Business Model Design of Commercial Housing
Transaction Virtual Enterprise

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by

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This document describes work undertaken as part of a programme of study at the International Institute for Geo-information Science and Earth Observation. All views and opinions expressed therein remain the sole responsibility of the author, and do not necessarily represent those of the institute.
To my beloved Parents - Zhu Wenwu and Ge Bixiu
Thank you for your encouragement and support!
Abstract

As a basic but expensive demand for living, a healthy real property industry is an important factor to maintain a harmonious society. Demands of the commercial housing are at a climax in current china, but the transparency of real property transactions in the international Real Estate Transparency Index is still at low level. So the issue on improving the transparency of real estate transactions become critical now. Many researches and practices in China have initiated to enhance regulations, standards, and high-tech aid, but the transparency of transactions is a systematic issue, any aspect’s shortage in this system may affect the whole work. This research uses the concept of virtual enterprise and the logic framework approach proposes a transaction business model which will solve the problem in recent China. Meanwhile, the development of SDI and GSI gives new channels which can enhance virtual enterprises.

First of all, this research initiates on understanding of relationship between commercial housing transactions and information service, the tendency of partnerships between real estate information services, the development of supporting mechanisms SDI and GSI, and virtual enterprise concepts and tools. Then it finds that, being intermediary, the role of real estate agencies should be emphasized in transactions, and workflow management system can be used as the tool to solve communication problem inside the virtual enterprise.

Furthermore, the findings in fieldwork show that many problems exist in the current business model, which can be reflected to institutional arrangements, policies, professional standards and technique supports. According to comparing this current business model with good examples in developed countries, solutions for these problems are found out, which gives light on the proposal of the new business model.

The designing procedure is based on the Logical Framework Approach, which includes objective analysis, stakeholder analysis, and the logical planning framework. The main resulting of this work is the architecture of the commercial housing transaction virtual enterprise, the business process of the virtual enterprise, and the data model.

At last, the business process is optimized with the workflow management system, which is as a case study of this proposed business model, and the supported ICT infrastructure for the virtual enterprise is also proposed.

Further research in other aspects of the commercial housing transaction virtual enterprise, which can not stressed much in this research, such institutional arrangements, policies, professional standards, etc. will contribute to improve the transparency of commercial housing transactions.

Key Words: Commercial Housing Transaction, Virtual enterprise, Business process, Workflow
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1. Introduction

1.1. Background

Nowadays the real estate market in China is growing fast. In 1980s, China got the highest birth rate; consequently, 20 years after that, housing consumption becomes a critical issue of the society. Because of the reform declaration of urban housing institution, commercial housing businesses began in 1998. After 8 years’ effort, the commercial housing businesses have developed significantly (see figure 1-1).

Figure 1-1 Percentages of commercial housing consumption in the whole real estate market by acreage (left) and by saleroom (right) [1]

The left chart in figure 1-1 shows the increase of commercial housing acreages from 2000 to 2005. In 2005, it was 97 percent of the whole real estate market, which is 10 points more than it was in 2000. The right chart reveals the increase of commercial housing saleroom. In 2005, it was 95 percent of the whole real estate market, which is 41.5 points more than it was in 1997[1].

Due to the fast growth of the commercial housing business, there is an urgent requirement for effective real estate information services as described in “the announcement about promoting the sustainable and healthy development of real estate market”: with the fast growing of real estate market, service agencies that work for real estate consultation, real estate appraisal and real estate transactions need to improve[2]. Currently, the general way for customers to buy a commercial apartment can be described by the case of Mr. Y.

1) Mr. Y collected some promotion information in the newspapers, magazines, some leaflets in real estate agencies, or from relatives. He compared these apartments based on his requirements and decided which developer’s apartment should be considered.

2) Mr. Y contacted the developer and discussed about the purchase plan with the developer. If the apartment has finished the construction, the developer can lead the customer to look around in the apartment; otherwise, the developer will show the template.
3) Mr. Y would negotiate those requirements with the developer. If they agree with each other, then they can sign the pre-contract with 1000€ as the deposit; otherwise, Mr. Y had to look for another developer.

4) If Mr. Y needs a loan for purchasing the apartment, the developer will help him to mortgage the house. If the credit of Mr. Y passed the examination of the bank, then the bank would require Mr. Y to insure the house before they sign the mortgage contract. Then the bank will grant the loan to Mr. Y.

5) Mr. Y got the apartment, and the sum is returned month by month. At the time all money has returned back, the bank returned the certificate back to Mr. Y.

From the case above, we can see that the whole commercial housing purchase procedure covers many organizations; each of them requires customers to fulfil certain task, some tasks even need the professional background, for example, customers should know which certificates the developers should have before they sell their commercial apartments. Moreover, the whole procedure lasts for a long time, which includes complex contents. But Mr. Y did the whole tired transaction by himself, without any help of agencies, only follow the purchase guideline from the developer. This is the common situation right now in China. Reasons for this phenomenon are:

- The main function for agency is to supply sale information of second-hand houses, other than being responsible for the commercial housing transaction service.

  For commercial housing businesses, big developers who have invested a lot on the sale, customers can easily find some advertisements about new apartments. But for second-hand house purchasers, buyers have to hire brokers to get sale information. Because common citizens don’t have much scattered sale information, only agencies can supply many house resources.

- Agencies’ credits are very bad.

  As there is not a reasonable system to monitor the professional behaviour of brokers in China right now, brokers don’t care the credit mark, they only concern whether they can get the commission or not without. So they even using tricks to persuade both parts to agree with each other to make transactions, even they know that persuade buyers to buy some developers’ apartments are risky. For example, because of the Pre-sale Policy [3] allow developers, who have more than 25% of the financial ability to finish the construction of a project, to presale their apartments to get money in order to finish the construction, it gives a lot of risk in commercial housing transactions. As developers can only use low prices to attract customers in order to presale their uncompleted apartments, and salerooms can’t be guaranteed, the money maybe still not enough to support the short of the finance. Consequently, developers have to try to buy some cheap construction material which is often bad quality to finish the construction, or maybe even this, the construction still can’t be finished, which makes benefits of customers can’t be guaranteed. As customers lack of professional knowledge, it’s hard for themselves to prove the real ability of developers, and also difficult to know the quality of apartments, brokers can easily mislead customers to agree on contracts.

  However, if the customers totally give up helps from brokers, there are following deficiencies:

- Customers lose the chance to make better decisions about apartment purchasing.
As in agencies, there are many house resources offered to customers, customers can require brokers to evaluate each other by comparison. In this way, last decisions will be more reasonable than only listen to developers who only want to persuade customers to buy their own apartments.

- It’s difficult for customers to understand the whole marketplace, so they can’t invest on the apartment properly.

Many developers use tricks to make customers have a wrong sense that their apartments are the best choices and many people want to buy them. For example, they may publish some statistics to show that many apartments have been booked, but those orders maybe fake; or give some bonus for earlier buyers. Usually, after reducing those bonuses, prices are still high. These tricks make customers decide to buy in a hurry, without really understand the marketplace.

- Contracts may have many problems which are hard to be found out by common citizens and may lead many reputations in the future.

Although bureaus have published some structured contracts, as each transaction has its specialty, supplemented contracts about extra items are also necessary now. For example, at the time to get the house, the developer may announce that if the house is a little bigger than what the contract regulated (their contract may say that if the excessive area is within 3% of the contracted area, the contract is still valid), so if the excessive area really happens, customers have to pay more money than the sum agreed before.

Above all, we can see that it’s necessary for commercial housing businesses to find a way to improve the ability of real estate agencies. Recently, many researches and practices have happened in China and international environment.

In China, some practices about better management of transactions have been initiated, such as the enhancement of regulations inside real estate transactions[4], standardizations of the mortgage procedure[5], house registration information query management [6]. With the wide use of ICT, many researches and practices tried to base on the E-business to facilitate the work of real estate agencies, in order to improve the transparency and efficiency of transactions, which includes electronic funds transfer[7], online transaction processing, online marketing[8], etc. For example, based on the three levels for the use of ICT in E-business, Tian Hua [9] classified information services in real estate agencies as:

1. Interface Commercial Mode: the agency works as an interface for customers to get services from other real estate organizations, but the service in each organization is individual. Namely, each organization has its own clients and independent service procedures, and agencies only supply information to make customers know which organization can supply what kind of service; customers should obtain each service from each organization separately.

2. Integrated Commercial Mode: it seems to be the “Client/Server” system, requirements from clients are the core to make many functions together to fulfil transactions, and inside this mode real estate organizations cooperate to work for the same clients.

3. Internet Era: it fully relies on Internet to fulfil the whole commercial procedure.

Furthermore, according the current situation in China, Tian Hua proposed a transaction system to combine the concept of Electronic Commerce with the traditional transaction, which is based on the LAN (Local Area Network) inside each real estate agency to manage the inner work, rely on the Electronic Commerce to communicate with customers, at the same time, the traditional facilitations still kept working, such as telephone, fax, fixed service windows etc.
From the current researches and practices, we can see the common point of these initiations is without changing the current business model, only attached regulations or the use of ICT (Information Communication Technology) to facilitate parts of transaction procedures, such as the customers’ personal data collection, signature of contracts, payment, certificates grants etc. However, as the business process is an integrated system, which includes several aspects, such as institutional arrangements, policies, regulations, management issues etc, the lack of consideration about any aspect may lead to the failure of the whole system.

Thus, we can see that, the transparency of commercial housing transactions can’t only rely on the use of ICT, but also depend on a right business model. As the work between organizations is closely related to each other, any delay or low transparency can impact the whole business. Moreover, related organizations are geographically distributed, so communications between involved organizations are key issues to improve the transparency. From the demand of customers, what they need is simple but transparent services; go for services in each organization are really complex for them. As a result, the needed business model should make these organizations work together virtually, all members has a shared value and belief, and work for the same customer [10]. It seems the concept of the virtual enterprise can be used to solve problems that exist in Chinese commercial housing businesses right now. From the view of customers, it is much simpler, as it seems only one organization is working, but actually, the independence of the management inside each member isn’t changed, they only temporarily cooperate for a task. Moreover, the concept of virtual enterprise can also create new ways to perform real estate businesses, because characteristics of this concept can be generalized as:

- The goal of the virtual enterprise is to create value from changing opportunities in the environment. The changing opportunities may come from a new market, a product or technology innovation, or new industrial cooperation.

- The virtual enterprise is an alternative way to differentiate and integrate work under dynamic conditions. To capture a new opportunity quickly, the cooperation is structured in a limited period of time, with a limited purpose, and with a minimum of overhead for coordination. The operation structure is closely linked to it’s adaptation to the new opportunity.

- If the virtual enterprise is permanently adapting, it follows that solutions to support it must share dynamic characteristics, which is a systematic routine for change.

- As a network enterprise, many interdependent but separated organizations can be connected by information and communication technology (ICT) tools (like Internet, Computer Supportive Collaborative Work and groupware such as Workflow Management Systems, Project Management Systems and Resource Management System) to establish the dynamic collaboration system [11].

- Same as the traditional enterprise, the virtual enterprise shares a common belief and value, which is cross-organizational boundaries, and is built up by the inter-communication within the virtual enterprises without formal management bureaucracy [11].

- With the increasing development of the geo-information Data Infrastructure (GDI), it leads to the introduction of the concept of Geo-information Service Infrastructure (GSI), which means many geo-data are not only available, but also able to be transformed based on the specification of clients by services providers to create value-added services, location-based services etc to reach a wider customer community through the channel of GSI[12].
1.2. Problem definition

According to the system approach [13], there are several aspects to interplay with each other in the system. As a system, the virtual enterprise can be seen as a process of co-evolution of social, political, and institutional and technological factors [11], it’s necessary to assume that services in each organization can be described, accessed, combined and managed to deliver geospatial information and real estate information[14].

However, even though organizations are able to cooperate with each other, there still exist several problems. Firstly, it’s hard to define the reasonable transaction model which can be used to make the transaction function effectively and transparently. It is the basic principle for the selection of the right partners and right combination of partners’ procedures to fulfil customers’ demands. Secondly, a way should be found to solve the problem of communication and to conquer the difficulties of controlling activities, in order to manage distributed business processes to produce higher quality products and services.

Therefore, this research will look at how to build up a virtual enterprise by proposing a commercial housing transaction model to better satisfy customers, benefit mutual participating partners and chaining workflows across the boundaries of participating organizations.

1.3. Research Objective and Questions

This research is based on the theory of workflow management in virtual enterprise. The objective is to propose a commercial housing transaction model and optimize this model with WFMS (Work Flow Management System) in order to improve the transparency of commercial housing transactions by combining and managing geographically distributed business processes within virtual enterprise. The concept of the CHTVE (Commercial Housing Transaction Virtual Enterprise) with specific reference to the workflow model can be described as figure 1-2.

As we see, real estate agency works as an intermediary between customers and real estate service provider nodes. The business process is defined by the real estate agency, and the communication between different service provider nodes is through the cross boundary workflow management system. If this objective is achieved, it has many good impacts.

First, Due to the virtual enterprise environment is able to reduce the time and cost of services, regulate the procedure of transactions and allow flexibility to afford new services that are available in the market according to client requirements, this may not only lead to an improved performance of those organizations within the virtual enterprise by increasing productivity, but also control cross-boundary processes and flexibility to fulfil participants’ missions. At the same time, participants become more powerful in the market, because virtual enterprise allows each participant to manage, monitor, automate and integrate their activities, improve organizations and make use of their resources and data in a better way for both internal and external processes.
Moreover, the supply of commercial housing transaction information services, in the architecture of virtual enterprise, is similar to the geo-information services provided using Geo-information Services Infrastructure (GSI). As the commercial housing transaction virtual enterprise serves as a business, it means the participation of real estate information services can be enlarged in the market; therefore, this research can also contribute to the enhancement of the concept of GSI to develop real estate business opportunities and increase the interest of organizations to participate on GSI initiatives.

