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Survey on the Applications of Big Data in Chinese Real Estate Enterprise

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Abstract

This paper focuses on the present applications of big data in Chinese real estate development and marketing from the perspective of real estate enterprises. The problems in this practice for big data’s application are analyzed by now. What’s more, the possible solutions to solve the above problems are proposed in this paper. It benefits the real estate enterprises to strengthen their competition with big data technology.

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Keywords: Big data, Chinese real estate enterprises, application status

1. Introduction

The explosion of data volume fueled by stunning and exciting advances in the computer technology and Internet techniques made the big data the focus of widespread attention. As early as 2000, in the first few weeks of Sloan Digital Sky Survey the data size observed by telescope in New Mexico is bigger than that has been collected in the entire history of astronomy. Big data almost derives its origin from astronomy [1]. In addition to natural science such as astronomy, biomedicine, geoinformatics and other fields easily accompanied by enormous data volume, big data is widely known in social life. Especially in recent years, the appearance of cloud computing and the IOT speed up the arrival of “the era of big data”. It says that Google and Baidu have to deal with dozens of petabytes every day; there is a video length of over one hour released on the YouTube per second; there are more than one billion Facebook accounts uploading almost ten million photos every day with “like” and comment up to billions; Taobao generates about 20TB data every day with over 35 billion transactions on November 11th[1-4]. This size of data is far away from the perception we had in pre-

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information-era society. In addition, there are more and more personal information controlled by banking and financial industry or some telecommunications industry; industrial data collected by pervasive sensors also rises sharply. As the CBC Capital chairman Tian Suning puts it, “Now, an age of mass production, sharing and application in big data is approaching.”[5]

There is no doubt that data resources are crucial in the age of big data. A number of enterprises have gained excellent decision making capabilities and immeasurable economic benefits through valuable information produced by data mining. In order to keep Chinese economic development in a sustainable, sound and rapid manner, it is very important for real estate enterprises to take full advantage of big data because of the status of real estate industry as a pillar industry of the national economy. Especially when property prices continue upward or property bubble inflation involves the national economy and people’s livelihood, those real estate enterprises should make effective use of big data to tap the potentials. Solving the problems in applications on Big data, improving the abilities of investment and marketing, the estate will be able to keep playing a fundamental guiding role in national economy.

2. Literature

To understand thoroughly the big data phenomenon is late in last several years relative to the recognition of usual data. So is the related academic research. Actually, it received high attention from academic and industrial sector at once presented, followed by the big data boom both in theory research and practical application. Chinese property enterprises seize opportunities in time making successful practices, though the systematic research about the applications in big data in academia is not sufficient so far.

It is McKinsey that first puts forward the concept of big data. Big data has become an important factor of production permeating into different industries and functional areas for now. The mining and applications of large data means a new wave of productivity growth and consumer surplus [6]. Viktor Mayer-Schönberger stared the research on big data. He is also known as the prophet of the era of big data. He made a point that prediction is the core of big data. The transformation from samples to the overall data, the change from the pursuit of exactness to acceptance uncertainty and the correlativity instead of causality are indispensable to prepare for the age of big data [1]. He also studied how to make a choice from complicated data volume and then how to build the positive healthy future [2]. The Nature made big data special issue as early as 2008, describing the potential value of big data and the challenge from data handling techniques in Internet technologies, biomedical and environmental sciences, cloud technologies and other fields. Likewise, the Science, one of the top international academic journals, published a special issue to convey the ideas of the time of big data. In 2012, the European academy of informatics and mathematics studied big data systematically including the management of big data, the direction and results of academic research [4]. In the area of applications of big data in realty, Lohr S. holds the view that the property sales forecasts for the next quarter depended on big data is much more precise than that made by economists [15]. Brown B and Chui M et al. believe that the reaching of big data provides potential for both realty enterprises and realty buyers with direct data sharing, bypassing the estate agents. And this can be a shock to the sense of data property right [16].

The MIIT stressed four innovative projects on key techniques including information processing technology in the "twelfth five-year" plan in December 2012, though “big data” was not official definition then. The information processing technology such as mass data storage technique and video image intelligent analysis is closely related to big data. With the time of cloud, big data is not only the IT hot word but also the focus of academic study. Studying a lot, Wang Shan at RenMin University of China illustrates the performance objectives of big data analytics platform. She reviews the framework of big data warehouse designed for analysis, supplying theory base for the structure of big data [3]. Li Guojie and Cheng Xueqi at the Institute of
Computing Technology in the Chinese Academy of Sciences make a systematic exposition on the academic
development of big data and the challenge in applications from a scientific research perspective, coming up
with the implications of big data study [4].

