



A Potential Value of Noise Control in Construction Sites for Real Estate Developers

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ABSTRACT

Since construction work is an indispensable part of daily lives, complaints of noise are unavoidable. Noise control in construction sites is normally known as a regulation by a government and self-motivated noise controls rarely occur. In this paper, a marketing strategy is proposed to provide a potential value of noise control for real estate developer. First, people's perception to construction noise was examined in means of collecting and analyzing media reports between 2005 to 2011. Then decibel test was done in order to test noise generated by different devices in a construction site in various distances. According to the theory of core competency, a conceptual model was raised to illustrate profit and loss situation of the real estate developers in the case they invest more in noise control. The construction noise is discussed that it will ruin people's perception to the company's brand image and reputation. Also, the investment in the creation of silent site is discussed that it will not only bring benefit to the brand image work but also have value of profit in the market.

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KEYWORD

Construction site,
noise control,
brand image,
core competitiveness,
Hong Kong

ACCEPTANCE INFO

Received July 17, 2014
Final revision received July 29, 2014
Accepted August 4, 2014

1. Introduction

Among persistent physical contaminants in human environments, noise is a major one, especially in the developed countries or areas like Hong Kong. Hong Kong communities responded that noise pollution was placed at the third ranking of social concerns among the five major concerns of air pollution, security, traffic jam and cleanliness [1]. Noise nearly exists everywhere in the life of Hong Kong, around shopping malls, MTR (a subway system in Hong Kong), construction sites, schools, and residential areas. In particular, noise generated by construction activities is one of the main acoustic pollutions in residential areas.

However, continuous noise in construction site is inseparable from the prosperity of real estate market. At the real estate market's heyday in Hong Kong, the numbers of projects under construction is increasing. Since these projects create more and more construction noise, the number of people's complaints is increasing. Although the noise control is essential to maintain the quality of life in residential areas, a real estate developer hardly put extra costs more than regulations by a government. In this paper, a potential benefit to real estate developers is explored to promote a significance of noise control in a construction site. By a model of potential value, the trade-off situation in the market strategy is

proposed in this paper.

2. Background

2.1. Noise Control

Noise is unwanted sound [2]. Noise levels are measured on a decibel scale (dB), which matches the ears sensitivity to sound. Noise was generated due to rapid development of urbanization, urban construction, great or small construction development. In particular, construction noise is one of the most frequent complains in a urban area [3].

At the beginning, noise control in the construction site was investigated to standardize noise levels and control of construction noise [4]. Gill [4] tested the standard of regulation with statistics of noise index. Manatakis [5] stated that workshop machines generated noise and vibration that could be harmful in working environments and workers' physiological and psychological conditions. In this case, the other workers in the same working area were also disturbed and then the working efficiency became lower [5]. Fernández [6] explained that as a contaminant agent, the vicious of noise effect may not be noticed instantaneously. It would accumulate to the destruction of physical, mental and social health. Also, the noise in the construction site is big danger to the auditory health of the site workers and people around the site. Workers and people made complaints that they could not hear as well as they used to.

2.2. Policy of Hong Kong Government

The Environmental Protection Department in Hong Kong was established in 1986 and the Noise Control Ordinance (NCO), the Chapter 400 of the Laws of Hong Kong was enacted in 1988, which is the first comprehensive legislation in order to control the environment noise. With the administrative and statutory arrangements, the environmental noise is sought to minimize and resolve through various approaches including participation in the planning and policy making processes, establishment of measurement and enforcement by Noise Control Ordinance. Before the NCO was enacted, noise in construction sites was severe and harmed people such as continuous piling work. In 1989, the government established a new policy that each construction site can only run the pile driver for 3-5 hours per day.

Despite the effort and establishment of legislation, violation of the Noise Control Ordinance was reported that 47 companies were enforced five or more times from 1997 to 1999, which influenced around 100,000 people per year [7]. Because the violation bill of breaking the ordinance is lower than the late-completion cost, construction companies would rather flout the law than pay the liquidated damages.

