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ISBN 978-981-10-6189-9 ISBN 978-981-10-6190-5 (eBook)
https://doi.org/10.1007/978-981-10-6190-5

Library of Congress Control Number: 2017950275

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Contents

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Professor Chau has many years of experience in real estate research and consultancy. He has done many consultancy works for private and public organizations. Professor Chau has also served and is serving on many government committees.

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Isabelle is a Lecturer at the Department of Real Estate and Construction, University of Hong Kong, PRC. In the past few years, she has participated in more than 10 government-/university-/industry-funded research projects covering areas of construction health and safety, stress management in construction, sustainable development, innovation in construction and so on. In line with these projects, she has over 50 international publications in books, journals and conferences. Isabelle is a Chartered Construction Manager. She also the Vice-chairman of the Institute of Safety and Health Practitioners in Hong Kong.

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community, smart infrastructure, smart construction, smart property and facilities management and Internet of Things (IoTs). His recent research projects fostered in *iLab* include how BIM can be used for construction cost management, smart construction, logistic and supply chain management and facility maintenance.

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Professor Chris Webster is Dean of the Faculty of Architecture, the University of Hong Kong, and leads the HKUrbanLab. He has degrees in urban planning, computer science, economics and economic geography and is a leading urban theorist and spatial economic modeller. He has published over 150 scholarly papers on the idea of spontaneous urban order and received over US$20M grants for research and teaching and learning projects. He was co-editor of Environment and Planning B for 10 years. Books include Webster and Lai (2003) *Property Rights, Planning and Markets*, Cheltenham, Edward Elgar; Glasze, Webster and Frantz, (2006) *Private Cities*, London, Routledge; Wu, Webster, He and Liu, (2010) *Urban Poverty in China*, Cheltenham: Edward Elgar; and Wu and Webster (Editors) *Marginalisation in Urban China*, London: Palgrave MacMillan; and Sarkar, Webster and Gallacher (2014) *Healthy Cities: Public Health Through Urban Planning*, Cheltenham: Edward Elgar. Professor Webster has nine prize-winning academic papers on urban theory.

He has many research interests on the go, including leading HKU's Healthy High Density Cities research group. His current research agenda for this group is to establish systematic evidence for the relationship between urban configuration (planned and spontaneous) and individual health. To do this, he has teamed up with the Oxford University-based UKBiobank (N = 500,000), the HKU LKS Faculty of Medicine's Family cohort (N = 40,000) and other national-scale epidemi-

ology studies (N = 500,000) to create large-scale medical-built environment platforms for healthy city science. He also co-leads HKU's One Belt One Road Observatory (OBOROBs), which has the objective of modelling and predicting connectivity improvements in the Eurasian urban network and advising city governments on smart land policy to capture more of the land value uplift of OBOR infrastructure for the urban poor.

Chapter 1
A Cluster Analysis of Real Estate Business Models in China

K.J. Li, Y. Zhou, A. Shrestha and G.W. Liu

1.1 Introduction

The globalized construction market leads to globally-interconnected projects and boosts competition between emerging players. To survive in such a challenging environment, companies are forced to embrace innovations for their business model. A business model can be understood as the approach that a company takes to generate revenue and makes profits (Ovans 2015). The model articulates the logic, the data, and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value (Teece 2010). It emphasizes organizational activities in a systems perspective of doing business which seeks to explain both value creation and capture (Pan and Goodier 2012). For example, the business model for Walmart, the world's largest company in revenue, was to sell products at a lower price by decreasing service. In the real estate industry, the "current trader" business model consists of a cycle of land acquisition, development, and outright sale (Pan and Goodier 2012).

Despite increasing academic interest and attention in this area, no commonly accepted definition of real estate business models have yet been established. Also, there is a lack of quantitative studies for the main streams of real estate business models in China. In order to fill on this perceived knowledge gap, and to facilitate cross-context learning, the aim of this paper is thus to reveal the clusters of real estate business models in China. The paper first examines the variables for studying the business model of the real estate market. It then examines 117 real estate companies identified through a two-step cluster analysis, and subsequently elaborates on the revealed real estate business model clusters in China. Coupling results provide a tool to depict real estate business model and quantifiable evidence for

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K.W. Chau et al. (eds.), *Proceedings of the 21st International Symposium on Advancement of Construction Management and Real Estate*,
https://doi.org/10.1007/978-981-10-6190-5_1

Chinese real estate practitioners to understand the main stream of real estate business models in China.