The present domestic researches center on fields with large amounts of data easily available, such as library
information management system and the building of digital library, the influence of big data to culture and
media, the business marketing and accounting context with big data, the micro-miniature credit management
based on big data, diseases control and prevention depended on big data, and so on. In spite of some
achievements, the applications of big data in a few certain fields are more advanced. For example, there are
quite a few portal sites support big data sharing and communication, while the academic research on big data
resources or how to value these resources is deficient. And the studies on the range of issues of data sharing
or transaction are less. Similarly, the academic research on big data of real estate is also behind the realty
entrepreneurs’ practice. Chen Dachuan and Zhang Baoshan studied the application of big data in housing
information system to propose the building of big housing database in 2012 [7]. Yan Juan studied the realty
enterprises’ precision marketing based on big data in 2013 [9]. By now, the research is not in-depth or complete
enough compared with the practical applications.

There are the following contents in this paper. Section 1 is a brief introduction for big data and the
application in real life. Section 2 is a literature for big data and application in real estate market. Section 3
analyzes the application of big data in Chinese real estate enterprise. And Section 4 analyzes the problem for
the application of big data in real estate market and proposes the solution. And sections 5 summarize the paper.

3. The Present Applications of Big data in Chinese Real Estate Enterprises

Regarding big data as the “future petroleum resource”, White House stared the Big data Research and
Development Program [4]. It is apparently to us to get the point. At the industrial level, the age of big data
likely offer an even greater space for growth for those enterprises with a huge number of data and advanced
data handling techniques. It seems that the property bubble is not endless and the housing price will back
suitable sooner or later [21]. Then it’s the key to reality development and marketing for Chinese real estate
enterprises to use big data effectively.

Those huge numbers of data with variety and complexity brings new revenue model and vast space for
development. In current applications of big data, the reality enterprises including developers, agency and
property management companies all expand multiple comprehensive business domains. The reality
development operation, intermediary services and property management are bound together inextricably.
Mainly, this paper centers on reality development and marketing to illustrate the current applications of big data
in Chinese real estate enterprises.

3.1. The Applications of Big data in Realty Development

Big data provide strong support for a more rational way to develop. It benefits reality enterprises to
implement diversified investment through data remining for potential value. The digital personal information
and the revolutionary changes in the way of thinking make innovative investments the new revenue growth
opportunities for reality enterprises in the age of big data.

3.1.1. Rational Investment and Diversified Development

There are more than 660 cities in our country with different housing price and different appetite for
investment as well as diverse natural environment and situation on economic development in different regions.
The real estate market is still rising steadily overall, but the phenomenon of ghost towns of empty houses seriously deviates from developers' expectation. Fortunately, the history of real estate is long enough for these enterprises to possess large numbers of data, such as geographic location, situation on economic development, urban planning and policy orientation, investment under construction, the land market competition, and so on. Using an advanced method to analyze the big data, these enterprises could be able to forecasts the supplies and demands and then value the investment to make a wise decision. Though this unstructured data is disordered, some even useless, the size of the data is big enough to make up the inaccuracy [1]. The more, the better. Google may be the pioneer in big data prediction. Before a potential pandemic influenza outbreak in 2009, google provided precise indicators swiftly by analyzing the relationship between searching key words collected from 2003 to 2008 and actual cases. That helped the US CDC get more chances. In like manner, google estimate the demand-supply equilibrium and predicted the price index in realty market successfully. What google has done is just to analysis stored data, mathematical modeling, manipulation and making a comparison. Google is several times the efficiency of the government at a fraction of the cost [22]. That is part of charm of the big data.

Land resources are very important for realty enterprises. The big data provides the potential for real estate enterprises to have access to explicit land market information. Realty enterprises should attach importance to the land market and pay attention to the market trend. China Vanke Co., Ltd. always concentrates on residential market, and its data on land resources almost come from the third party. Facing the constantly climbing land prices, Vanke analysis the big data to get land in the secondary market, or from the "three old" transformation, or the affordable housing construction land. It's benefit for realty enterprises to analysis big data of land resources to deal with the rising land price. “Holding on residence, no property hoarding and no land hoarding” is the big data strategy of Vanke [8].

Apart from supply-demand analysis or buying land reasonably, the applications of big data in diversified investment within the business-wide also bring massive profits. Wanda Group and Greenland Group and some other companies take the opportunity of big data to expend their business diversely to hotel and traveling commodity service, exploring profit space out of housing market. As Viktor says, the recycle of data can reveal its potential value instead of depreciation [1]. The big data not collected for diversified investment at first may bring extra profit through professional analysis.