2.3. Brand Image and Loyalty

Brand image is a mental picture of the production by customers [8]. When the specific attributes of the production are impressive, customers will associate them with the brand image together, as symbolic meaning [9]. Thus, brand image will influence the market sales [8]. Brand image is also a perception which consumers form, after the association with the brand reflection [10]. Thus, real estate developers should consider the important role of brand image. Making a brand image into those who are prospective buyers of their housing should be pivotal.

Additionally, the brand loyalty should be developed within the customers. When developing the brand loyalty, the brand trust is a critical factor [11]. Because developing the brand loyalty is articulated after continuous, repeated buying of a production or a service, the mouth advocacy is significant [12]. Thus, people's cognition and perception of brand affects the brand loyalty and may help survive the brand in the market competition.

2.4. Theory of Core Competency

The theory of core competency is a management concept how a company achieves its competitiveness in the market [13]. Three main elements are comprised in developing core competency of a company: It should be difficult for competitors to mimic; It can be widely adopted for various markets and products; It must enhance

the consumer's benefits of service or products [13]. If developer's strategy of improving the quality of living such as noise control is adopted, residents will appreciate the developers for their effort. The core competitiveness can be acknowledged. Thus, the developer's brand can achieve the brand loyalty.

3. Methodology

The research question is: what is a potential market benefit that the creating of silent construction site will bring to the real estate developers? Based on news in public media and decibel tests of noise at construction sites, core competency are argued. In particular, this paper focuses on Hong Kong's circumstances. News and reports in the Apple Daily, Sing Pao, Oriental Daily, the Sun are collected from 2005 to 2012. In total, 35 news illustrate people's perception about the construction noise.

Additionally, decibel test is conducted in the construction site of Tong Chou Mansion project in Sham Shui Po, Hong Kong with the acoustic testing device in a mobile phone system to measure the noise decibel of different working machines at different distances such as 15 and 20 meters. Because the decibel is a visual way to demonstrate the loudness of the noise in the construction site, the figures of the decibel result can make a clear comparison between the noise levels generated by different construction machines in site. This test examines people's perception to a construction site.

The theory of core competitiveness is a theoretical foundation of making a conceptual model because this concept of creating the core competitiveness can be comprehensive and acceptable to the developers regarding a noise control strategy. The noise control-oriented marketing strategy is argued so that the developer can identify market performance because the noise control strategy itself is a core competitiveness. Thus, the model of noise control marketing strategy can connect noise control to market value, as the key factor in promoting developers' commitments to enhanced noise control. The main objectives starts from developers' trade chain, to the investment of noise control and the building of brand image and brand loyalty that the noise control brings, and then to the analysis of the market growth. Although the market reaction of the model has not been tested yet, this model can be a suggestion to developer.

4. Perception of Noise

4.1. Construction Noise in Public Media

Although noise should be controlled under the regulations of the Environmental Protection Department, there are still complaints raised about noise. According to the Hong Kong local media, such

Table 1. News about noise control and residents' perception between 2001 and 2011