1.2 Methodology

1.2.1 Samples Selection

Chinese enterprises with more than 70% of their total revenue generated from the real estate development were selected as the samples in this study. As of December 2014, there were 143 enterprises listed on the Shanghai and Shenzhen real estate sector. All 143 companies were investigated and based on the inclusion criteria, 117 companies were selected as the research samples while the remaining 26 enterprises that did not meet the criteria were excluded.

1.2.2 Variables Considered for Cluster Analysis

In order to establish the variables for depicting real estate business models, this study reviewed the papers on business model published between 1998–2016. Seven items for measuring the construct of business model were derived from studies including Moore (2004), Johnson et al. (2008a, b) and Brege et al. (2014). According to our knowledge, this is the first study that analyses clusters of enterprise business models applying multiple dimensions and using a large sample size. The selected indicators were greatly represented the model of comprehensive and data available.

The variables are discussed individually below.

(1) Target customers: This variable was used primarily to measure the enterprise customer groups. According to the income of target customers, which were mainly derived from corporate annual reports, the target customers were divided into: (i) ordinary customers (ordinary-income groups), (ii) high-end customers (high-income groups) and (iii) integrated customers (both ordinary and high income groups).

(2) Product: Product refers to the product types of the enterprise. According to the analysis of the income data obtained from the corporate annual reports regarding the enterprises' main businesses, they were divided into: (i) residential oriented; (ii) commercial oriented; and (iii) others. If residential construction accounted for more than 70% out of the main business income for the enterprise, the enterprise was classified into residential oriented; if commercial buildings account for 70% out of the main business income for the enterprise, the enterprise was classified as business oriented; and for the enterprises with

70% of their income not being generated from either residential or commercial construction were classified as others.

(3) Market orientation: This variable was used to identify the proportion of sales income based on where the location of the enterprises' market. The proportion of domestic sales income and the proportion of foreign sales income was used as the basis of classification. In addition, regional division was based on the administrative regions in China, i.e., East China, North China, South China, Central China, Northeast, Southwest, Northwest. Enterprises whose regional sales accounted for more than 70%, were classified as local leading type, while the others were classified as domestic leading type.

(4) Finance: This variable was mainly used to measure whether the corporate finance structure was adequate to support the sustainable development of enterprises. If the debt-to-assets ratio index was less than 40%, the enterprise was classified as risk-adverse. If the debt-to-assets ratio index was greater than 40% but less than 70%, the enterprise was classified as risk-neutral and if the debt-to-assets ratio index was higher than 70%, the enterprise was the classified as risk-seeking. Risk adverse enterprises may not use full leverage of funds to create greater value for shareholders. Risk neutral enterprises use funds to generate medium level of earnings. Risk seeking enterprises may take more financial risks by making full use of financial leverage to obtain high profits.

(5) Collaboration network: This variable was mainly used to measure the cooperation relationships between enterprise and stakeholders (such as government, contractors, suppliers, investors, etc.). The industrial chain theory divides stakeholders into the upstream stakeholders (such as government and financial institutions), the peer stakeholders (such as designers and contractors) and downstream stakeholders, (such as business partners and terminal customers). We examined whether sample enterprises had established long-term cooperative relationship with the three types of stakeholders. Therefore, this study classified the relationship between enterprises and stakeholders into: (i) upstream cooperation type; (ii) peer cooperation type; and (iii) downstream cooperation type; (iv) upper and peer cooperation type; (v) peer and downstream cooperation type; (vi) upstream and downstream cooperation type; and (vii) the industry-wide cooperation type.