3.1.2. Innovative Investment

It’s good for rational development and diversified investment to analyze previous data of investment and sale. However, these enterprises, especially the bigger ones, possess more than that. The data of buyers’ personal information is also considerable, and this information is far more than the name, family structure, incomes and purchasing intent. More and more personal informations are getting easily available due to the development of the Internet and the spread of computers in era of big data. A lot of informations that used to be meaningless for real estate such as the buyers’ habits and customs and the preferred travel routes will be revealed by mining these data. Although these data isn’t so structured, the potential value is great. It means new opportunities for realty development and breakthroughs of benefits.

Vanke Group and Fantasia Group, two of the leader realty enterprises, also stay ahead of the applications of big data. Based on consumer demand, Fantasia planned to build community e-commerce creatively, combining commercial tenants with customers through app on cellphones. Holding millions of homebuyers’ data, Fantasia is able to establish a convenient efficient platform for marketing. This advantage of big data will help Fantasia to improve strength at the same time. In addition to community e-commerce, Fantasia expands its big data business based on the Mobile Internet to other eight areas, such as financial sector, hotel services, culture and tourism. It seems that Fantasia is far away from traditional real estate enterprise [24]. The improving big data
handling techniques bring tremendous business opportunities to Vanke Group in the same way. The 4.8 million property owners means an enormous amount of wealth for Vanke as the realty almost become manufacture nowadays. After data processing, Vanke put forward the concept of building city support services, combining community logistics, medical services and pension with the 4.8 million property owners’ big data. It will bring a great opportunity [25].

The innovative investment made by Shimao Group is more remarkable compared to Vanke and Fantasia. As its business ideas state, the homebuyers prefer an experience of a lifetime rather than a mere house in the future. Therefore Shimao introduced the “health clouds” business management to its property owners for the health monitoring and advisory opinion. Analyzing the monitor data collected by some mobile devices like cellphones and watches in real time, they can produce a health scheme, preparing for disease and helping these owners keep healthy or providing them with hypostatic medical service [25]. Taking advantage of big data, other enterprises like Gold Ground Group and Green Ground Group also open up new operations such as Intelligent City and Cloud Service in succession. These enterprises pay more attention to consumer's satisfaction of spirit and psychology instead of a shelter. Better service for customers matter a lot.

The applications of big data in innovative investment are common occurrence at foreign real estate enterprises. The classical case, Windermere Real Estate, is popular in American college textbooks. They plan for the potential buyers with their commute routes and the cost of time by analyzing information from nearly one hundred million drivers’ GPS [17]. This innovative business not only meets the customers’ demand with improving quality of service, but also promotes the realty seals. That’s worth considering.

### Table 1. The Applications of Big data in Realty Development

<table>
<thead>
<tr>
<th>Enterprise</th>
<th>The big data resources</th>
<th>Realty development and investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google</td>
<td>key words</td>
<td>estimate the demand-supply equilibrium and predict the price index in reality market by analyzing the relationship between searching key words and the data of housing price, providing strong support for rational developments</td>
</tr>
<tr>
<td>Vanke</td>
<td>land resources</td>
<td>analysis big data of land resources to deal with the rising land price</td>
</tr>
<tr>
<td>Wanda, Greenland</td>
<td>realty development</td>
<td>reveal potential value of big data for diversified investment</td>
</tr>
<tr>
<td>Fantasia Group</td>
<td>buyers’ requirement</td>
<td>build community e-commerce creatively and expands its big data business to financial sector, hotel services, culture and tourism</td>
</tr>
<tr>
<td>Vanke</td>
<td>owners’ personal information</td>
<td>put forward the concept of building city supporting services</td>
</tr>
<tr>
<td>Shimao Group</td>
<td>owners’ health conditions</td>
<td>introduce the “health clouds” business management to its property owners for the health monitoring and advisory opinion</td>
</tr>
<tr>
<td>Goldland, Greenland</td>
<td>owners’ personal information</td>
<td>open up new operations such as Intelligent City and Cloud Service</td>
</tr>
<tr>
<td>Windermere</td>
<td>information from drivers’ GPS</td>
<td>plan for the potential buyer with their commute routes and the cost of time</td>
</tr>
</tbody>
</table>

### 3.2. The Applications of Big data in Realty Marketing

In fact, there are over-developed real estates in some medium and small cities in our country. House is essentially a special consumer good while the seemingly substantial benefit attracts large amounts of
investment. Actually, the attraction there is far less than tier one and tier two cities leaving the vast number of vacant houses. Therefore, how to use big data to promote sales is crucial. In addition, traditional marketing models are ineffective as the popularization of electronic commerce is changing the consumption manners of the Chinese. The prospects of realty marketing are not so bright.