According to the research objective, some research questions are identified as follows:
1. What’s the relationship between commercial housing transactions and information services?
2. What’s the trend for commercial housing transaction information services?
3. Which business methods, techniques and tools are used to manage virtual enterprises?
4. What’s the current situation of Chinese commercial housing transactions?
5. How is the efficiency and transparency of the current commercial housing transaction in China compared with developed countries? And what are reasons?
6. What is the architecture of the CHTVE?
7. What’s the business process model of the CHTVE?
8. What's the data model of the CHTVE?
9. Which workflows can be generated from the business model of the CHTVE?
10. How to create the workflow applications of the CHTVE?
11. What are steps to create the CHTVE?

1.4. Methodologies

Methodologies to answer each research questions are as follows:

- Identify the relationship and the trend between the commercial housing transaction businesses and information services by reviewing real estate literatures. (1, 2)
- Review literatures about virtual enterprise, workflow management system, enterprise modelling to define an approach for integration management of CHTVE. (3)
- Review the current commercial housing transaction situation in China in fieldwork, model it and compare it with the situation of some developed countries by the transparency and cost of transactions. (4, 5)
- Design the business model of the CHTVE by the methodology of LFA (Logical Framework Approach). (6, 7)
- Based on the Core Cadastral Domain Model to design the data flow of CHTVE, based on the generic model and using the XMLspy to propose the data transfer schemas. (8)
- Review literatures on management tools regarding Workflow Management System to identify their functions, requirements and usability for geo-information organizations as an enabling technology for the management of virtual enterprise. Generate and validate workflow applications and propose implementation guidelines for the CHTVE. (9, 10, 11)

The workflow for this research is shown in figure 1-3, which illustrates the time schedule, tasks in each period of time, and the procedure to finish the whole research.
1.5. Prior work

This research uses the concept of virtual enterprise and workflow as the tool to formulate the business model to manage the real estate transaction businesses. In China, researches about the use of the concept of virtual enterprise in real estate transactions are not yet, but a lot of similar work has been done in international environment. And followings are relative and supportive research studies:

- FIG (International Federation of Survey) Commission7 [15] deals with land administration and land management. In 29th general assembly, it proposed appropriate concepts and tools for land administration and land management with regard to the specific institutional and operational context of developed and developing countries, which supply a base for real estate transactions, for example, the proposal of the core cadastral model, which can be developed as a computerized cadastral system by standardization, in order to support a customer and market-driven organization with changing demands and requirements [16].

- Action G9 of COST (Coordination in the field of Scientific and Technical Research) [17] has organized a lot of seminars about modelling real property transactions of European cases. The main outcomes of this action has made a better insight and understanding in many aspects that frame the real property transactions, which include:
  - Institutional arrangements
  - Land registration and real property right
  - Transparency of real property markets
  - Reduction of costs of real property transactions
  - Modelling of real property transactions businesses according to stated criteria
Assessment the economic efficiency of transactions

- Alvarez Casallas [18] used the concept of geo-information service infrastructure (GSI) virtual architecture created a land agency as a virtual enterprise, in which services are provided by external organizations in Egypt. This concept is a possible solution to activate the Real Estate Market of Egypt.
- Lars Bernard [14] presented a use case of using the workflow to chain a number of services together for a specific disaster management (windfall timber blocked the roads).
- M. Radwan [19] proposed a Egyptian survey authority business model which operated as a virtual enterprise consist of dynamic collaboration of many partners who are various public and private Mapping and GIS institutions in Egypt; they worked as a network to deliver the mapping services that beyond their individual capacity.
- M. Radwan [20] proposed an online cadastre portal, eCAD Portal. It offered a single stop for providers to post the metadata that described their resources and customers to discover resources through services brokers. A workflow management system is used to control and coordinate the whole network. Also eCAD Portal provided the platform of real estate agencies to work in as a virtual enterprise within Egypt.

1.6. **Thesis structure**

Chapter 2 describes the relationship and the trend between the commercial housing business and information services. Chapter 3 reviews the supporting concepts and tools enabling virtual enterprises. Chapter 4 gives an overview of the current situation of the Chinese commercial housing transaction, and compares it with good examples in some developed countries to find out the problems and solution for the commercial housing transaction business. Chapter 5 tries to use the logical framework approach to redesign the business model of commercial housing transactions. Chapter 6 designs and validates workflows in the virtual enterprise and proposes the steps to create the VE. Chapter 7 gives a summary, conclusions and recommendations.
2. Information Services vs. Commercial Housing Transactions

2.1. Introduction

The commercial housing businesses have developed drastically due to the continuous fast improvement of the economy, the increased income of citizens and the fast speed of urbanization in China. More new demand from customers and new service providers appear which make the competition in this field more drastic. At the same time, thanks to new technologies with higher speed and lower prices, the development of geo-information market leads to a new era of commercial housing. For example, the telecommunication technologies for mobile services and Internet technologies for online services make geo-information easily accessible, and it can supply information with high quality and good prices from reliable sources to meet the needs of commercial housing businesses. This has led to an increasing number of hardware, software, data, and services that have promoted the development of commercial housing businesses. This chapter analyzes the basic relationship between commercial housing transactions and information services, deduces the trend according to some good examples in developed countries, and introduces the kind of mechanism that supports the trend.

2.2. Relationship between Commercial Housing Transaction and Information Services

As the real property belongs to the immovable commodity, real estate transactions rely much on information services, for characteristics of the immovable commodities can cause the information asymmetry to influence the market.

2.2.1. Real estate information services

Information services, in the scope of cyberspace can be categorized into data processing services and database services. Data processing services mean any computer processes that convert data into information. The processing is usually assumed to be automated and running on a mainframe, minicomputer, microcomputer, or personal computer. A database service supplies a collection of logically related data designed to meet the information needs of one or more users.

In this thesis, information services are seen as the business processes available in real estate organizations, and that can be provided and required by organizations. It is different from web services but it uses the similar infrastructure and tools to discover, evaluate and select services. Moreover, real estate information services here ask for to be supplied in an integrated way, and managed within the service chain, so communications between different service systems needs common definition of standards, policies and technologies. Requirements for this information structure have much comparability with the geospatial data infrastructure.
2.2.2. Classes of the Real Property Market

In China, there are three classes of the real property market. They are listed as follows:

- The first class market is the transfer of the land use rights. It should base on the general planning of the urban area; the state and rural collectivises are sellers who have land ownerships.
- The second class market concerns the development and management of the real property after gaining the land use right. Specially, residential real property in this class of market is called commercial housing.
- The third class market concerns the transaction of the second-hand houses.

The dominated market class is the second one, which dominates more than 60% of the whole real property transactions, and the development of the third class property market is just at the beginning [21]. In this research, we concern transactions that happen in the second class market, which is a crucial part in Chinese real estate businesses right now, specifically, focus on commercial housing transaction.

2.2.3. Characteristics of the Commercial Housing Transaction

Peter Buxmann [22] generalized characteristics of the commercial housing transaction as:

- No two parcels are exactly alike, as the different location determines different value of the land use; it requires some experience to determine the correct value.
- The government plays a dominant role through fiscal and monetary tools and by other controls, such as zoning, environmental, and health codes.
- Buying a house is usually the single most expensive investment for the average family, so it’s a very cautious business.
- Usually there are only few participants on either side of the transaction. Because private persons are only very infrequently involved in real estate transactions.

Altogether, the real property transaction is legalistic, complex, and expensive and requires legal and technical knowledge often not possessed by the common citizen. As a result, participants in real property transaction consists not only the demand side and supply side, but also the middle side, who supply information services to facilitate the transaction, such as broker, notary etc. So, the three sides of commercial housing transactions can be generalized as:

- **Demand side (Purchasers)** who purchase apartments for living in.
- **Supply side (Developers)** who prepare raw land for buildings and get new products for markets.
- **Middle side (Facilitators)** who help facilitating the purchase and sale of real estate; this includes banks, real estate brokers, notaries etc.

2.2.4. Information Asymmetry in Commercial Housing Transactions

The basic and core function of markets is doing transactions, namely, exchanging goods and services between sellers and buyers[23]. Generally, the commercial housing transactions can be broken down into three steps:

- The first step is called *information* phase. Prospective buyers are looking for and evaluating goods or services and sources, and potential sellers are identifying potential customers and arrange to provide goods or services.
- The second step is **negotiating** phase. Two sides negotiate terms of a deal, such as the prices and quantities, and at last finalized by a contract or purchase order.
- The closing step is the **execution** of the exchange of goods or services based on conditions negotiated in the second step. Mutual monitoring of the performance concludes the deal.

We can see that the exchange of information between participants plays a major role throughout the whole process in transactions.

However, as said before the real estate transactions have some imperfections and complexity [22] such as durability, immobility, high transaction costs, less participants on either side of the transaction than other markets, and government plays a dominant role, difficult to determine the correct value etc, the exchange of real estate objects turns to be legalistic, complex, and expensive and requires legal and technical knowledge often not possessed by the common citizens. In addition, the trend of marketplace can’t be clearly informed to sellers and buyers, so the lack of transparency can distort prices. It’s also impossible to distribute the power equally as in the case of other transactions with more participants on either side. Although the real estate is indeed influenced by the interaction of demand and supply, the interaction between sellers and buyers are not smooth.

This condition is called information asymmetry [24] in the market. It means information distribution in both sides is not balanced, which results in different market power distribution. So the value of commodity tends to go down, even for those of perfectly good quality; unmoral sellers can cheat the buyer. As a result, many people will avoid being involved in transactions because of the risk. Even more, the market may disappear.

### 2.2.5. Information Service Mode

In order to overcome the imperfections of the real estate markets and to deal with their requirements, real estate facilitators are needed. Facilitators such as real estate brokers make the transaction mode seem to be a centralized one (see left chart in figure 2-1), which is against decentralized mode (see right chart in figure 2-1).

![Figure 2-1 Decentralized transaction & centralized transaction](image)

Figure 2-1 describes the difference between decentralized transaction and centralized transaction. The left chart in figure 2-1 shows the decentralized transaction, that developers and buyers interact directly. The right chart illustrates both sides in transaction are connected by facilitators. This reduces maximum number of contacts that developers and buyers have to establish in order to gather all possible information. This consequently reduces overall transaction costs. Moreover, brokers can also provide information about opposite market side and offer additional services like the categorization and evaluation of products to assure quality, and
establish trust between transaction participants. Consequently, this reduces the information asymmetry much to make the transaction go smoothly.

2.3. **Trend of Real Estate Information Services**

The use of ICT has facilitated the cooperation between different organizations during real estate businesses, which can be reflected in good examples in developed countries, which also deduces the trend of the real estate information services.

2.3.1. **Traditional vs. ICT-based Real Estate Markets**

Based on the Information and Communication Technology, the global network has been established in the corporate world, which facilitates many businesses by supporting the exchange of information. Correspondingly, they also support transactions, which is applicable to markets. The difference of the ICT-based real estate markets from the traditional real estate markets can be illustrated from the following aspects.

**Accessibility to Information Services:** Accessibility is a general term used to describe the degree to make things as accessible as possible to as wide a group of people as possible. Before the use of ICT, realtors’ work has some limitations: Firstly, realtors act as wholesalers offering complete service packages to customers [25] by implementing in manual ways, which include doing market researches, providing current information about prices, rents, and other information in specific areas, such as crime rates, schools, stores, neighbourhoods etc before the transaction; during the negotiation phase, realtors help setting up contracts, negotiate property loans etc. In the last phase, realtors help executing the exchange. Secondly, because of difficulties of communication between different areas, realtors usually operate within a limited geographic area.

However, the network based on ICT provides a virtual marketplace that let buyers and sellers can easily access at least some of the services that traditional realtors offer. Sale information can be searched down to certain details levels. Apart from making information about houses for sale available online, networks offer a number of additional information and services to their customers, such as comparable sale information, mortgage calculations, maps etc. Many companies, not only one, usually supply these services; they link together to one stop, which make customers can easily access. Furthermore, the transaction procedure can also be implemented in the network by combining related services in the virtual marketplace.

Altogether, we can see that ICT can make customers easily access real estate information, services can be easily offered on a global basis, and also collaboration between business partners can provide complementary products and services.

**Speed of Information Services:** With the help of Internet, Telecommunication, applicable software etc, sellers can broadcast their property with rich information, such as pictures, locations in the digital maps, as soon as the reliability of the information sources is checked, instead of notifying realtors to collect their property information and waiting for realtors to do advertisements. Buyers can search property information in the search engine using applicable tools, such as keywords, categorizations etc, in a fast speed without a long time waiting for realtors to search in a maximum number of advertisements. Fast speed saves much time for
customers, also realtors. As a consequence, costs for information services are largely reduced. Moreover, as we see, part of traditional realtors’ services can be supplied by using ICT with a far less cost, so majority of realtors could see a need to unbundled their services, professionalize their services, and let customers to choose the services that they want to pay for [26].

Economics of Information Services: Obviously, initially providing these kinds of services using telecommunication, Internet and geospatial technologies will not be cheaper especially for individual agent. But if the system grows with the time along with the number of customers, these services will be definitely very cost effective in comparison to the present ways of information. Different types of collaborations among different types of industry players can lead to minimum services cost. If land price formulations and negotiations could be done using these services, the activities of these markets would increase.

2.3.2. Good Examples of Real Estate Information Services

This section takes some good examples of real estate information services in developed countries within the context of the wide use of ICT. The reason for the selection of these countries as good examples is because their high transparency, which belongs to top10 in the list of International Real Estate Transparency Index [27]. Looking at the real estate market, it reveals that many collaborations or mergers are taking place. It shows real estate information services are walking towards full services in one stop, although it’s impossible to take place of realtors’ all professional services. However, ICT have been used to execute many services right now, which include house resources notification, sellers and buyers matching, contracts subscription, capital custody and property right registration. The alliance areas cover brokerage, finance, notary etc. The information service chain tries to shape a safe, convenient, high effective virtual real estate information sharing environment based on the ICT. The following regional real estate information services are shown to illustrate the current status of real estate information services in some developed countries.