(6) Core capability: This variable was mainly used to compare the competitive advantage between enterprises and the competitors. Looking at the descriptions of the core capabilities in the annual reports of the real estate enterprises, it was found that it generally included competencies such as skilled staff, supply relations, relationship with government, technical resources and capabilities, sources of capital, management capability, brand influence and so on. This variable was further investigated using surveys the combines findings from the two methods were used to divide the enterprises into three types: (i) external enterprise; (ii) internal enterprise; and (iii) integrated enterprise. External enterprises' core capabilities lie in the integration with the industry chain regarding the interests of the relevant parties (including upstream and downstream industries, consumers and government resources) and the relevant

Table 1.1 The business model scales of real estate enterprise

Logical level	Components	Dimension	Reference	Data sources
Value orientation	Target customers	Ordinary; high-end; integrated	Brege et al. (2014)	Interview
	Product	Residential oriented; commercial oriented; others	Brege et al. (2014)	Financial statement, interview
	Market orientation	Local leading type; domestic leading type	Self-designed	Financial statement
Value creation	Finance	Risk-adverse; risk-neutral; risk-seeking	Pan et al. (2012)	Financial statement
	Collaboration network	Upstream; peer; downstream; upper and peer; peer and downstream; upstream and downstream; and the industry-wide	Self-designed	Interview
	Core capability	External; internal; integrated	Chesbrough (1996)	Interview
Value source	Revenue	Sales oriented; rental oriented; integrated	Chesbrough (1996)	Financial statement

sources (including land, funds, raw materials, etc.). Internal enterprises' core capabilities lie in their own strong management and technological capabilities, including human resources, life cycle management and control ability and so on. Integrated enterprises' core capabilities lie in the integration of the external and internal capabilities mentioned above.

(7) Revenue: This variable was used to measure the enterprise's main source of income. Through the analysis of the annual income for the listed enterprises, it was found that the real estate business revenue sources include property sales, property rental, hotel experience, property management, design and decoration, etc. Based on the availability of the data, the real estate enterprises' source of income was divided into: (i) sales oriented; (ii) rental oriented; and (iii) integrated type. Enterprises with more than 50% of their income coming from property sales were classified as sales oriented, while enterprises with more than 50% of their income coming from property rental was classified as rental oriented. All other enterprises were classified as integrated type (Table 1.1).

1.2.3 Data Collection

The data was collected in two parts. Firstly, in terms of data resources, the variables, i.e., target research customers, products, market positioning, capital structure, source of income and cost structure of data were collected from the published

corporate annual reports of the listed enterprises. Secondly, the data of cooperation network and the core resources and capabilities were collected through questionnaire surveys.

Data from corporate annual reports were obtained by examining the contents of the reports as well as the sections that offered prospectus. Data was also collected from other published sources as well as enterprises' websites. Subsequently, based on the analysis of the data collected, we divided the core capabilities into: (i) platform type enterprise; (ii) managing type enterprise and (iii) comprehensive type enterprise. The cooperation network was divided into: (i) short-term cooperation; and (ii) long-term cooperation.

The questionnaire items used 7-point Likert scale, and the respondents provided answers mainly based on their personal experience and opinions. One of the issues with subjective questionnaire data is that the accuracy can be partly affected due to the respondents' bias (Podsakoff et al. 2003). However, in order to improve the quality of the data, the only the data from experienced respondents were used in the analysis. Particularly, the data collected from respondents who were familiar with business models in the real estate industry and experts who had more than 5 years' research experience in business modeling were considered. In addition, data from any respondents who were employees of the enterprises under investigation were also excluded from the analysis.

The questionnaires were administered to experts. The progress of scoring involved two stages. In the first stage, three experts (authors, academics and industry experts) were asked to provide scores through discussion. In the second stage, 15 experts were asked to provide their scores separately. Once the filled out questionnaires were collected, we compared the results from the two different stages. The enterprises showing large deviations (in the findings from the two stages) were selected for in-depth analysis in order to determine the category of each enterprise.

1.2.4 Method of Cluster Analysis

The SPSS 'Two Step Cluster' method was applied to reveal the clusters of the business models of house developers in china. This method is designed to discriminate natural groups from a set of variables stabilizing the nearness criterion, with a hierarchical agglomerative clustering whose centres are far apart (Fraley and Raftery 1998). Compared to classical cluster analysis methods, SPSS 'Two Step Cluster' can deal with both continuous and categorical attributes. Also, this method can automatically determine the optimal number of clusters. Likelihood was selected as the distance measure, which defines the normal density for continuous variables and the multinomial probability mass function for categorical variables. The cluster analysis involved two steps:

(1) Pre-clustering step: the data records were scanned one by one and the algorithm decided whether the current record could be added to one of the previously formed clusters or it started a new cluster, based on the distance criterion;
(2) Clustering step: the clustering stage had sub-clusters resulting from the pre-cluster step as input and grouped them into the optimal number of clusters. To determine which number of clusters was optimal, each of these cluster solutions was compared using Schwarz's Bayesian Information Criterion (BIC) as the clustering criterion. An optimal number of clusters will have a smaller value of the BIC, a reasonably large Ratio of BIC Changes and a large Ratio of Distance Measures.