To deal with these issues, above all, is to market successfully in the era of big data. Data resources are very important for realty enterprises to raise competitiveness. The huge and perfect sources of data ensure precise customer location and the effective marketing. At first, real estate enterprises can implement precise marketing relying on information system. They can build the customer data system based on the possession of big data to categorize the customers, then extract useful information by big data mining for the precise marketing [9].

![Realty Precise Marketing Flow Chart](image)

In addition, some large estate enterprises change marketing patterns, actively turning to e-commerce. Xinfeng real estate created five big data application system last years. The resources decision support system, the house book network and Xinfeng automated assessment systems are part of the five systems already running with high performance. The houses book network can select certain houses according to the users’ demand. The automated assessment systems can evaluate the housing price automatically depended on the big data processing. Once the users input the data of the conditions it will estimate the price and other information like loan and mortgage or the transaction tax. It’s impossible without advanced big data processing technique. Xinfeng made realty e-commerce the same as Wanda Group, combining online services with offline services. The offline sales departments also get in touch with customers according to the online information [26]. This marketing pattern requires excellent technique on data collection, storage and analysis. So the estate enterprises should master the data processing technology as well as the big data.
Those marketing models above all widen existing business domain proactively without the third-party. In Viktor’s opinion, if the estate enterprises are willing to share data, they can cooperate with the third-party, joining up with the market players like developers and home services and customers, fully demonstrating the advantage of big data. For example, the CNFS real estate big data system includes data of 289 cities ranging from government to the estate enterprises even the Second-hand housing market, and some reach a length of ten years. There is no doubt that the data are only collected and processed by CICC [27]. Realty Mogul bridges opportunities of small investments between estate enterprises and investor via the Internet crowd funding. The information and analysis result provided for investors all come from its possession of big data [28]. E-house China is rather typical for the asset-light strategy, leading a diverse scope of services in Chinese realty estate. E-house introduces the China Real Estate Information Circle servicing for over one million property buyers. Depended on advanced IT, the big data with low cost brings considerable profit [29]. There are many similar third-party marketing platforms, such as SouFun, Myfun, Real Estate Network, Ifeng, and so on, possessing advanced Internet and data processing technology for big data collection and storage. Some reality platforms have made great achievements like Fangdd and Haowu, though the history of realty estate e-commerce is short. Haowu absorbed huge number of buyers’ personal information, and established the big data warehouse, then matched the buyers’ demand with the house available through certain algorithm, promoting the sales successfully [30]. There are 1.6 million page views on Ifeng. That makes the customers’ demand well available, so they can market more precisely by analyzing big data effectively. The thought on big data will promote the real estate. Ever since the introductions of Instant Messenger, there are more and more users registered. In March of last year, the cooperation between Tencent qqfangshi and the Country Garden made a marvelous success on realty marketing with 3300 houses available at the opening. This is a win-win situation----the big data on Internet platform provide realty enterprises with precise marketing pattern based on habits of users; meanwhile the realty buyers’ information online is used for the update of the Internet platform [31]. Other famous enterprises like Longfor Group ever attempted group-buying, making effort to build the realty TaoBao.

<table>
<thead>
<tr>
<th>Enterprise</th>
<th>The big data resources</th>
<th>Marketing patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xinfeng</td>
<td>property information, buyers’ demand</td>
<td>create five big data application system to recommend certain houses and evaluate the housing price</td>
</tr>
<tr>
<td>CICC</td>
<td>transaction data in different places</td>
<td>CNFS real estate big data system</td>
</tr>
<tr>
<td>Realty Mogul</td>
<td>realty information, investor’ ability</td>
<td>bridge opportunities of small investments between estate enterprises and investor</td>
</tr>
<tr>
<td>E-house China</td>
<td>historical transaction information</td>
<td>lead a diverse scope of services and introduce the CRIC</td>
</tr>
<tr>
<td>Haowu</td>
<td>buyers’ personal information</td>
<td>establish the big data warehouse, then match the buyers’ demand with the house available</td>
</tr>
<tr>
<td>Ifeng</td>
<td>page views of users</td>
<td>get their customers’ demand better and market more precisely by analyzing big data effectively.</td>
</tr>
<tr>
<td>Tencent qqfangshi &amp;Country Garden</td>
<td>data on social network software</td>
<td>the big data on Internet platform provide realty enterprises with precise marketing pattern based on habits data of users</td>
</tr>
</tbody>
</table>

4. The Problems of Applications of Big data in Real Estate Enterprises and the Solutions

Big data is new. Estate enterprises should pay more attention to the challenges and potential problems while taking advantage of big data for development and marketing. The contradictions between privacy protections
and big data are irreconcilable. The big data processing technology is not easily available for most enterprises. In addition, the characteristic of real estate corporations bring more challenges into the applications of big data.