1. America

In America, sources of real property are registered in the common Multiple Listing Service (MLS) [28] which covers the national range and shared by all real estate agencies, so competitions between agencies changes from the holding of sale information sources into service quality. Good service qualities come from good brokers. Namely, competitions between agencies are focus on recruits of excellent brokers. However, excellent brokers require high salary, so benefits of agencies are reduced by brokers’ high salaries. Consequently, the way for agencies to increase their benefits can only turn to enlarge the scope of services. That’s why American commercial housing set their goal as the one-stop real estate information services.

2. Europe

Real estate market in Europe has changed much. First, with the gradually federal development of services and technical devices, real estate services in Europe often require the combination of services and physical products. This phenomenon will create integrated services for customers. Secondly, the development of ICT has led to new ways to deliver real estate services. Thirdly, customers become the focus of the real estate business. As a result, new
partnerships have been formulated in Europe. So, real estate researchers predict that the customer will take a major role in real estate cooperation, and the better effective way to do real estate businesses is through partnerships between relevant actors in real estate market, for example, developers, banks, brokers, bureaus etc. These partnerships require that each partner focuses on its main function and recognize other partners’ roles in the service chain to increase the breadth and depth of real estate services. Otherwise the partners can’t get any additional value from the network [29]. Examples of real estate services in Finland and Netherlands are shown as follows.

**Finland:** During recent years, the Finnish real estate services have undergone a rapid development. Up until the mid 1990s, services were mainly related to brokerage, valuation and property management [30]. As a consequence of the use of ICT, currently, a wide variety of management, transactions and advisory services are available in the market, and real estate services are becoming more and more professional, which is verified by the fact that decisions of real estate developers, constructors and brokers are often based on the specific requirements of the customer. Many companies specialize in managing the services and service-provider network on behalf of their clients with a flexible and high quality way.

**Netherlands:** Dutch real estate business shows a good partnership between Dutch Cadastre [18] and notaries. The Dutch Cadastre produces cadastral maps in order to maintain the real estate information system of the Netherlands. For the maintenance of the real estate system, the Dutch Cadastre has a legal partnership with Notaries. There is an agreement between the Dutch Cadastre and Notaries that Notaries can login the Intranet of Dutch Cadastre to check ownerships and view the database when a transaction takes place. This is an example of tight cooperation between two separated organizations to provide single service, which is connected by ICT. Except that, cooperation between notary, bank and insurance company can support services for performance of transactions in a simple but effective way without customers’ participations.

2.3.3. **Trend of Real Estate Information Services**

As shown above, clients, who ask for integrated and professional services, take a more and more important place in the real estate industry. The real estate organizations have to concentrate on their core services, and cooperate with other organizations to supply combined services. It means collaboration and partnership become the strategy to improve the real estate services, and it should be noted that this cooperation emphasizes on using ICT to connect participants in the market and being full of flexibility to fulfil customers’ multiple requirements.

In terms of technologies, all the cases show that information technology offers many opportunities to real estate businesses. The difficulty is in finding the right technology that improves activities. Johanna Nummelin[29] illustrated that the trend of technology in real estate businesses should cover processes taking place in spaces and premises, human-technology interaction and technical systems. Namely, real estate businesses ask for a kind of integrated technology, not only physical systems but also human interfaces.
2.4. **Supporting Mechanisms and Concepts**

Most information in real estate businesses is geo-information, which requires geo-spatial technologies to deal with, and the trend of real estate information services is integrated services, which needs a mechanism to facilitate the searches of products or services, so supporting mechanisms need to employ Geo-ICT infrastructures, namely, GDI or GSI, and the concept of virtual enterprise is available to manage agent-based one-stop services.

2.4.1. **Virtual Enterprise**

The virtual enterprise is based on the ability to create temporary cooperation and to realize the value of a short business opportunity that partners can’t (or can but only to lesser extent) capture their own[31]. This concept can be defined by three elements:

- **Value** is the reason for the cooperation between independent organizations to structure a virtual working environment for the same goal.
- **Virtual operations** are processes that combine competencies and resources for the period needed to realize the value of a business opportunity.
- **Network model** is used to combine a pool of partners together.

More detail explanations about the virtual enterprise will be in Chapter 3.

2.4.2. **Geo-spatial Data Infrastructure (GDI)**

The Geo-spatial Data Infrastructure is defined as: “encompasses the networked geospatial databases and data handing facilities, the complex of institutional, organizational, technological, human, and economic resources which interact with one another and underpin the design, implementation and maintenance of mechanisms facilitating the sharing, access to, and responsible use of geospatial data at an affordable cost for a specific application domain or enterprise” [32]. Especially, the application domain or enterprise here means “a large degree of common semantics in the definition of geospatial entities which facilitates optimal data sharing” [32]. The development of GDI has encouraged the information services sectors to grow and rigorously structured.

However, services right now which geo-information clients asked for are usually beyond the capacity of “single” sectors, because these services are in large volumes and in near real-time mode. Thus, these geo-information organizations are looking for a new infrastructure that supports the combination of their processes to make service chains. This means “the traditional GDI has to change, from being a simple data discovery and retrieval facility to become an integrated system suitable for the provision of customized information and service. [33]”

2.4.3. **Geo-information Service Infrastructure (GSI)**

Therefore, this research is focusing on another infrastructure that aims at generating value-added services required by the new network environment. We call it Geo-information Service Infrastructure. GSI makes elementary services can be described, accessed, combined and managed to create service chains in order to perform complex geo-processing tasks [12]. Moreover, within the context of GSI, separated organizations work together in a virtual
environment, offer their core competences and join together in dynamic ways to supply complex services. It means, based on GSI, concept of virtual enterprise can be applied in this environment.

2.5. Concluding Remarks

As immovable commodities, real property markets have many imperfections and complexity. It results in information asymmetry in real estate markets. Centralized markets, which are connected by intermediaries such as realtors, make markets go smoothly. The broad use of ICT gives many opportunities to traditional real estate markets, such as broad accessibility, fast speed, and economic effectiveness to do businesses etc. However, there are also some challenges, such as some of realtors’ services are replaced by online services, fast speed may lead customers to make wrong decisions because of the lack of considerations. From some examples of current real estate information services, we find that the popularity of the Internet, Telecommunication, Geotechnologies have led to drastic competitions; as a result customers have more power, so they tend to look for more customized services. However, it’s difficult for a single organization to supply all professional services. With the supporting mechanism GDI and GSI, and the concept of virtual enterprise can be used as one solution.
3. Virtual Enterprise: Concepts and Tools

3.1. Introduction

This chapter describes the enabling concepts and tools to create virtual enterprises, which include description of concepts of virtual enterprises, modelling aspects and tools, concepts of workflow management and enabling technologies for virtual enterprise.

3.2. Concepts of Virtual Enterprise

Virtual Enterprise is a new trend in the cooperative business, or B2B scenario. In the past, it has been applied to outsourcing and supply chains, as well as temporary consortiums. Due to the fact that the formation of virtual enterprises is an intricate process, new forms of technologies have been developed to support it. And the trend of support systems is to automate parts of the creation process [34]. Following paragraphs intend to give a full understanding of this concept.

3.2.1. Virtual Enterprise Definition

Virtual enterprise is defined as cooperation between separated players (providers, brokers etc.) where core competences of each player are combined together to fulfil one mission to make a product or supply a service. The connections between players use advanced information and communication technologies. One main benefit for virtual enterprise is that it can be generated in a fast speed, for it gets rid of lengthy contracting negotiations, but cooperation rules and trust between enterprises must exist. Long term virtual enterprises need to supply with their own identities to offer their services to the market. We can see that the concept of virtual enterprises tries to combine big enterprises which have big financial power and large pool of resources, and small enterprises which are flexible and easy to lead and coordinate.

3.2.2. Causes for Emergence of Virtual Enterprise

With the development of ICT, organizations in modern world have experienced a big change, from industrial age to digital age [35]. The ICT represents a substantial and increasing part of the value added products and services, and has an important impact on industrial value chain, so organizations today strive to become agile and to operate beneficially in an increasing competitive environment, which is continuously and unpredictably changing markets. In the digital era, businesses between separate organizations are characterized as follows:

Networking Economy-The internet makes the world economy change into a global hyperlink economy, not only hyperlink of documents, but also hyperlink of people and organizations. With Internet spreads into all aspects of communication, markets are getting much smarter every day [36]. It is presented by connections between people and organizations in whatever role they may be, and each role in networks was seen as stakeholder who can contribution to the success [35].

Value-added Products and Services-In the digital era, products and services have more extra values than traditional ones. There are two reasons: first, networks make products and services
provision nodes have more chances to become intermediaries to others; second, economic value is not only derived from tangible asset which likes investment in labour, plants etc., but also from intangible assets such as information, content, knowledge, brand etc.[35]

**Intangible Assets:** Intangible assets mean those assets are incapable of being perceived by senses. Right now, brand and knowledge are known as two important intangible assets[35]. In digital market, brands are an invaluable source of trust. Good reputation of a brand can make customers trend to purchase, because good brands lead high quality and security. Therefore, many organizations invest heavily in brand building. The term of knowledge is also a key intangible asset, which contains specific information about specific item, which should be developed and protected.

**The Growing Need for Trust:** As many businesses dispersed in a geographic distributed way, involved organizations have to depend on technologies and infrastructures to communicate with each other. Therefore, open communication networks and associated information systems become vulnerable to be threatened. For example, computer viruses and private information filching etc. are common ways to crash the network. Consequently, in the socio-organizational context, trust becomes an important element of network management[35].

To respond to the changing digital economy and the trends for organization cooperation as listed above in the digital age of businesses, the concept of virtual enterprise was introduced.

### 3.2.3. Characteristics of Virtual Enterprise

By compiling a variety of literatures, characteristics of virtual enterprise are described by pointing out the following aspects.

**Network Enterprise:** Virtual enterprises emphasize on location-independent and temporary collaboration between separated organizations, which is based on the notion of interdependency. ICT is used to connect involved organizations and facilitate the exchange, distribution and sharing of information, knowledge and other resources. In this approach virtual enterprises appear to be one enterprise when in reality it doesn’t. The virtual enterprise describes a situation where people and facilities are not parts of an organization are linked to as they were[11].

**Trust and loyalty:** Within a network of connected computers, the virtual enterprise dynamically allocates the information processing capacity. Time-sharing is made possibly by the connection of computers and networks, enables the parallel disclosure and use of information and knowledge within a network. The interconnection of information processing capacities enables involved organizations to develop a loyalty and trust to each other[11].

**Core Competency:** Each member inside the virtual enterprise brings to the cooperation its core competencies relevant to a well defined mission[37].

**Enterprise Identity:** Long term virtual enterprise supplies products or services with its own identity and profile to the market[37].

**No Formal Management Bureau:** Because of the need for fast speed to set up virtual enterprise, a great deal of trust must exist among members, so no formal management bureau is established, and each member is equal [37].
3.2.4. Benefits of virtual enterprise

As virtual enterprises have those characteristics as depicted above, it can lead to many possible benefits as depicted in the following paragraphs.

Benefits for organizations: Because cooperation potentials exist in virtual enterprises, organizations involved in are trying their best to do well, to improve their core competences in the market. This made competitions are drastic, many organizations would like to try to develop customized services and products, and this may increase their competitive abilities. Meanwhile, as organizations only need concentrate on core competencies and core activities, organizations can benefit from virtual enterprises through more economical connections with suppliers, greater opportunities to create revenue, more efficient operations, and reductions in administrative costs by a high level of self-service way. Moreover, diverse agencies within national or local governments can integrate operations to make it easier and more efficient to deliver services to constituents. Simplifying services delivery for multiple agencies in areas such as public services creates opportunities to simultaneously improve users’ experience and control administrative costs. And being able to integrate suppliers’ operations with organizations’ internal information systems, new opportunities can be created in some areas such as inventory control. [38]

Benefits for customers: Virtual enterprises supply one-stop facilities to customers. It can not only save time for customer, but also provide higher quality customized products and services, as the service in each member is more professional, and the use of ICT makes virtual enterprises can usually provide real time products and services.

Benefits for the market: Virtual enterprises work in dynamic and flexible ways. Big and small enterprises are combined to work; this made it can provide complex products and services, and the flexibility of products and services are also increased. This change can attract more customers, and make the competition more furious.

3.2.5. Management of Virtual Enterprise

Leimeister brought forwards four perspectives to manage the virtual enterprise, in the following introduced them as: the political economy approach, resource dependence approach, core competence theory and transaction cost theory [39].

Political Economy Approach: is described as an integrative framework which consists of the structure that it provides and its holistic approach. It improves interdisciplinary investigation and structures the analysis of research of organizations.

Transaction Cost Theory: focuses on economic efficiency aspects and explains the development and selection of governance mechanisms. Transaction costs are incurred for information and communication during initiation, arrangement, realization, control and adaptation of the interchange of services or products. Thus transaction cost can be considered as a scale for efficiency of organizational setting.

Core Competence Theory: illustrates that the success and failure of virtual enterprise are based on its unique or specific potentials, assets or resources. A strategy based on core competencies implies very often different types of cooperation, so it’s possible to identify an ideal size for organizational setting.
**Resource-Dependence Theory:** describes that within the virtual enterprise, involved members try to ally or cooperate with partners based on their assumption to perceive a benefit exceeding the cost of interaction. As social interactions do not have fixed prices and comprise only unspecific obligations, trust becomes a key issue for partners’ motivation to cooperate. Also the roles of power in exchanging relations influence the efficiency of organizational setting.

Moreover, the alignment of ICT, corporate strategy and business processes are crucial to efficiency and effectiveness of virtual enterprise setting. The relationships of these elements are shown in figure 7.