Time	News	Media
2011 Nov	Public house undertakes noise control measures to reduce complaints	WenWeiPo
2011 Oct	Residents in Hong Kong require noise control scheme in a city	Jinglilun
2011 Sep	Noise between 7:00am to 7:00pm is permitted	Singpao
2011 Jul	Noise complaints should be tackled within 3 days	Duhong
2011 Jun	12 hrs every night of forbidden noise	Ming Pao
2010 Jun	The noise of piling work disturbs the residents in Kun Tang	Oriental Daily
2011 Jun	Noise increases the rate of heart disease	Oriental Daily
2011 Apr	The court: the night construction of railway disturbs residents	Oriental Daily
2011 Apr	The construction site of Heritage Mall made too much noise	Apple Daily
2011 Feb	Residents get trouble to sleep due to noise of construction site	Oriental Daily
2010 Jul	Noise from TDD disturbs the residents in the area	Apple Daily
2010 Feb	Noise of MTR construction disturbs residents at night	Apple Daily
2009 Dec	House Agency convive developers in construction and noise	Oriental Daily
2009 Oct	Disturbed by noise that 6 years without a good sleep	Oriental Daily
2009 Jun	The noise of New Road West Kowloon will continue to 2030	Oriental Daily
2009 Feb	Developer refused to pay for compensation in Quan Wan	Singpao
2009 Feb	Residents complaints about the noise of Road of Lo Ma Chou	Singpao
2008 Oct	The overnight construction of wall makes residents complaint	Oriental Daily
2008 Sep	The noise generator should be punished in a serious way	Ming Pao
2008 Aug	EPD : 400th of Legislation; noise control ordinance	EPD
2008 Mar	Sino Group made a good example of noise control	Singpao
2007 Dec	EPD undertake the overall noise control	Singpao
2007 Jul	The noise of 9th railway disturbs residents	Apple Daily
2007 Jun	Residents appeal for more care about construction noise control	Apple Daily
2007 Feb	Construction site in West Kowloon, noisy all the time	Singpao
2006 Nov	NCO made special regulation for site noise control in Kun Tong	Ming Pao
2006 Jun	Developer and EPD never agreed with each other?	Singpao
2006 May	The noise of Caifeng Palace disturb the residents a lot	Apple Daily
2005 Nov	Residents complaints about the noise of Ma Tie	Ming Pao
2005 Sep	The regulation of low frequency noise will act in July	Apple Daily
2005 Aug	Students in Zhang Qi School complain about the noise	Apple Daily
2005 Jun	Residents parade outside the site in Shek Kep Mei against the noise	Oriental Daily
2005 May	EPD: enhance education of noise control	Oriental Daily
2005 Feb	Xin Yi Middle School in Yuan Lang, noise control around site	Oriental Daily
2005 Feb	EPD will monitor the noise of Disney Land construction site	Oriental Daily

as Apple Daily, Oriental Daily and Sing Pao, people's complaints to construction noise are common, and from 2003 to 2012 more than 1000 news were reported about their dissatisfaction to developers

about the construction noise. People were difficult to sleep, organized protest against noise from construction sites. Table 1 illustrates representative news in Hong Kong between 2005 to 2011, concerning about the construction noise control and the disturbed people's perceptions.

4.2. Construction Noise at Sites

The decibel acoustic test was conducted by an acoustic application in Android operating system. The application program can test the sound level in the neighborhood area. The test was conducted near a construction site in Sham Shui Po, Hong Kong. The testing time was afternoon, which was the busiest time in a day. Based on the test done in site, the acceptable level of noise is under 85dB. Typical noise-generating devices like pile driver, excavator, blender and tower crane are the testing subjects and the tests are conducted in different distance separately. However, the testing result might be higher than the actual sound level since the sound is the mixture sound of all the devices.

In Table 2, the pile driver generates 106-115 dB of noise in the construction site, which is the highest among the noise of different devices. Usually during the construction process of foundation, the noise created by pile driver consists 13%-50% of the noise although it depends on the total number of working machines and the type and manufacture of the pile driver. Trucks, tower cranes and excavators come after the pile driver, which are the second noise maker in the construction site. As a major material transportation method, trucks and tower cranes are normally on the working process. Bulldozers, paver rock brokers and concrete mix/pumpers are all necessary working devices throughout whole construction stages, which together consist about 20% to 29% of the noise. Thus, in order to effectively control noise in a construction site, developers should consider refining machines, adopting technology and employing specialties in noise control. The decibel test can be a reference for developers on the refining work. In this paper.