4.1 The Problems on Big data and the Solutions

It’s inevitable to get enough personal information when the estate enterprises provide specific services for different customers. If the size of the data is big enough, recognition rates of the personal identity can reaching more than 99% even without personal information [1]. According to present ethics and moral concept it’s impossible for us to ignore the big data containing much personal privacy. To deal with this problem, Viktor prefers the data users rather than the possessors to take responsibility of privacy protections or making the personal information indistinct deliberately to give up some precision for the protection of personal privacy [1]. Whether it works or not has to be studied further.

Big data encompasses much more than just lots of number. It’s more complex and disordered. The collection, storage and processing of this enormous unstructured data needs unusually advanced technology. The generation of big data is fast and sustained with lower and lower value-density. It’s a big challenge for any estate corporation to capture the sort of useful information from the large numbers of multifarious data. On the one hand, to make national big data strategies and to promote the process of academic study on big data and the conversion of research achievements into realistic productivity will help estate corporation improve the big data handling capabilities. On the other hand, it may be a good choice for real estate enterprises to have big data handled by professional third parties. Different types of companies play different roles at the age of big data. The estate corporations can center on the applications of information to deepen development, leaving big data processing to third-parties excellent on technology.

Great importance should be attached to international exchange and cooperation in the era of big data. Meanwhile, real estate enterprises should pay attention to the possible impact making by foreign advanced technology on applications of big data. Seeing the big data in Chinese market, several foreign companies want to enter the market for the big data business, while there is no comparable domestic enterprise being able to counter that at present. Under this condition domestic companies should cooperate with the foreign at first, promoting the internationalization of big data business. Meanwhile appropriate operation model and the status of both sides matter a lot. The foreign companies play role of middlemen and the domestic companies should keep the property right and potential value of big data.

4.2 The Problems on Real Estate Enterprises and the Solutions

Real estate is the mainstay of real economy with some characteristics of fictitious economy such as complexity, metastability and high risk [32], increasing the uncertainties in applications of big data. As fictitious economy system is highly sensitive to expectation, the publicity and sharing of big data can impact investment demand because of the changes on people’ expectations of reality. Given the metastability this impaction will destroy the instability of real estate, influencing national economic development. Therefore, these estate companies should be judgmatical in revolution while taking the opportunity of big data for innovation.

The advantage of big data is not nature for real estate other than e-commerce. There exist data structural imbalances and information asymmetry. So the platform for data sharing is a crying need. The platform should be designed for the realty data storage and help to build a huge real estate database referring to the Real Estate Appraiser’ work. For example, set up and improving of housing information system is beneficial to systematical management of the data of housing monitoring, housing fund and housing security. Building a
safety integrity level and limitation of independence system by designing program for data collection, warehouse and searching, the system achieves the goal of data sharing within government, enterprises and individuals [7].

More comprehensive business, wider range and more collective management are the current growing trends in real estate enterprises. Under the conditions, how to operate effectively is also a big data problem. The estate enterprises have to build a big data warehouse planning person, money, matter, and information, and carry out the integration management by data mining and analysis for predictions.

5. Conclusions and Prospects

The big data has become a type of significant strategic resource for estate enterprises to enhance competitiveness. At present, the applications of big data in Chinese real estate enterprises have achieved great success. The processing and analysis of big data is conductive to practical avoiding over-development and positive coping with the rising land prices for enterprises, and it facilitates the diversified development and the innovative investment. What’s more, the applications of big data in realty marketing have promoted the realty sales greatly. Nevertheless, since the big data is just beginning, the practice on this field is incomplete, facing lots of problems such as privacy protection, data processing technique and the challenges derived from the unique characteristics of real estate.

Further research might focus on the specific application of the big data, studying the internal methods and technology in detail. The theory and the practice complement each other. The ambitious attempt at the applications of big data in estate enterprises will deepen related research. Meanwhile, scientific research will be conducive to the splendid achievements for estate enterprises at the era of big data.

Acknowledgements

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References

[31] Realty marketing has entered the era of big data in 2013 [EB/OL]. http://gd.qq.com/a/20130309/000055.htm