![Diagram](image)

**Figure 3-1** Relationship between ICT and corporate success[39]

Figure 3-1 shows corporate strategy and ICT-systems are influencing each other. Especially in the context of virtual enterprises, ICT seems to lie at the heart of the whole organizational setting. As it’s hard to assess how much the potential productivity can be gained if ICT is used, and the correlation between ICT-investments and productivity is hard to prove, the connection between ICT-investment and corporate success can’t be stated directly.

### 3.3. Enterprise Modeling

To remain competitive, virtual enterprises must produce products and services that are “of consistently high quality throughout the product/service’s life, customized to local market needs, open in that they may be integrated with other products/services, environmentally benign, and technically advanced” [40]. The key to achieve these capabilities is “agility” [40], which means the virtual enterprise should “continuously monitor market demand; quickly respond by providing new products, services, and information; quickly introduce new technologies; and quickly modify business methods” [40]. All the things that need to be modelled are the different business processes. It means the enterprise modelling is driven by business processes modelling. Meanwhile, it also said that “enterprise modelling is to offer different views on an enterprise” [41]. It means that there isn’t a single model that can describe all aspects of the enterprise, and all the models should “complement each other and thereby foster a better understanding of complex systems by emphasizing appropriate abstractions” [41]. The resulting enterprise model is the integration of the views. Thus, keep a consistency between different models that are used to illustrate different aspects of enterprise are very important.
3.3.1. Modelling Aspects

In order to achieve the consistency, an appropriate modelling techniques needs to be selected. It’s hard to find out any modelling techniques that can integrate all aspects of enterprise. No matter which modelling tool used, interrelated models should be required to describe the following two main aspects of an enterprise:

**Business perspective:** As businesses have to improve their relative and absolute performance, business perspective modelling needs to combine factors both internal and external of businesses. It includes customer satisfaction, financial performance, life cycle of products etc., which should be abstracted into data model, resources management model, business process model. To achieve successful management of these factors, businesses need to be able to monitor and improve their performance against strategic objectives, namely business processes management model, organizational model and quality management model.

**Technical Perspective:** Enterprise modelling techniques should support generic core of practical knowledge based modelling tools and methods for business application and be developed in accordance with existing and emerging standards in open systems and knowledge representation.

Considering this research only has 6 months, so only select the data model aspect and business process model to model the business perspective of the CHTVE, and the technical criteria will be introduce in section 3.5.

1. Business Process Modelling Methodology

The business process modelling is using the LFA (Logical Framework Approach) to analyze the whole business process. LFA is defined as a method to help one develop a clear framework for what a proposed project will do. It’s a method for developing a solid foundation and a clear layout for the project brief. Steps to do the logic framework are[42]:

- Analysis of the project’s context
- Problem analysis
- Objective analysis
- Plan of activities
- Resource planning
- Indicators/Measurements of results
- Risk analysis
- Analysis of assumptions

Analysis of the project’s context is the current situation description; the problem analysis is in section 4.8. All the following analysis is done in chapter 5.

2. Data Modelling Methodology

The data model is the basis for the definition of business processes, and it also helps to identify responsibilities for collection and updates of the information system, so the right selection of the data model is important for the business model[18]. As all real property transaction data are included in the cadastre and land registry, here chooses the Core Cadastral Domain Model as the data model of CHTVE. As an international standard for cadastral domain
model, the core cadastral domain model is accepted by FIG, OGC, and ISO. It solved problems in three aspects that exist in cadastral domain [43]:

- Computerization of cadastral data sets
- Data dissemination in a distributed environment which is a condition in case data are maintained by many different organizations
- Shared concepts and terminology in the cadastral domain

And the main advantages of the core cadastral domain model are:

- Avoids re-implementing same functionality again, and provides a basis extensible model driven approach
- Facilitate cadastral data exchange between in-country organizations and between countries

As the processes for how to maintain consistency between two related distributed system in case of updates etc is not covered yet. So in this research it is necessary to define the process of the data flow model to structure the data model in an environment, in which data are maintained by many different organizations. More detail introduction about Core Cadastral Domain Model is in section 5.7.

### 3.3.2. Modelling Tools

The enterprise modelling makes an enterprise-wide view of an organization is obtained and these models are able to be used as a basis for taking decisions, comparing, evaluating, simulating, controlling, analyzing, coordinating, communicating or monitoring parts of the enterprise. All these models can also be used for Business Process Reengineering (BPR), System Design, and System Integration. The design of virtual enterprise also needs to use modelling techniques and tools. In this thesis, the aspects to be taken into account are business processes and workflow aspects, and the modelling language is Unified Modelling Language (UML).

UML is a general purpose modelling language that includes a standardized graphic notation used to create an abstract model of a system. It isn’t restricted to any modelling software. It can not only be used for software development, but also for other non-software system, such as business process modelling. With UML, the different perspectives of enterprise can be modelled using different types of UML diagrams. In this thesis, the Use Case and the Activity Diagram have been selected.

Use cases provide scenarios that convey how the system should interact with the users called actors to achieve a specific goal or function. Use case actors may be end users or other systems. So the use case diagram describes relationship among uses cases and actors, and the main components of the use case diagram are the actors and use cases. The activity diagram represents the business and operational workflow of a system.

After the process model is designed, the supported tools are needed to execute these models at run time. The next section introduces available tools that can support virtual enterprise.
3.4. Workflow Management

The concept of workflow is defined by the Workflow Management Coalition (WfMC) who defined workflow as “the automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules”. Normally, a workflow comprises a number of logical steps, each of which is known as an activity. An activity can be done in manual way like a user or a workflow participant, or can be executed by machine resources. The “automation of a business process” is managed by a workflow management system, which “defines, creates and manages the execution of workflows through the use of software, running on one or more workflow engines, which is able to interpret the process definition, interact with workflow participants and, where required, invoke the use of IT tools and applications” [44]. Workflow systems automate the work between different parts of enterprise, or even dissimilar organizations’ systems together for a common mission, this make the integration between separated organizations possible.

The benefits of applying workflow management system can be summarized into tangible benefits and intangible benefits. [44]

Tangible benefits include:
- Reduced Operating Costs
- Improve Productivity
- Faster Processing Times

Intangible benefits include:
- Improved Services
- Improved Conditions for Employees
- Improved Change Management
- Quality
- Improved Communication
- Decision Support
- Improved Planning Capability
- Improved Deployment Capability
- Inter-Organization Communications

The concept of workflow automates the actual work and provides managers with the facilities to create virtual enterprise [44]. Specially, the communication is improved through the workflow system makes the workflow management system an important tool that supports processes which are across enterprises.

3.4.1. Workflow Deployment

The workflow is created based on the business processes. Accordingly, the workflow has a practical effect on business operations. The processes that happen are described as follows:

Before workflow- Before the execution of the workflow, customers need to fill in the application forms. The application forms could be sent by mails, E-mails, or just need to submit after filling them in the websites. Then the organization received an application with the requirements in a form which is listed by the customer. After that, the workflow is executed.
During workflow-The first activity in the workflow is to validate the application forms. And the workflow management system drives applications to create the acceptance, rejection letters or business contracts. Next, the application is replicated so that the workflow management system can execute many activities synchronously. This can reduce time taken to handle each application and improve customer services.

With workflow, other systems can be updated automatically, so the supervisors can only handle exceptions; decisions can be determined automatically in anytime of the day, which gives more business opportunities to organizations; and then approval processes is supervised, and dispatch the documents by fax or E-mail.

3.4.2. Workflow Component

With the development of the concept of object-orientation, WfMC specified the workflow enactment system as a component as it can conceal the complexity of the system, and the result of this work is the Workflow Reference Model, which is composed of five main models and five interfaces, and this reference model is shown as figure 3-2. The main function for each part in the reference model is described as follows:

![Workflow Reference Model](image)

**Process Definition Tools**

**Interface 1** is dealing with the passing Process Definitions from external tool to workflow engine where processes are enacted. The process definition consists of “a network of activities and their relationships, criteria to indicate the start and termination of the process, and statement of each activity, such as participants, associated IT applications and data, etc.” [44]. And Process Definition Language is used to do process definition. Right now Wf-XML is a popular process definition language and is used in workflow area. It realizes the aim that to enable users to employ many different process visualization tools with each workflow engine deployed, when workflow engines are set up together towards common goals.

**Workflow APIs (Interface 2 & 3)**-These interfaces make the users’ applications or inner invoked applications access the workflow management engine to enact processes (workflow enactment service), and at last the applications are implemented.
**Inter-Engine Workflow (Interface 4)**-Interface 4 gives mechanisms for one workflow engine requests another workflow engine to effect the selection, instantiation, and enactment of known process definition by that other engine. It is also responsible for passing context data (workflow relevant or application data) and receives back status information and the results of the enactment of the process definition. Thus, the workflow management system seems to be a transparent system to users. To facilitate communication between workflow engines, there is a requirement for audit data to be produced.

**Administration and Monitoring (Interface 5)**-This model supports analyses of consistent audit data across heterogeneous workflow products. The audit information can be used not only for analysis, but also for deriving status information, with a consistent format, and all events that occurred within a given set of criteria. Moreover, this model support current status inquiries by the process instance ID.

### 3.5. Enabling Technology, Standards & tools for VE

The Internet (Intranet and Extranet) together with Knowledge Management and Work Management are powerful enabling technologies of virtual enterprise. [46]

**Knowledge Management (KM)**: is a series of tools used to understand the market place, and the possibilities that are offered in various areas, in order to decide what to produce and how to produce it. It includes tools such as: document management, data warehouses, data mining tools, full text indexing, search agents, linguistic tools, semantic networks, intelligent document retrieval tools etc.

**Work Management (WM)**: is a collection of tools used to assist the work done for producing products and services. It includes tools such as E-mail, meeting scheduling, forum, collaboration tools, groupware, document management and workflow.

**Internet (Intranet and Extranet)**: enable massive deployment of KM and WM applications.

The list of standards on which virtual enterprise is reasonable to rely, covers the main tools to be used in KM, WM application and network. [46]

**TCP/IP**: supports communication protocol both over local and wide area networks. HTTP, HTML, XML, MIME, LDAP and SMTP are Internet standards can be made to ensure large deployment over the Internet, Intranet and Extranet.

**WfMC Workflow Standards**: are moving fast on top of the Internet technology and supports inter operation. Standards for workflow products defined in figure 3, and the interface 1 and interface 4 in it are essential to virtual enterprise.

**ActionWorks Software**: is business process management software. It consists of three basic components, which are part of the *Metro Environment*. The included components are:

---

1 *Metro Environment*: is the combination of hardware and software necessary to provide metro application to client web browsers via an Intranet and/or Internet. To be able to run the Metro Applications is necessary to have some supporting software: a database server, a web server and a mail server.

http://www.actiontech.com
• *ActionWorks Process Builder* is a tool to design and analyse business processes.
• *ActionWorks Process Administrator* offers quality control, administration and maintenance for the business processes created with the Process Builder.
• *ActionWorks Metro* is a web-base environment for delivering interactive, responsive workflow application for the Internet and Intranets.

*Altova XMLSpy*: is the industry-leading XML editor for modelling, editing, transforming, and debugging XML technologies[47].

### 3.6. Virtual Enterprise Creation Process

Based on the work of Luis [48], the creation processes for virtual enterprise are illustrated in figure 3-3.

**Figure 3-3 VE creation process**

The main processes as shown in figure 3-3 are:

- **Definition of the VE objective and final product or service**: This step is triggered by the collaboration opportunity, which is originated by a (potential) customer and detected by the real estate agency. The main actors involved in this step are the service agent and the customer.

- **Rough VE planning**: the rough structure of the VE is determined, which includes the required competencies and capacities, as well as the organizational form of the VE and the corresponding roles. The main actors are service agent and service assistant.

- **Partner search and selection**: The identification of potential partners, and their assessment and selection. The credit and the length of collaborative time can be referenced to decide
which partners to be selected. Main actors include service agent, service assistant, and partners.

- **Negotiation**: this process is to reach agreements and align needs with offers. Main actors involved are service assistant, and partners.

- **Detailed VE planning**: after partners have been selected and agreements have been drafted out, this step refines the VE plan and administrative principles. For example, the private policy, copyright, communication protocols etc. Main actors in this step are service assistant, partners.

- **Contracting**: the main tasks in this step are to formulate and model the contracts and agreements, also including the contracting process. Main actors involved are service assistant, partners.

- **VE launching**: is to put VE into operation, the application created by the Process Builder in the former section, which has been installed in the Metro Server, can be initiated and start to work in this step. Main actors involved are service assistant, WFMS administrator, and partners.

### 3.7. Concluding Remarks

As illustrated in Chapter 2, the common trend between real estate organizations is the cooperation and collaboration through network. Clients ask for professional and customized services in one stop shop. This phenomenon is one of clear examples of virtual enterprise according to the concepts presented in this chapter.

The concepts described in this chapter can support the collaboration of real estate organizations to be managed as virtual enterprise. The following chapters need to use these concepts and tools to define real estate information service virtual enterprise in China. Based on fieldwork findings, Chapter 4 will elaborate the current status of the real estate markets in China and found out the problems and solutions by comparison with good examples. The findings in chapter 4 will become the basis for proposing the business model.
4. An Overview of Chinese Commercial Housing Transaction

4.1. Introduction

In this chapter, the current situation of commercial housing transactions is viewed from several aspects, which includes legislative framework, and land registration system. Based on this information, the business process of current transaction is modelled by use case diagram and activity diagram, also the data model is modelled. Following that, the cost of the transaction is evaluated and compared with good examples in some developed countries. At last problems and solutions in current situations are found out by problem analysis.

