borne TCs due to the implementation of the GFA Concession Scheme (Table 2), but only developers can benefit directly from this scheme with bonus GFA. It in turn influences the effectiveness of the GFA Concession Scheme negatively. It seems that the developers have to use GFA concession to offset the extra TCs. If they pay other participants more for their extra efforts, developers will benefit less from the GFA Concession Scheme. In this situation, developers may not have interests in GB development because of its high opportunity cost. If nobody can obtain extra fee from developers in a competitive market, all the other stakeholders have to absorb the TCs by themselves. This may explain the slow growth of the GFA concession projects. If 10% GFA concession is the only benefit, TCs must be reduced to make the GFA Concession Scheme implemented more efficiently. It is obvious that at the time of designing the GFA Concession Scheme, TCs were ignored. It has affected the implementation efficiency of the GFA Concession Scheme and should be taken into considerations when design the benefits allocation of the GFA Concession Scheme.

6.2 TCs changed with the design of the policy instrument and highly specific to the policy

It is recognized that three dimensions, asset specificity, frequency and uncertainty, of the GFA Concession Scheme would induce TCs. This paper identified the sub-determinants regarding the GFA Concession Scheme. It illustrates that at the time of designing the building regulations and control, the transaction determinants have been generated. For example, the BEAM Plus is designed ambiguously, which leads to a lot of transaction uncertainties and induces TCs. Therefore, if the BEAM Plus is changed to be more precise, and participants only need to follow the certain standards, the TCs resulted from transaction uncertainties could be reduced. Mover, every policy instrument has its own sub-determinants under the three main transaction dimensions, which induce different types and the amount of TCs. Therefore, TCs are highly specific to the policy, as supported by Mundaca et al (2013). However, there are some common relationships between the regulation design and TCs involved: 1) the more criteria the regulations have, the more TCs induced; For example, before 2011, developers could also apply for the GFA concession as long as they provide the twelve building features according to the Joint Practice Note (JPN) 1 and JPN 2. While after 2011, they have to comply with the SBDGs and BEAM Plus that are prerequisite to be granted GFA concession. This induced a lot of TCs in the process (see Table 2). 2) The more stakeholders involved, the more TCs induced. For instance, to fulfil the BEAM Plus, GB consultants have to be involved that induces more coordination and negotiation costs. 3) The more precise and standard the regulations are, the less TCs borne by private sectors. As mentioned, BEAM Plus is ambiguous that participants have to spend more time reducing uncertainties.

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Appendix 1

Profession	*Qualification and Position*
Architect	*Authorized person; more than 20 years working experience; Director of Architectural firm*
Architect	*Registered architects; Chairman of architectural firm*
Architect	*Authorized person; Hong Kong Institute of Architects Fellow Member*
Architect	*Senior architect; Working in leading architecture firm for 5 years in Hong Kong; All the projects the architect has joined are green buildings.*
Architect	*Manager, working in leading architecture firm that all the projects it did are green buildings.*
Developer	*CEO in one of leading real estate development firms in Hong Kong*
Surveyor	*Green building professional, environmental officer working in leading construction firm. Familiar with LEED and BEAM Plus.*
Surveyor	*Authorized person; Project director of consultancy firm*
Surveyor	*Director of consultancy firm*
Professor	*Over 10 years working experience in project management and building control*