Table 2. Noise of Devices in Different Distance

Name of Devices	Noise(dB)		Name of Plants	Noise(dB)	
	From 15m	From 20m		From 15m	From 20m
Excavator	83-95	69-73	Tower Crane	86-88	75-76
Bulldozer	83-87	65-68	Mobile Crane	75-87	65-69
Charger	72-84	53-60	Air Compressor	75-87	63-67
Paver	87-89	76-77	Generator	71-82	57-62
Roller Press	72-74	54-57	Vibrating Compactor	87-89	69-76
Truck	90-94	79-80	Pile Driver	106-115	89-92
Concrete Mixer	81-88	75-78	Rock Borer	81-98	71-76
Concrete Pump	81-83	74-76	Electric Saw	73-82	62-65
Blender	69-72	63-54	The JZC	76-81	61-64

5. A Trade-Off Model for Developers

5.1. Theorizing a Conceptual Model

In this study, the customer value method [14, 15] was adopted and refined. The customer value was transformed into developer's trade-off. By focusing on the relationship between the noise control and the building of customer loyalty, a new market strategy is advocated in terms of the trade-off situation of developers in Figure 1, which is based on the theory of customer value method [14, 15].

Based on the findings of public media and on-site decibel test, a refined strategy is articulated adopting the theory of core competency. In Figure 1, this strategy uses P+, R, and M+ effects. P+ work is to make a symbol of the propaganda work of the silent site strategy. P stands for propaganda and + stands for the positive effect to enhance the brand image. R is used to illustrate a model that developers will adopt for a strategy of machine refining. M+ effect stands for positive market influence. The propaganda work is not a deviation from the original intention of the caring attitude of developers to the residents, but developers will not investment a new project without return, that is the reason of making the propaganda work.

H1a (with R effect or Refining work effect): This step is the key point in the whole model. The realization of the strategy starts with the investment to making a silent site. Greater returns would come in the following paths of H2a, H3a, H4a and H5a.

H2a (with P+ effect): This link is the relationship between making of silent site and brand image. It is suggested that making a silent construction site positively affect the brand image. When making a silent site plan, the developer can let layperons to identify the developer's efforts on the silent construction site through the propaganda. This process is in accordance with the analysis of public media, which is symbolized as P+ effect (propaganda work with positive effect).

H3a: This link is the relationship between making of silent site and company reputation. The whole path is the same to H2a.

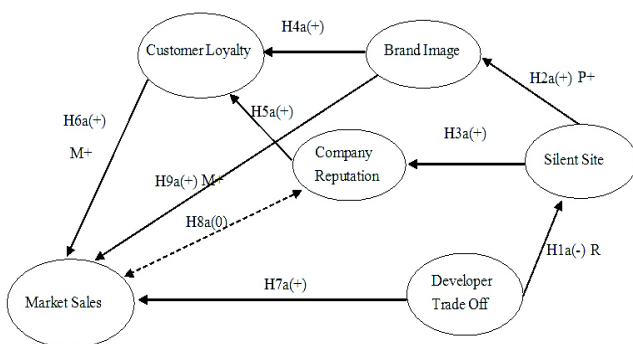


Fig 1. A Trade-Off Model

Although making a silent site might not directly influence the company reputation, the propaganda work of the construction developer's brand can help enhance the reputation.

H4a: The brand image positively enhances the customer loyalty. Once the brand image is successfully established in the market, the customer loyalty can be sustained. This relationship is a positive effect, plus sign in the model. If a company achieve good reputation in the market, it usually attract customers' trustworthy and credibility. The company with a poor reputation will definitely hurt its reputation of quality [16].

H5a: The company reputation positively influence the customer loyalty. As stated in the pass of H4a, the theory of Chen and Dubinsky [16] illustrates how the reputation of a company influence its market and brand. In particular, because in the real estate market the selling production is a long-term, non-consumable production, once the customer loyalty generated by brand image is established, it is uneasy to be changed. Thus, the customer loyalty is built at the same time and the link is positive.

H6a (with M+ effect): The link between customer loyalty and sales market is positive. In other words, the sales market will increase once the customer loyalty is established. It illustrates that the establishment of consumers loyalty leads to the increase of market sales. This path is related to the effect of core competency symbolized as M+ effect.

H7a: This link stands for the only standard which developers use to measure the success of the market strategy. In this model the length of the link can make clear illustration of the promotional effect of the market strategy. The extended link is a joint effect of making a silent cite, and establishing customer loyalty and brand image. This joint effect will help increase the market sales.