4.2. Legislative Framework

4.2.1. Constitutional Framework about Real Property Law

It is clear from the Article 10 of Constitution of People's Republic of China to declare some basic things about property. The urban land belongs to the state; most of the rural or suburban land (except that claimed by the law belongs to the state) is possessed by collectivises. The land use right can be transferred according to special property laws, no one is allowed to dispossess, and trade or use other ways illegally transfers land. For public utility, the state can expropriate the land with the compensation to the original owner. The land should be used properly.

4.2.2. Special Laws about Real Property

According to the Constitution, two core special laws about real property are published, which are the Land Administration Law and the Urban Real Estate Administration Law. Land Administration Law aims at enhancing the management of the land and proper land uses to promote the sustainability of the land use. It is composed of four parts:

- Ownership and use right of the land;
- Land use general planning;
- Protection of agricultural land;
- Management of constructive land.

The major idea of the Urban Real Estate Administration Law is to strengthen the management of urban real estate, and it consists of 4 parts:

- Acquisitions of land use rights;
- Real property development;
- Real property transaction, including transfer, mortgage, lease;
- Real property registration.

4.2.3. Main Types of Rights

The main types of real property rights in China are presented in table 4-1:
Table 4-1 Main types of real property rights

<table>
<thead>
<tr>
<th>Type of Right</th>
<th>Subtype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Right of possession</td>
</tr>
<tr>
<td></td>
<td>Right of use</td>
</tr>
<tr>
<td></td>
<td>Right of getting income</td>
</tr>
<tr>
<td></td>
<td>Right of transfer</td>
</tr>
<tr>
<td>Use right</td>
<td>Right of use</td>
</tr>
<tr>
<td>Other rights</td>
<td>Right of pledge</td>
</tr>
<tr>
<td></td>
<td>Right of mortgage</td>
</tr>
<tr>
<td></td>
<td>Right of lease</td>
</tr>
<tr>
<td></td>
<td>Right of donation</td>
</tr>
<tr>
<td></td>
<td>Right of inheritance</td>
</tr>
</tbody>
</table>

4.2.4. Main Ways of Acquisition of Rights

The main ways of acquisition of a right in China are presented in table 4-2.

Table 4-2 Main ways of acquisition of a right

<table>
<thead>
<tr>
<th>Method of acquisition of a Right</th>
<th>Ways</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original acquisition</td>
<td>Construction of real property according to the law</td>
</tr>
<tr>
<td></td>
<td>Confiscation of real property according to the law</td>
</tr>
<tr>
<td></td>
<td>Confiscation of derelict real property to the state</td>
</tr>
<tr>
<td></td>
<td>Increments of real property according to the law</td>
</tr>
<tr>
<td>Continuative acquisition</td>
<td>Transaction of real property</td>
</tr>
<tr>
<td></td>
<td>Donation of real property</td>
</tr>
<tr>
<td></td>
<td>Exchange of real property</td>
</tr>
<tr>
<td></td>
<td>Inheriting of real property</td>
</tr>
</tbody>
</table>

4.3. Land Registration System in China

The registration system is based on the theory of land title registration and Torenssyhem. Some items to depict the characteristics of the land registration in China are shown in table 4-3.

Table 4-3 Characteristics of the land registration

<table>
<thead>
<tr>
<th>Item</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theories</td>
<td>Land title and Torenssyhem</td>
</tr>
<tr>
<td>Character</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Legal Requirement</td>
<td>Registration</td>
</tr>
</tbody>
</table>
### 4.3.1. Property Value in China

In China, the property value is composed of several parts. Main parts involved are land value and construction value, besides other minor parts include the cost to tackle problems, cost of finance management, cost of sale, cost of plan, cost of taxation, profits of the bank, interests of the developer etc.

The values are usually reflected by the price in the market. There are three kinds of property prices which are regularly published and updated by the government to guide the market in China, including:

- **Benchmark price:** The average price defined for homogeneous land area with the specific type of land use in urban areas. The principles to partition the homogeneous land area are:
  1. Similar land use;
  2. Conjoint land;
  3. Similar land price.

- **Demarcated price:** according to the benchmark price, and considering land use duration, plot area, shape, rate of capacity, location, market etc, the price for a specific plot can be defined by the government. And this price is used as the symbolistic price for parcels in a similar location, and similar land use.

- **Reset price:** the price is defined by the total cost to reset a specific house in a specific area.

### 4.3.2. Real Property Transactions

The term of *real property transaction* is defined as behaviours of transfer, mortgage and tenancy in the real property market. The *real property transfer* concerns the trade, exchange, and donation the property from the owner to other people. The *real property mortgage* concerns the deposit of the property as the insurance to repay a debt without change the possession of the
property, if the mortgager failed to repay the debt; the renter has the priority to auction the property to get back the debt. The *houses tenancy* concerns the leasehold of the use right and possession of the house by the payment of the rent.

### 4.3.3. Real Property Registration

Based on the Civil Code, the real estate transaction contract defines the relationship of the debt; it guarantees the performance of the debt and is protected by the law. After the signature of the contract, the performance of the contract includes two parts: one is the physical behaviour, which is executed through the exchange of the fund and the real property; the other is the legal behaviour, which is carried out through the real property registration.

The Urban Real Estate Administration Law stipulates that the land use right, house ownership and other rights related to the real property should be registered in local house administration bureaus; otherwise the law does not protect these rights.

In China, the general, initiation, transfer, variation, and abolishment and other rights should be registered. And following the registration, the declaration of the content of the registration should happen in 30 days, which includes:

- Description of the registered district;
- Time of the register application;
- Related certificates of the party;
- Registration authority;
- Other items.

### 4.3.4. Main Actors Involved in a Commercial Housing Transaction

Generally, the main actors that are involved in a commercial housing transaction in China are presented in Table 4-4:

**Table 4-4 Main actors involved in a commercial housing transaction**

<table>
<thead>
<tr>
<th>Public</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Administration Bureau</td>
<td>Real Property Agency</td>
</tr>
<tr>
<td>House Administration Bureau</td>
<td>Real Property Developer</td>
</tr>
<tr>
<td>Buyer</td>
<td>Bank</td>
</tr>
<tr>
<td></td>
<td>Insurance Company</td>
</tr>
</tbody>
</table>

### 4.4. Modeling the Commercial Housing Sale

This section models the commercial housing transaction in China. Here uses the UML use case diagram to show the interaction between actors and the system, and the activity diagram to represent the current existing business processes.

### 4.4.1. Use Case Diagram

The use case diagram in figure 4-1 shows interaction between the involved actors. The main actors participate in the process are the buyer who makes the transaction happen, and
communicates with other actors, the developer who sell houses to the buyer, the special officer in
the bank who supplies loan to the buyer, the insurance company who insures the house for the
buyer, the house and land administration bureaus’ officers who register the house and land, and
grant the certificates to the buyer. The detailed description for the basic course of the action and
the alternatives for a sale of a commercial apartment as they take place in China are in the
following paragraph.

![Diagram of the commercial housing transaction process]

**Figure 4-1** Use case diagram of the commercial housing transaction

**Basic Course:**

1. The **buyer** wish to make a purchase of the selected commercial apartment, this can have
   some support form a broker to do the preparation.
2. The **developer** and the **buyer** must meet to initiate the purchase process.
3. The **buyer** should examine the construction (normally, not yet) of the apartment and the
   reliability of the developer, for example, should check permissions from the relevant
   authorities on the real property, and all mortgage issues should have been eliminated.
4. The **buyer** and the **developer** negotiate about the purchase, and they may write a pre-
   contract, which they both sign. It is also possible to agree on some partial prepayment
   or a security deposit.
5. In the case of mortgage on the commercial apartment concerned appropriate agreements
   must be pre-arranged among the developer the buyer and the bank before the signature
   of the final contract (see alternative).
6. The **buyer** and the **developer** prepare the final contract. The buyer transfers the
   purchase sum and the buyer and the developer sign the final contract, and the buyer
   becomes the owner of the apartment.
7. The **developer** must pay the real property transfer tax to the tax authority concerned,
   which also checks the trustworthiness of the contract sum.
8. The **tax authority** also registers the purchase price in its database.
9. After the **developer** finishes the construction, the **buyer examines** the quality of the
   apartment for any possible deviations from the final contract (usually, the negotiation is
   necessary here to solve disputes).
10. The buyer gets the physical possession right of the new apartment.
11. The developer must represent the buyer to submit the request for registration to the house registry to get the legal ownership right.
12. The house registry issues the ownership certificate to the buyer.
13. The house registry changes the ownership and updates in the house registry database.
14. The developer must represent the buyer to submit the request for the subdivision of the land registration to the land registry to get the land use right.
15. The land registry issues the land use certificate to the buyer.
16. The land registry changes the land use right and updates data in the land registry database. This registry completes the transaction.

Alternatives:
In connection with the pre-contract and the final contract the buyer and the developer negotiate with the bank about the loan.

1. The buyer and the developer agree on a loan, buyer submits a request to the bank.
2. The special officer of the bank examines the pre-contract and other necessary documents about the buyer ought to collect and decide whether the loaning is permitted.
3. The bank agrees with the developer and the buyer to give a loan by mortgage the apartment.
4. The developer signs the assurance contract with the bank to make sure the apartment can finish the construction on time.
5. The buyer signs the mortgage contract with the bank to mortgage the apartment to the bank for a loan.
6. The buyer submits a request for mortgage registry to the land administration bureau to register the mortgage.
7. The land administration bureau issues the mortgage certificate.
8. The buyer submits an insurance request to the insurance company to insure the apartment.
9. The insurance company examines the request and related documents.
10. The insurance company agrees with the assurance, and the buyer pay for the entire premium at one time (duration of insurance is equal or more than duration of the loan).
11. The insurance company issues the invoice.
12. The buyer submits the mortgage certificate and the insurance invoice to the bank.
13. The bank grants the loan.
14. After the developer submits the house ownership certificate and land use certificate, the bank cancels the insurance contract.
15. After the buyer pays off the entire loan, the bank cancels the mortgage contract, loan contract, and returns back the house ownership certificate and land use certificate.
16. The buyer gets the house ownership certificate and land use certificate, and the transaction is completed.
4.4.2. **Activity Diagram**

*Figure 4-2 Activity diagram of the commercial housing transaction*
The activity diagram in figure 4-2 represents activities that happen in each organization, and the relationships of activities are described by the direction of the arrows. As shown in the diagram, first of all, the buyer prepares for purchase. The transaction really begins from the moment when the pre-contract is signed. After that, at least 1000€ should be paid as a deposit. Then the task for the client is to make sure the other 70% can be paid by loan or by other ways. If they don’t want to ask for a loan, they can pay for the house at one time or by stages before the developer transfers the new house. Else they can request a loan from the bank by mortgage the new apartment by the insurance of the developer to guarantee that the construction of the apartment can be completed on time and the certificates about the apartment can be gained from the government bureaus, the house ownership certificate and land use certificate can be given to the bank before the loan is returned back, and the apartment is insured in the insurance company to make sure if the house is damaged, the insurance company can repair the apartment to insure that the value of the apartment doesn’t change, so even the loanee can’t return back the loan, the bank can get back the money by selling the apartment. So before the buyer sign the loan contract with the bank, the buyer should sign the mortgage contract with the bank, the developer should sign the insurance contract with the bank, and insures the apartment in the insurance company which should pay the insurance fee until all the money has been returned back to the bank. After the developer get all the money, and the construction of the house would be finished, the house can be physically transferred to the buyer, and the legal transfer happens when the apartment ownership is registered in the house administration bureau and land use right is subdivided in the land administration bureau, but the buyer can't get the house ownership certificate and land use certificate until the entire loan and interest is returned back to the bank.

4.5. Commercial Housing Data Model

The data models for each local real property administration bureaus are different, but they are based on the same principle that from the guideline of the Ministry of Construction. Here takes the data model of the Changzhou Real Property Administration Bureau as an example to show the structure of the commercial housing data storage in China [49], see figure 4-3.

There are three datasets: spatial datasets, attributive datasets, and ichnographic datasets. The spatial datasets contain images, topographic maps, cadastral maps and building shapes to show the location, the geographic environment, geometry etc. of the property. The ichnographic datasets give the ichnography of the specific real property, which include the apartment ichnography and the floor ichnography. The data source of the spatial datasets and ichnographic datasets is from survey and mapping, and GIS is used to manage and maintain these datasets. The attributive datasets include parcel attributes, building attributes and apartment attributes, which are created from the transaction, management and other management processes in the administration bureaus that happen every day, and they will be updated as soon as changes occur. The common fields can connect these datasets. For example, the parcel map can be connected with parcel attributes by the common field parcel number.

It has to point out that the data model here is only used in house administration bureau, there is a separate data model in land administration bureau too, which also includes the parcel
information, fundamental geometry information etc. These datasets in the two bureaus are not cooperated because disputes in power and decision-making. Conflicts and restraints are derived from the data redundancy and inconsistency between the two systems. Because of the separation of the two bureaus, the redundancy and inconsistency of the data management cause many problems during transactions. Moreover, for each transaction should do registration twice, one for land, and another for house, the procedure is complex and time cost is high, see section 4.6.

![Conceptual data model of the commercial housing](image)

**Figure 4-3** Conceptual data model of the commercial housing [49]

### 4.6. The Cost Evaluation of the Property Transactions

Based on the investigation in the fieldwork, the criteria for evaluating the cost in “Real Property transaction” COST G9, and the criteria in “Doing Business in 2005” from World Bank for evaluating the transaction cost, here chooses the capital expenses and the duration for the buyer as the alternatives to evaluate the cost of the property transactions.