Silhouette Coefficient (Rousseeuw 1987), a measure of density of all the data in the cluster, was utilized to measure the goodness-of-fit of the outcome. This index combines both, cohesion (based on the average distances between all the objects in a cluster) and separation (based on the average distance of any object to all the other objects not contained in the same cluster), and can range between −1 and +1; values below 0 are indicative of inappropriate fit, between 0 and 0.2 are poor, between 0.2 and 0.5 are fair, and above 0.5 are good.

1.3 Results and Analysis

1.3.1 The Optimal Number of Clusters and Relevant Variables

With the seven variables, each of the cluster solutions was compared using Schwarz's BIC as the clustering criterion in order to determine the optimal number of clusters. The optimal number of cluster should have a smaller value of the BIC, a reasonably large Ratio of BIC Changes and a large Ratio of Distance Measures. The results of this analysis suggest that the optimal number of clusters was five, with a smaller value of the BIC (2353.658), a larger Ratio of BIC Changes (0.311) and a larger Ratio of Distance Measures (1.549) (Table 1.2). These results suggest that goodness-of-fit was achieved, with fair average silhouette coefficient equal to 0.30.

1.3.2 The Clusters Revealed

Through the two-step cluster analysis five clusters of the 'real estate business models' (117; 81.8%) were revealed. These clusters involved the use of seven variables consisting of target customers, product contents, market region, capital structure, external relations, core resources and capabilities, sources of income. These five clusters (Fig. 1.1) were with the sample size of 18 (15.4%), 26 (22.2%), 20 (17.1%), 31 (26.5%), and 22 (18.8%). The ratio of sizes comparing the largest to

Table 1.2 The indices for identifying the optimal number of clusters

Number of clusters	Schwarz's Bayesian Information Criterion (BIC)	BIC change[a]	Ratio of BIC changes[b]	Ratio of distance measures[c]
1	3435.351	–	–	–
2	2965.696	−469.655	1.000	1.403
3	2658.389	−307.306	0.654	1.584
4	2499.766	−158.623	0.338	1.052
5	**2353.658**	**−146.108**	**0.311**	**1.549**
6	2293.357	−60.301	0.128	1.001
7	2233.150	−60.207	0.128	1.231
8	2202.264	−30.885	0.066	1.160
9	2188.877	−13.388	0.029	1.105
10	2185.910	−2.966	0.006	1.199
11	2199.344	13.434	−0.029	1.125
12	2221.933	22.589	−0.048	1.001
13	2244.584	22.651	−0.048	1.061
14	2271.461	26.878	−0.057	1.017
15	2299.496	28.034	−0.060	1.355

Bold represents the optimal number of clusters based on results of the analysis
[a]The changes are from the previous number of clusters in the table
[b]The ratios of changes are relative to the change for the two cluster solution
[c]The ratios of distance measures are based on the current number of clusters against the previous number of clusters

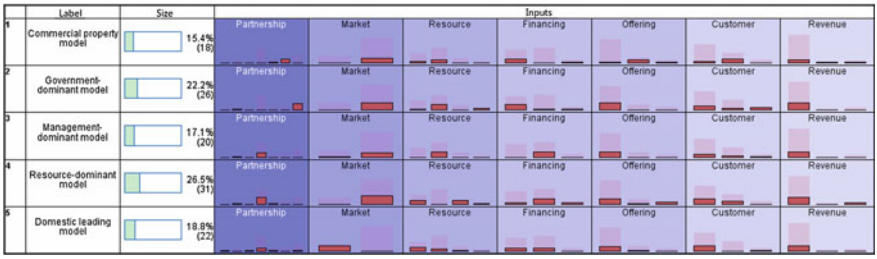

Fig. 1.1 Profiles of the revealed clusters of real estate business models

smallest cluster was 1.72. Figure 1.1 illustrates the accumulative distribution of the building cases grouped in the five revealed clusters against the seven critical variables.