H8a and H9a: They are a direct impact of brand image and company reputation on the market sales. Real estate markets affect the market sales regarding their image of brand and company. Thus, H9a is positive and is expressed as active line in the model. H8a is a dotted line with a mutual effect expressed as zero. When projects are directly related to the developer company's name, the company reputation will affect the sales market. However the condition whether projects are directly related to the company's name depends on the characteristics of projects. The relationship is illustrated with a dotted line and zero. At the end, no matter that the company name is directly related to the project name, the brand image and company reputation eventually become positive on market sales.

5.2. Comparison to a Conventional Model

In Figure 2, a model of conventional strategy is made with simple paths to illustrate the trade-off situation of developers in

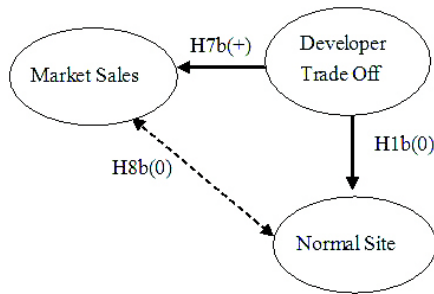


Fig 2. A Conventional Model

terms of a conventional value. This model illustrates the situation of the conventional value system, which is oriented for construction projects.

H1b: Regarding the conventional value of developers, the investment in noise control is uneconomic in the short term, but beneficial in the long run. Thus, H1b link shows neutral growth. However, the developers with conventional values hardly compete the developers with the new marketing strategy.

H7b: This link is the normal situation between the developer trade-off and the market sales. The market sale with the conventional strategy makes no increase and remains in the normal position, not as much as in the new strategy. Because H7b in the conventional trade-off situation loses positive effects like H4a, H5a and M+ effect, the market sales would not be as positive as the new strategy does.

H8b: A normal site of noise will hardly have positive influence on the market sales. H8b is a dotted line since it lost M+ effect, company reputation, customer loyalty and brand image in the market.

With comparison of the two key lines linking developers' trade-off and market sales, H7a and H7b, the investment to noise control is a smart choice, and will pay back in coming projects because of the brand loyalty.

6. Conclusion

In this study, the perception is one of the important elements that developers should consider when making the market strategy of the company. In terms of people's perception, news in Hong Kong's public media reported the complaints about the construction noise. By adopting a core competency, developers is suggested to adopt caring strategy and create a core competency by making a silent construction site. This strategy may help developers to receive laypersons' support for making a positive reputation. Additionally, according to the on-site noise test, some noise of devices obviously exceed certain levels of human tolerance. In terms of the marketing strategy, developers can refer to this finding to decide which

machine should be replaced or refined.

A trade-off model is articulated adopting the marketing strategy including developer's trade off, silent site, brand image, company reputation, customer loyalty and market sales. The positive propaganda effect was adopted in the model to illustrate the effect of propaganda work. As the decibel test illustrated the noise levels, the refining work of device and machines should be considered. According to the theory of core competency, the positive market influence was adopted to integrate the core competency into the developer's trade off.

This paper demonstrates two significant contributions. First, the connection between the human perception and the noise control of the construction site is explained. Construction noise is a significant element to negatively affect the quality of living in an urban area, and the noise control should be considered to improve the environmental conditions. Second a theoretical model is proposed to illustrate the trade-off situation for real estate developers as a marketing strategy in relation to making a silent construction site. This proposed marketing strategy is an integrated model which will be beneficial to both developers and laypersons.

Although the proposed model can be used as a tool to promote noise controls, the proposed model is expected to examine whether it works appropriately in the future. Real market reaction is suggested to observe with cases. Case studies would help improve the proposed model in real market conditions. However, the proposed model will eventually make commitments to improve the condition of construction noise and the marketing strategy to enhance real estate company's brand image and reputation as well as living environments.

Acknowledgement

This paper is a revised version of Mr. Guo Zheng's MSc thesis submitted to the Department of Architecture and Civil Engineering at City University of Hong Kong, and is supported by City University of Hong Kong Grant (Project No. 7200342).

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