#### 4.6.1. Expenses in Real Property Transactions in China

Expenses for the buyer during the real property transaction are presented in the table 4-5:

**Table 4-5** Types of expense

<table>
<thead>
<tr>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract tax</td>
</tr>
<tr>
<td>Fund for the maintenance of common facilities</td>
</tr>
<tr>
<td>Transfer tax</td>
</tr>
<tr>
<td>Stamp tax</td>
</tr>
<tr>
<td>Payment for the lawyer</td>
</tr>
<tr>
<td>Registration fee</td>
</tr>
<tr>
<td>Others</td>
</tr>
</tbody>
</table>

Contract tax of commercial housing in sales is:

- 2% of the property price for ordinary apartments (the property price <=500€/M²);
- 4% of the property price for high-class apartment (the property price > $500\€/M^2$). Fund for the maintenance of common facilities in sales is 2% of the property price. Transfer tax is paid by the following formula: Transfer tax = $0.3\€/M^2 \times \text{Areas of the property}$, (about Property price * 0.1%). Stamp tax of the commercial housing in sales is 0.1% of the property price. Payment for the lawyer is about 60\€.

For the competition of the transaction, registration in the property register authority is needed. The expense for ownership registration is 8\€ for each apartment. Other expense is about 20\€ for each transaction. Additionally, if the buyer asks for a loan by mortgage, extra expenses should be included:

- The mortgage registration fees, which are listed in table 4-6:

<table>
<thead>
<tr>
<th>Mortgage sum (x)</th>
<th>Rate</th>
<th>Expense</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower than 50,000\€ (including 50,000\€)</td>
<td>0.08</td>
<td>40 (\€)</td>
</tr>
<tr>
<td>Between 50,000\€ and 100,000\€</td>
<td>0.06</td>
<td>(x-50,000)*0.06%+40 (\€)</td>
</tr>
<tr>
<td>Between 100,000\€ and 300,000\€</td>
<td>0.04</td>
<td>(x-100,000)*0.04%+70 (\€)</td>
</tr>
<tr>
<td>Higher than 300,000\€</td>
<td>0.02</td>
<td>(x-300,000)*0.02%+150 (\€)</td>
</tr>
</tbody>
</table>

- The insurance fees, which are listed in table 4-7:

<table>
<thead>
<tr>
<th>Insurance duration (years)</th>
<th>Rate</th>
<th>Expense</th>
</tr>
</thead>
<tbody>
<tr>
<td>1~5</td>
<td>0.001</td>
<td>0.001*property price</td>
</tr>
<tr>
<td>5~10</td>
<td>0.0008</td>
<td>0.0008*property price</td>
</tr>
<tr>
<td>10~20</td>
<td>0.0006</td>
<td>0.0006*property price</td>
</tr>
<tr>
<td>20</td>
<td>0.00045</td>
<td>0.00045*property price</td>
</tr>
</tbody>
</table>

Finally, some people may seek professional help from the real estate experts in real estate agencies; the fees are usually about 1% of the property price.

Above all, the total expense for the real estate transaction of average real property could be:

- Without loan, and without expert help: Property price*4.2%+88\€
- Without loan, and with expert help: Property price*5.2%+88\€
- With loan, but without expert help: Property price*4.3%+128\€
- With loan, and with expert help: Property price*5.3%+128\€

### 4.6.2. Duration of Real Property Transaction in China

The following description shows the minimum duration for each procedure in the recent commercial housing transaction in China, which is from the initiation to the completion of the transaction. Additionally, the case of loaning is also taken into the consideration.

**Basic Courses:**

1. Buyer seeks professional help from the real estate agency 1d
2. Buyer examines the contraction and the reliability of the developer 1d

\(^2\) The meaning of d is days.
3. Buyer and developer meet and initiate the purchase by signing the pre-contract and deposit the prepayment 1d
4. Buyer and developer prepare and sign the final contract 1d
5. Buyer and developer pay the tax to the tax authority 1d
6. Physical transfer of the new apartment 1d
7. Legal transfer of the new apartment by registering in the house administration bureau 30d
8. Subdivision of land registration in land administration bureau 25d

<table>
<thead>
<tr>
<th>ID</th>
<th>08 Nov 05</th>
<th>08 Nov 06</th>
<th>08 Dec 06</th>
<th>08 Dec 07</th>
<th>08 Dec 08</th>
<th>08 Dec 09</th>
<th>08 Dec 10</th>
<th>08 Dec 11</th>
<th>08 Dec 12</th>
<th>08 Dec 13</th>
<th>08 Dec 14</th>
<th>08 Dec 15</th>
<th>08 Dec 16</th>
<th>08 Dec 17</th>
<th>08 Dec 18</th>
<th>08 Dec 19</th>
<th>08 Dec 20</th>
<th>08 Dec 21</th>
<th>08 Dec 22</th>
</tr>
</thead>
</table>

**Figure 4-4** Minimum duration of commercial housing transaction (without loan)

**Case of Loaning:**
1. Approval for the loan by the bank 15d
2. Sign contracts 1d
3. Mortgage registration in the house administration bureau 5d
4. Insure the apartment in the insurance company 1d
5. Submit the insurance invoice and mortgage registration certificate to the bank and the bank grants the loan 1d

| ID | 08 Nov 05 | 08 Nov 06 | 08 Nov 07 | 08 Nov 08 | 08 Nov 09 | 08 Nov 10 | 08 Nov 11 | 08 Nov 12 | 08 Nov 13 | 08 Nov 14 | 08 Nov 15 | 08 Nov 16 | 08 Nov 17 | 08 Nov 18 | 08 Nov 19 | 08 Nov 20 | 08 Nov 21 | 08 Nov 22 |
|----|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|

**Figure 4-5** Minimum duration of mortgage commercial housing

Above all, the minimum duration for real estate transaction of average real property could be:
- Without loan: 61 days (Registration duration 55 days)
- With loan: 84 days (Registration duration 60 days)

We can see that the registration in the bureaus takes the most part of the duration. Else, it has to be pointed out that the total calculation time (61 and 84 days) of the transaction is assessed for the ideal conditions of property purchase such as no delay at any institution, the real figure would be longer depending on many diverse factors.

### 4.7. Comparison of the Sale between China and Developed Countries

This section compares the current real property transaction in China to good examples in developed countries through aspects of transparency and cost, to find out what are the problems existing in Chinese current commercial housing transaction, and try to look for solutions for each problem.
4.7.1. Comparison of Transparency

1. Statement of the real estate transaction transparency

Transparency means letting the truth be available for others[50]. In 2004, Jones Lang LaSalle [27] defines the real estate transparency as “any open and clearly organized real estate market operating in a legal and regulatory framework that is characterized by a consistent approach to the enforcement of rules and regulations and that respects private property rights”. In 2006, new dimensions have been added to this definition: “the ethical and professional standards of private sector advisors, agents and brokers who are licensed to conduct business”. The methodology of the transparency survey includes five attributes:

- Availability of investment performance indexes
- Availability of market fundamentals data
- Listed vehicle financial disclosure and governance
- Regulatory and legal factors
- Professional and ethical standards

From the global real estate transparency index in 2006, the Chinese real estate transparency score is 3.50, which belong to low transparency. Compare to the transparency scores of developed countries, such as US 1.15, Netherlands 1.37, Chinese transparency needs more improvement.

The following comparisons are based on the attributes for transparency survey:

- Compare involved actors to find out problems about professional and ethical standards.
- Compare procedures to find out problems about regulatory and legal factor.
- Compare the disclosure situation of real estate information to find out problems about information disclosure.

It has to be pointed out that there each attribute for the transparency survey is not isolated; they overlay about some parts between each other. For example, many professional and ethical standards are also regulated in the regulatory and legal factors to make them perform more effective.

2. Involved Actors and professional standards in the Transaction

Table 4-8 Involved actors and responsibilities in real property transactions

<table>
<thead>
<tr>
<th>Actor</th>
<th>China</th>
<th>Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seller</td>
<td>Compulsory</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Buyer</td>
<td>Compulsory</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Real Estate Agency</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>Bank</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>Notary</td>
<td>Optional</td>
<td>Compulsory</td>
</tr>
<tr>
<td>House Administration Bureau</td>
<td>Compulsory</td>
<td>(Cadastral Agency)</td>
</tr>
<tr>
<td>Land Administration Bureau</td>
<td>Compulsory</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Insurance Company</td>
<td>(House) Compulsory</td>
<td>(Life) Compulsory</td>
</tr>
</tbody>
</table>

Involved actors are listed in the table 4-8; we can see there are following differences:

(1) Professional standards for private notaries in Netherlands include[51]:

---

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<tr>
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<tr>
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<td>(Cadastral Agency)</td>
</tr>
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<td>Compulsory</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Insurance Company</td>
<td>(House) Compulsory</td>
<td>(Life) Compulsory</td>
</tr>
</tbody>
</table>

Involved actors are listed in the table 4-8; we can see there are following differences:

(1) Professional standards for private notaries in Netherlands include[51]:

---
• Has special type of law degree
• Worked as assistant notary for > 6 years
• Appointed by the government (Crown) for a certain area, once business plan has been approved viable (before limited number)
• Has legal mandate for main functions
• Is trusted, independent advisor
• Also looks at some 3rd party interests

Because the function of the notary is not compulsory in transactions, and functions for Chinese notary are only verification of contract, requirements for professional ability of notary are very low, they are:

• Has passed the examination hold by the government.
• Worked as assistant notary for >2 years.

In Netherlands, functions of notaries can not only improve the validity of contracts, but also help submitting deeds and perform transfers of money, which simplify the transaction procedure.

(2) Different from China, the cadastral agency in the Netherlands works as the union of house administration and land administration bureaus, which manages commercial housing transactions by registrations of house and land together, but the separated management method in China need to register twice.

(3) Type of insurance for the loan is different between the Netherlands and China. In the Netherlands, the life insurance is combined with the loan to make sure that even the loanee loses the ability to repay the money, the insurance company can repay it for the buyer; but in China only the house be insured, the benefit of the buyer can’t be properly guaranteed.

(4) Roles of the real estate agencies hold different status between China and developed countries. In America, 80% [22] of all real property transaction are assisted by the real estate agencies. In China, we can see the status of real estate agencies from the questionnaire done by Sina.com[52], which are listed as follows:

• For the credit of the real estate agencies, more than 60% of interviewees totally don’t believe in real estate agencies.

• For those successful real property transactions, only 25% were done by real estate agencies, 27% by advertisements on the internet, 25% by the introduction of friends or relatives, 3% by advertisements in the newspapers or magazines, 13% by dispensing leaflets in communities, and 7% used in other ways.

• For those experiences with real property agencies, 54% of people have the experience of being cheated.

• For the reasons to rely on the real property agencies, 69% are because of lack of channels to promote transactions.

Compare the characteristics of real estate agencies in America and China; there are also many differences, which are listed as follows:

• Real estate brokers have higher level of education in America than in China. In America, More than 45% of them get the bachelor’s degree, 20% can master the foreign language very well, and all brokers should regularly attend related training courses and examination every year. In China, the regulation is not as strict as in America; many of brokers even don’t get the certificates.

• The cooperation and the use of the ICT are more popular by brokers in American than that in China. For example, the cooperation between agencies leads to the American MLS (Multiple Listing System), which makes 90% of the property sources are controlled by the agencies, the competition between agencies has changed from the house sources
into the quality of services, which makes the market more healthy[28]. However, Chinese agencies are lack of cooperation between each other, and the competition mainly focuses on house sources, other than concentrating on the quality of services.

- Most of the developed countries have their real property brokers’ guilds. For example, there are two brokers’ associations in America; more than 1 million brokers are members of these associations. These associations try their best to protect the reputation and benefits of brokers; they also regularly hold some training to improve the capacity of brokers. These associations make the brokers have good credit to serve in the society. However, currently, the strength of associations or organizations to regulate the behaviour of brokers is not strong enough, the credit and quality of brokers can’t be guaranteed.

3. Comparison of Procedures in the Transaction

The model of transaction procedures in the Netherlands is shown in figure 4-6. There are only two parties that the buyer and the seller should directly interact with, one is real estate agency, which is optional, and the other one is the notary, which is compulsory. Before signing the final contract, the real estate agency helps the buyer and the seller to collect information, contact the bank for a loan by the mortgage, and prepare the final contract. The procedures for the real estate broker do during the transaction include[53]:

- Listing a property for sale in the MLS to let all other agents in the community can see what the broker has listed for sale.
- Finding buyers, who have checked the information in the MLS.
- Negotiating the sale or purchase of a property.
- The seller’s broker prepares the final contract, and arranges the signature of the contract between the seller and the buyer. While signing the contract, the notary can be selected to witness the signature.
- Buyer’s broker negotiates with a bank to obtain mortgage financing.

After signing of contracts, the notary is responsible for following work, which includes [51]:

- Notary draws up deed
- Buyer (and his bank) pay all money to notary
- Notary checks cadastre for recent deeds

---

**Figure 4-6** Real property transaction model in the Netherlands
Parties and notary sign deed
Notary acknowledges official copies
Notary sends/brings two copies to Agency
Agency informs notary of safe arrival of copies
Notary checks cadastre for recent deeds
Notary pays out to seller, his bank, tax department, Agency, and keeps his own fee
Agency enters copy in public register (passive) and updates information in cadastre (active)
Agency stamps and returns other copy
Notary presents it to buyer as ‘ownership-doc.’

Compare procedures of Chinese real estate transaction with the Netherlands; we can see that:

- In China, the real property transaction has more procedures than that in the Netherlands. As indicated in “Doing Business in 2005” [54] that “the fewer procedures, the lower the cost, the shorter the time to resolve disputes- the better that businesses rate the efficiency and integrity of the courts and the more likely that businesses are to go to the judge the next a disputes arises.” The procedures in Chinese real estate transaction need a reform.
- Without the brokers’ credit system, most of clients in China, who are lack of professional skills, almost do all the work what real property agencies do in the Netherlands.
- As the institutional arrangement makes real property bureaus in China can only do passive work, which means clients have to attend two bureaus to do the legal transfer. Compared with the Netherlands, the work of the notary and the cooperation between cadastral registration and notary simplify the procedure and improve the transparency of the transaction, which makes the procedure of the real property transaction much faster and simpler for the clients.
- The popular use of the ICT, such as the use of MLS and the electronic connection between the notary and the cadastral registration increases the transparency of the procedures and improves the efficiency.