The revealed five clusters were:

- Cluster 1 was dominated by peer-to-upstream cooperative (72.2%), internal capabilities (55.6%), risk-neutral (77.8%), commercial oriented (66.7%), regional (100%) enterprises which sales (66.7%) for high-end customers (72.2%).

- Cluster 2 was dominated by upstream cooperative (88.5%), internal capabilities (73.1%), risk-neutral (73.1%) residential oriented (96.2%), regional (100%) enterprises which sales (96.2%) for ordinary customers (53.8%).
- Cluster 3 was dominated by peer cooperative (85.0%), internal capabilities (100%), risk-seeking (100%), residential oriented (100%), regional (85.0%) enterprises which sales (100%) for ordinary customers (55.0%).
- Cluster 4 was dominated by peer cooperative (83.9%), external capabilities (48.4%), risk-seeking (64.5%), residential oriented (67.7%), regional (96.8%) enterprises which sales (83.9%) for ordinary customers (61.3%).
- Cluster 5 was dominated by peer cooperative (45.5%), comprehensive capabilities (59.1%), risk-seeking (54.5%), residential oriented (81.8%), nationwide (95.5%) enterprises which sales (90.9%) for ordinary customers (86.4%).

1.4 Discussion and Conclusions

This paper has identified clusters of 'real estate business models'. The examination was carried out through a two-step cluster analysis of 117 'real estate enterprises' that have emerged and have been reported in China. Five 'real estate business models' clusters were revealed: (1) commercial property model; (2) government-dominant model; (3) management-dominant model; (4) resource-dominant model; and (5) domestic leading model. The findings indicate that the 117 enterprises were spread across five clusters evenly and every cluster has its distinct characteristics. This goes on to show that there are a variety of real estate business models, with each one varying from the other based on their applicability conditions. So, an enterprise should not replicate the business model of successful enterprises, but instead, should choose a suitable business model that fits their purpose.

The findings should help with understanding the complex profiles of real estate business models and support cross-context learning of the real estate practices. However, such learning should take into account the different characteristics of the house developers against the relevant variables. The variables examined in this paper provide a useful framework for developing cross-context learning of practices. The examined variables were descriptive and explanatory: target customer, product, market orientation, finance, collaboration network, core capability and revenue. Future research may analyze the relativity between the clustered results of variables in each type of business model.

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Chapter 2
A Comparison of Barrier-Free Access Designs For the Elderly Living in the Community and in Care and Attention Homes in Hong Kong

Ibukun Famakin and Mei-yung Leung

2.1 Introduction

As in other developed countries, Hong Kong is experiencing changes in the age structure of its population. The number of elderly people is rapidly growing, which has been attributed to increasing life expectancy and declining fertility (Hui and Yu 2009). The proportion of the elderly aged 65 years and over is expected to reach about 1.74 million (i.e., 22% of Hong Kong's population) in the next 10 years (Census and Statistics Department 2012). The rate of increase of the elderly population is creating concerns for research and policy makers, due to the high prevalence of disabilities in this age group (Cutler 2001; Spillman 2004).

In order to moderate the effects of medical intervention, reducing the levels of elderly people's dependence has been identified as a means of sustaining the elderly. A recognised method for enhancing elderly independence is the installation of barrier-free access to support their mobility and activities of daily living in the living environment. This study therefore seeks to compare the levels of satisfaction with barrier-free access designs between the elderly living in community buildings and the elderly living in C&A homes in Hong Kong.

2.2 Housing Types for the Elderly in Hong Kong

To meet the diverse needs of the elderly in Hong Kong, different housing types provide accommodation designed to sustain their daily life activities: community buildings and C&A homes. Community buildings are defined in this study as housing programmes designed to meet the needs of independent elderly people,

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K.W. Chau et al. (eds.), *Proceedings of the 21st International Symposium on Advancement of Construction Management and Real Estate*,
https://doi.org/10.1007/978-981-10-6190-5_2