3. Comparison of Disclosure of Real Estate Information

The general real estate information disclosure is responsible by several departments in China, they are:
- Ministry of Construction: disclosure technique information about real estate.

The frequency for the information disclosure is once of every half a year. And the meetings for real estate information disclosure are also held. Contents of these meetings are:
- Real estate statistics information of 40 important cities of China;
- National or provincial real estate development index;
- National real estate policies and regulatory information;
- Real estate markets’ monitoring information.

Characteristics for this information disclosure are:
- The scope is about large area, but not each developer’s apartment information. So the information is very general, and the updating is very slow. It can reflect some trend in the marketplace and help investors to make decisions, but it can’t help average customers to get detail information to decide to buy which developer’s apartments. Detail information can only be gotten from developers, who are not as authoritative as the government.
- The main object of these information are governmental organizations, such as real estate transaction centre, bureau of construction, house administration bureaus etc, who use these information to do decision-making.
Real estate transaction information is stored in the information system of the real estate transaction centre. For the pre-sold apartments, registrations for this kind of transaction are called pre-sale registration, which is different from the formal registrations, as they are allowed be cancelled before formal registrations. So many developers make use of this point to register some pseudo transactions to make a phenomenon that their apartments have a good sale. The bad results are: in one hand, customers may be misled to buy their apartments in a hurry without considerate considering about the high price; one the other hand, the general information about the marketplace is reflect a pseudo boom, which can mislead the investors, even banks, whenever the price reached to a certain level that out of the ability for customers to afford, the real estate market will be in a crisis.

In many developed countries, any developer or private sellers’ property should be registered in the cadastral information system, and the cadastral information system is open to the public; average citizens can even search the detail cadastral information for any property. Correct transaction information can make sure the correct statistic information about the marketplace, which correctly leads investors, so the information disclosure leads a liquid market, and drives a good cycle for the development of real estate market.

4.7.2. Comparison of Cost

Based on the comparison of the model of real estate transaction between China and some developed countries, and the cost evaluation criteria of the “Real Property Transaction” in Cost G9, the following two sections give the cost-efficiency comparison of the real estate transaction between China and some developed countries (take Netherlands as an example) by aspects of the expenses and duration.

1. Expenses in Real Property Transactions:
   For an average house in the West, the price of which is about 200,000€, the expense of the transaction includes [51]:
   - Payment for the real estate agent: 2-3% of sales price
   - Payment for the notary: 1000-2000€ (about 0.5-1% of sales price)
   - Recordation fee 75€
   - 42€ for searches (include VAT (Value-Added Tax)) deed
   - 42€ for mortgages
   - Other fees 500€

   As many people in the Netherlands are used to ask for agents’ help, and 68% of the purchasers asked loan from banks by mortgage[55], so the total expense for the real estate transaction of average real property in the Netherlands should consider the mortgage fee and the payment for agents, which is about Property price * 4%. Compare the percentage of the expense of real property transaction between China and the Netherlands, we can find that, in the Netherlands, although the payment for the real estate agent takes a big part of the transaction expense, but the whole percentage of expense is less than the Chinese real property transaction. This reflects two points:
   - Resulting from the different institutional arrangement and activity procedures, compulsory taxes or fees during the transaction is less than Chinese real estate transactions.
   - Real estate agents have set up reliable statuses in the Netherlands; people would like to apply for their services even with a high commission.

2. Duration in Real Property Transactions:
From the World Bank report “Doing Business in 2005”, the duration for registering real property is only 5 days[56], and 3 days re-think time before register the contract[57], extra time should be spent on information collection, negotiation, contract preparation etc. The ideal duration for a whole property transaction in the Netherlands might be only 14 days which is listed as table 4-9:

<table>
<thead>
<tr>
<th>Name of activity</th>
<th>Time (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collecting information</td>
<td>1</td>
</tr>
<tr>
<td>Exam and check the house</td>
<td>1</td>
</tr>
<tr>
<td>Prepare contract by the agent (including mortgage)</td>
<td>1</td>
</tr>
<tr>
<td>Notary search deed and other information</td>
<td>1</td>
</tr>
<tr>
<td>Sign the contract</td>
<td>1</td>
</tr>
<tr>
<td>Re-think the transaction</td>
<td>3</td>
</tr>
<tr>
<td>Draft deed of transfer, payment of bill, submit to register</td>
<td>1</td>
</tr>
<tr>
<td>Property registration</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14</strong></td>
</tr>
</tbody>
</table>

Comparing the transaction duration between China and the Netherlands, we can see that:

- The credit system makes the examination procedure (several minutes) cost much less time than China (15 days).
- In the Netherlands, electronic transaction (the bank transfers the bill electronically, notary register the contract), electronic records storage (cadastral records, credit records etc.), telecommunication technology and internet techniques make the searching information and inter-operation between different organizations (Notary and the Dutch Kadaster) save much more time than manual ways in China, it can be reflected by the duration for registration (5 days in the Netherlands, 55 days in China).
- Remarkably, take the re-think time in the procedure in the Netherlands makes the transaction more considerate and humanistic, which can be used to reduce many disputes about the halfway transaction.

### 4.8. Problem Analysis for Current Commercial Housing Transaction

Based on the comparison between some developed countries and China, we can see that the commercial housing transactions in China have the lower transparency and higher cost than good examples. Here a list about the general problems and possible solutions in current transactions.

**P1:** The pre-sale system creates many problems in the real estate transaction.

- Customers can only get the information about apartments by advertising models, developers’ introduction and documents, whether the apartment will be finished as regulated in contacts or not, especially the detail data, like area, quality, or facilities, can’t be totally guaranteed by the un-completed construction. In this situation, risks of customers are increased.
- Many developers let their own staffs pretended to be purchasers to mortgage apartments, in order to get enough money for the completion of the construction. Because banks can only check the ability of the loanee other than the information about apartments (which is controlled by bureaus), when apartments really get some purchasers, the apartments are mortgaged again, which make risks of banks also increased.
- Many developers make use of pre-sale registrations to make fake prosperity of the real property markets, so many investors may be misled by the prosperous statistics, more investment would be put in the market, but the purchase power of buyers are declining, which makes the investment is hard to be gotten back, so many investors may bankrupt, and the market would be in danger. (See 2.7.1 3)

**Solution:** Propose to cancel the pre-sale system to reduce risks of customers and banks. Although it isn’t possible to implement right now, because right now, the real estate market have many developers to enter the market with enough financial support, so if suddenly stop them to sale apartments before finishing construction, these developers may bankrupt and apartment prices will become high, the whole market may be in danger. This system can only be implemented when the market have enough developers with strong finance. At the same time, propose banks submit the mortgage information to bureaus to register the mortgage with the detail information about the loanees and combine it with the apartment information immediately in the LIS (Land Information System) database, to make sure that each apartment is only mortgaged one time. The structure data model of the LIS and the use of ICT can achieve this.

**P2:** Land bureau and house bureau in China are separated organizations, they are responsible for their own markets separately, and have independent databases and register methods. This situation results in many land use right can’t match with the house ownership, and customers should apply to register twice in two bureaus which cost more time and money than registering only once like in many developed countries. Additionally, the data redundancies create extra costs for data management, and the inconsistency between databases make these databases are hard to link. Especially, many commercial apartments are in multi-storey buildings, so the same land is registered for several times, it easily creates redundancies and disputes.

**Solution:** One solution is merging the two bureaus together, and makes them administrated by the same standards and the same database which contains the fundamental cadastral data, legal cadastral data and fiscal cadastral data into one cadastral information system. But this solution may require many changes, not only the institution, but also some policies and laws, which are hard to implemented in a short period. Another solution is integrating the database by solving the conflicts that exist in the databases without changing the institutional arrangement; this research has done by Liu Lingling [58] in her MSc research, she used the federated data model to integrate both databases to solve this problem.

**P3:** The procedure inside each organization is hard to be monitored, especially, as the governmental bureaus lack of competition in the market, so procedures inside bureaus are hard to be monitored, which cost the significant time during the whole procedure as shown in figure 4-4.

**Solution:** propose to use ICT and structured data models to automate and monitor procedure.

**P4:** Customers’ benefits can’t be guaranteed without the verification of the contract.

**Solution:** propose the notary to be compulsory in the transaction to make sure the contract is valid. After the verification, the notary can be also responsible for contact with bureaus for the registration of the transaction and ownership of the apartment, which can make the procedure simpler and effective.

**P5:** Insurance companies only insure the property safety, so the safety of the customer can’t be guaranteed if the customer loses the ability to return back the money.
**Solution:** propose to change the property insurance for the mortgage into the life insurance to make sure that even the mortgagee loses ability to return back money; their benefits can still be protected. Moreover combine the insurance issue with mortgage issue to simplify the procedure.

**P6:** Customers do not trust brokers. Because many brokers are not professional, most of them only don’t have high education or even without the professional certificates. And they lack of ability to use the ICT to facilitate services. The management ability for brokers’ guilds is not strong enough to regulate the behaviour of brokers and lack of regular activities and trainings to improve the professional capacity of brokers.

**Solution:** Propose high requirements for the entering of brokers, and regulate and improve brokers’ professional behaviour through the monitoring and regular training, which is held by the guild, to improve the quality of brokers.

**P7:** The level to supply services in agencies is low, as agencies lack of cooperation between each other and low credit degree. They attract customers by house resources other than the quality of services.

**Solution:** Propose MLS to manage all the house resource in the country to change the competition between agencies from house resources into quality and quantities of services. And propose the guild enhance the ability to manage the credit of each broker.

**P8:** It takes long time for the bank to check the credit of customer to lower down the risk of the loan, and the procedure to prove the credit of the broker, real estate agencies, developers etc. are also takes time of customers.

**Solution:** propose the built of the credit system for citizens, real estate organizations, which can be used to search the credit scores for each participant in the society, to facilitate the work which needs the checking of the credit.

### 4.9. Concluding Remarks

This chapter gives an overview of Chinese commercial housing transaction. The second section indicated the structure of the real estate markets are shown by the legislative framework as the base. The third section described the background of the property transaction which includes land registration system, the land valuation, land markets, involved actors etc. The fourth section uses the UML to model the current commercial housing transaction procedures and evaluated the cost of the current model. The fifth section illustrated the data model. The sixth section did the cost evaluation for the transaction. The seventh section compared the Chinese current real property transactions with some good examples in developed countries by aspects of transparency of procedures and the cost-efficiency. In the eighth section, problems that exist in current situation were listed and solutions were proposed for each problem. According to the findings from this chapter, the following chapter will recommend a conceptual framework and business process for Chinese commercial housing transaction.
5. Business Model Redesign

5.1. Introduction

Based on the analysis of the current situation in China, good examples in developed countries, and the problem analysis results in chapter 4, this chapter uses the methodology of LFA [59] to manage and plan the design framework of the CHTVE research. The contents of this chapter include the conceptual frameworks, business process models and data model.

5.2. Objective analysis

Based on the problem analysis in Chapter 4, we can have the following objective tree in figure 5-1 to reflect which objectives we should achieve in this research.

![Objective tree of the research]

Figure 5-1 Objective tree of the research

In this objective tree, the core objective of this research is to improve the transparency of real estate transaction. To achieve this objective, the following objectives should be achieved:

- Good quality of services from brokers, agencies, and notaries, which is achieved by the improvement of professional and ethical standards;
- Correct information collection from market, which is achieved by improvement of policies;
- Unified information disclosure, which is achieved by the improvement of institutional arrangements;
- Efficient communication between organizations, which is achieved by the increase of technique supports
If the core objective is achieved, then the apartment price can reasonably reflect the right situation in the market. So it will have the following good effects:

- Liquid market, because correct information disclosure (apartment price, trend of the marketplace etc.) can lead investors invested properly.
- Harmonious society, as people have the balanceable purchasing power to own their homes.

5.3. Stakeholder Analysis

5.3.1. Purpose of analysis

The boundary of this research is described as in figure 1-2, which shows the objective of this research is to improve commercial housing transactions based on three indicators transparency, expense and duration. So the nature of the problem can be described as:

Which stakeholders should be involved in the projects (their roles and responsibilities)? What activities they should perform in the projects to achieve the goal of the project?

So the purposes for the stakeholder analysis can be subdivided into:

- To identify the interest, importance and influence of each stakeholder;
- To find out key stakeholders in proposed commercial housing transaction business process;
- To identify assumptions and risks about stakeholders;
- To understand interactions (communications) between stakeholders.

5.3.2. Stakeholder interest analysis

Selection criteria: is major concerning about the equitable distribution of benefits and costs, based on considering all those groups who in some way will be affected by the implementation in current transactions and the results of the problem analysis.

Tools: reviews about document and reports, semi-structured discussions and interviews with key people, field visit etc.

Stakeholders and their interests are listed in table 5-1.

<table>
<thead>
<tr>
<th>Table 5-1 Stakeholder interest table</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary stakeholders</strong></td>
</tr>
<tr>
<td>1. Customer</td>
</tr>
<tr>
<td>- Reliability/good quality</td>
</tr>
<tr>
<td>- Low expense</td>
</tr>
<tr>
<td>- Time consume</td>
</tr>
<tr>
<td>- Simplified procedures</td>
</tr>
<tr>
<td>2. Real estate agency</td>
</tr>
<tr>
<td>- Business volume</td>
</tr>
<tr>
<td>- Profits</td>
</tr>
<tr>
<td>- Professional improvement</td>
</tr>
<tr>
<td><strong>Secondary stakeholders</strong></td>
</tr>
<tr>
<td>3. Notary</td>
</tr>
<tr>
<td>- Business volume</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Stakeholder Group</th>
<th>Interests</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Bank</td>
<td>Business volume +/-</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Profits +/-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low risk +/-</td>
<td></td>
</tr>
<tr>
<td>5. Insurance company</td>
<td>Business volume +</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Profits +/-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low risk +/-</td>
<td></td>
</tr>
<tr>
<td>6. Developer</td>
<td>Sale volume +/-</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Insure to get money +</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Brand promotion +</td>
<td></td>
</tr>
<tr>
<td>7. Bureaus</td>
<td>Improve efficiency +</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Law enforcement +</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public information /image +</td>
<td></td>
</tr>
<tr>
<td>8. ICT company</td>
<td>Business volume +</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Profits +</td>
<td></td>
</tr>
<tr>
<td>9. Ministry of construction</td>
<td>Improve efficiency +</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Law enforcement +</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public information /image +</td>
<td></td>
</tr>
<tr>
<td>10. Ministry of Land &amp; Resources</td>
<td>Improve efficiency +</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Law enforcement +</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public information /image +</td>
<td></td>
</tr>
<tr>
<td>11. Institute of Real Estate Agents</td>
<td>Professional improvement +</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Standardization +</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public information /image +</td>
<td></td>
</tr>
<tr>
<td><strong>External stakeholders</strong></td>
<td><strong>Research direction</strong></td>
<td>8</td>
</tr>
<tr>
<td>12. Real estate researchers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Survey and mapping agency</td>
<td>Profits +</td>
<td>7</td>
</tr>
</tbody>
</table>

*Note: expected project impacts on various stakeholders’ interests can be classified into positive (+), negative (-), uncertain (+/-) and unknown (?). And the equal relative ranks of priority for each stakeholder are using “=” to mark out.*

From table 5-1, we can summarise stakeholders’ interests and their relevance to the project as:

- Interests of the primary stakeholders (customers and real estate agency) have the highest priority, so their interests are the most important indicators for the evaluation of the project.
- Main interests of secondary stakeholder can be divided into two classifications:
  - Private stakeholders: business volume, and profits
  - Public stakeholders: public image and law enforcement
Except that, specific profession interest with their professional benefits, such as the bank and insurance company concern about low risk, notary concerns about cooperated services, the developer concern about brand promotion etc.

Secondary stakeholders’ participation is the necessary precondition of the success of this project, so main interests of these stakeholders should also be considered in the evaluation.

- For external stakeholders, they don’t directly involve in the project, but outcomes of the project can benefit them. So their interests are not subjects of project management.

### 5.3.3. Stakeholders’ Influence and importance analysis

<table>
<thead>
<tr>
<th>Importance</th>
<th>Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>B</td>
</tr>
<tr>
<td>Low</td>
<td>A</td>
</tr>
</tbody>
</table>

**Figure 5-2** Stakeholder classification matrix

Figure 5-2 illustrates classifications of stakeholders, which is based on the level of the influence (horizontal axe), and the importance (vertical axe) in real estate transactions. Implications of each box are summarized as:

A. Stakeholders have high importance but with low influence on the research. This implies that they will require special initiatives to protect their interests (stakeholder 1).

B. Stakeholders with a high degree of influence on the project, and they are also of high importance for its success. This means project staff needs to construct good working relationship with these stakeholders, to ensure an effective coalition of support for the project (stakeholder 2, 3, 4, 5, 6, 7 and 8).

C. Stakeholders with high influence, therefore they can affect the project outcomes, but their interests are not targets of the project. Their needs should be carefully monitored and managed; otherwise they may be able to block the project (stakeholder 10, 11, and 12).
D. Stakeholders in this box, with low influence, and low importance to the project objectives, so they are unlikely to be subjects of project activities or management (stakeholder 9 and 13).

Those who can significantly influence the project or are most important are key stakeholders. So stakeholders in boxes A, B and C are the key stakeholders of the project.

To make sure the project can be successful, external factors about each key stakeholder, which are likely to influence the project, management should give assumptions as follows:

**Assumption 1:** the Ministry of Construction and the Ministry of Land and Resource can initiate the project; provide enough budgets and instruments and related regulations or policies to promote the operation of the project.

**Assumption 2:** Institute of Real Estate Agents can initiate the relevant standards and regulations for the improvement of agents’ professions.

**Assumption 3:** services provided by notary, bank, insurance company, bureaus and ICT companies can be described, accessed, combined, managed and evaluated. Else, they are willing to join in the project.

### 5.3.4. Participation analysis

**Table 5-2 Participation matrix**

<table>
<thead>
<tr>
<th>Identification</th>
<th>Inform</th>
<th>Consult</th>
<th>Partnership</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Real estate agency</td>
<td>Bureaus</td>
<td>Ministry of Construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Notary</td>
<td>Bank</td>
<td>Ministry of Land &amp; Resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insurance company</td>
<td>Developer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Customers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning</td>
<td>National Council</td>
<td>Real estate researchers</td>
<td>Ministry of Construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ministry of Construction</td>
<td>Ministry of Land &amp; Resources</td>
<td>Ministry of Construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Institute of Real Estate Agents</td>
<td>Institute of Real Estate Agents</td>
<td>Ministry of Land &amp; Resources</td>
<td></td>
</tr>
<tr>
<td>Implementation</td>
<td>Real estate researchers</td>
<td>Ministry of Construction</td>
<td>Ministry of Construction</td>
<td>National Council</td>
</tr>
<tr>
<td></td>
<td>Ministry of Land &amp; Resources</td>
<td>Ministry of Land &amp; Resources</td>
<td>Ministry of Land &amp; Resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Institute of Real Estate Agents</td>
<td>Institute of Real Estate Agents</td>
<td>Ministry of Land &amp; Resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Real estate agency</td>
<td>Notary</td>
<td>Ministry of Construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bank</td>
<td>Bank</td>
<td>Ministry of Land &amp; Resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insurance company</td>
<td>Insurance company</td>
<td>Institute of Real Estate Agents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Developer</td>
<td>Developer</td>
<td>Institute of Real Estate Agents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bureaus</td>
<td>Bureaus</td>
<td>Institute of Real Estate Agents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ICT company</td>
<td>ICT company</td>
<td>Institute of Real Estate Agents</td>
<td></td>
</tr>
</tbody>
</table>
In table 5-2, the project cycle stages are set against different kinds of participatory actions: from informing and consultation at the lowest extreme, to full control by stakeholders as the highest level of participation. Stakeholders are selected from the analysis of stakeholders’ interests. Here summarise which of them will be involved in participatory actions of the various kinds and at which stages.

5.3.5. Interaction analysis

The communication matrix illustrates who has contact with whom, how intensively, and how each stakeholder perceives this contact. Based on the current situation model and the result of the problem analysis, main communications between stakeholders can be shown in the table 5-3.

The communication linkages between stakeholders in table 5-3 can be explained as follows:

- In the first column, it reflects that the customer is fully responsible by the real estate agency. As some specific procedures need the participation of the customer, such as with the developer, the notary, the bank and the insurance company, so there need some communication between customer with those organization, but real estate agency acted as the intermediary for every communication.
- In the second column, we can see that, real estate perform the purchasing procedure by communicating with the notary, bank, insurance company and developer.
- In the third column illustrates the notary’s work needs the participation of the bank and bureaus. The bank helps notary to perform the transaction, and bureaus are working together with notary about the registration issues.
- In the fourth column shows the bank should communicate with insurance company to reduce the risk for the loan.
- In the seventh column, the bureaus information needs the help of the ICT Company to manage and disseminate to the public.
Table 5-3 Communication matrix

<table>
<thead>
<tr>
<th></th>
<th>Customer</th>
<th>Real estate agency</th>
<th>Notary</th>
<th>Bank</th>
<th>Insurance company</th>
<th>Developer</th>
<th>Bureaus</th>
<th>ICT company</th>
<th>Ministry of Construction</th>
<th>Ministry of Land and Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real estate agency</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notary</td>
<td></td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Insurance company</td>
<td>●</td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Developer</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Bureaus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>ICT company</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Ministry of Construction</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Ministry of Land and Resources</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

=Strong communication linkage; (Direct contact, without mediators)
=Middle communication linkage; (Contact through mediators)
=Weak communication linkage. (Without contact)
5.3.6. **Use of findings of stakeholder analysis**

With the results of the stakeholder analysis, key stakeholders’ roles and responsibilities, the participation at each stage and interactions between stakeholders can be directly used in the proposal modelling, and interests of key stakeholders can be used in monitoring and evaluation.

5.4. **Logical Planning Framework**

<table>
<thead>
<tr>
<th>Table 5-4 List of goals, performance measures and initiatives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Goal</strong></td>
</tr>
<tr>
<td>1. Better service for real estate purchasers</td>
</tr>
<tr>
<td><strong>2. Purpose</strong></td>
</tr>
<tr>
<td>1. High transparency of real estate transaction</td>
</tr>
<tr>
<td><strong>3. Outputs</strong></td>
</tr>
<tr>
<td>1. Improved professional and ethical standards</td>
</tr>
<tr>
<td>2. Improved policies</td>
</tr>
<tr>
<td>3. Improved institutional arrangements</td>
</tr>
<tr>
<td>4. Increased technique support to automate operations</td>
</tr>
<tr>
<td><strong>4. Activities</strong></td>
</tr>
<tr>
<td>1. Initiate professional and ethical standards about the brokers, developers, and notaries and undertake training courses regularly</td>
</tr>
<tr>
<td>2. Cancel pre-sale policy, and propose proper policies</td>
</tr>
<tr>
<td>3. Combine land and house administration bureaus, and cooperation between bureaus and notaries, enhance cooperation between banks and insurance companies.</td>
</tr>
<tr>
<td>4. Structure data model, develop virtual enterprise communication network, and install WFMS</td>
</tr>
</tbody>
</table>
Based on results of the problem analysis, subjective analysis and stakeholder analysis, Ministry of Construction and Ministry of Land and Resources have to conduct several initiatives to achieve those objectives mentioned in section 5.2 to the reality by initiating certain activities for the improvement of real estate transactions. The goal to be achieved, purpose, outputs, activities, inputs, indicators and assumptions of this project are shown in table 5-4.

It has to be pointed out that, considering about the time for this research, more detail work about activities 1, 2, and 3 will be analyzed in the future work, this thesis mainly focus on the activity 4.

5.5. Proposed Conceptual Architecture of CHTVE

![Proposed conceptual architecture](image)

Figure 5-3 Proposed conceptual architecture

These components and activities for each component in the commercial housing transaction virtual enterprise come from the current context of this research in China, results of the problem analysis about the current context (see section 4.8), objective analysis, stakeholder analysis, and also use researches about the trend of the real property transaction as references. Figure 5-3 shows a conceptual architecture of the proposed CHTVE with the real estate agency as an intermediation to organize the real estate transaction. The detail explanations about this architecture are in 5.5.1 and 5.5.2.

5.5.1. Involved Components and Activities

The conceptual architecture of CHTVE involves the following components:

*Real estate agency:* The goal of real estate agency here is still to promote the transaction to happen. But the difference is that the focus of the agency is the quality of the service, other than the volume of the sources of the real property. As described in chapter 2, service chain for one-stop services, customer-focus principle and the core competence for each organization are the trend in the new era for real estate information services in developed countries, and the characteristics of the virtual enterprise and workflow management tools in chapter 3 reflect that
the concept of virtual enterprise with WFMS can be one solution for the new trend of real estate information services.

**Credit System:** The credit system is one component of the national information infrastructure, it is created and maintained by the government (Municipality), but the data source providers are guilds or civil administration departments. Here, the credit system can be used to check the credit of any natural person or non-natural person (organization). It facilitates the work of the mortgage by checking the score of the loanee [55], and improves the reliability of the agencies and brokers. Moreover, the selection of service nodes for each transaction can also be decided by checking the credit system for each service provider, which can facilitate the work of the agency.

**LIS:** LIS is the storage centre of the cadastral information. The property administration bureau is responsible for the management of the LIS, but the technical support comes from the ICT companies. The LIS is composed of two main sub-systems, which have the common database, one is Property Register System, and the other is Cadastre, which supply the information services for each service node to fulfil transaction[60]. For example, the notary can verify the cadastral record through the check of the LIS before he/she perform transactions. Information services inside the LIS are obtained through the Geo-information Service Infrastructure (GSI) that covers a large range of information services supplies, so the LIS can afford the largest quantity of property information services. According to the ICT support from ICT companies, those information service about the property is generated inside or acquired from outside, such as register records, subdivision parcels etc, can be supplied to public users.

**Service Nodes:** Service nodes include public organizations and private organization. Usually, the public organizations can’t be selected by agencies, they are unique and compulsory for each transaction, but for the private ones, there may be many congeneric or coordinative competitors. The competition between private organizations optimizes the services of the virtual enterprise.

Only bureaus are public services nodes, and they are responsible for the taxation and registration. Their work makes the rights of clients can be protected by the national laws.

Private service nodes include the bank, developer, notary, insurance company, and ICT companies. The function of the ICT companies has been described before.

Bank and insurance company work together to make sure that the even the loanee loses the ability to return back the loan; the insurance company can return back the money to the bank. The work way is referenced from the Dutch mortgage, it is like this: while the buyer mortgages the house for a loan from the bank, he bought insurance with the same sum from the insurance company at the same time. So he only needs to pay the insurance premium each month to the insurance company, after all the insurance premium has been paid to the insurance company, the money and interest can be paid to the bank at one time by the insurance company [55].

The way for notary to work is referenced from the Dutch notary[51]. They work as private practitioners, but serve public officials, which means that they go through legal duties. So requirements and management for the qualification of notaries are very strict, which can be referenced from the Dutch notary qualification requirements. They are responsible for preparation of transaction contracts, verifying contracts, performing transactions and registration submission etc. The notary in the whole transaction plays an important role.
Users: The users of the virtual enterprise include any parts that can use the property information, such as investors, appraisers, researchers etc. Especially, the service nodes inside the virtual enterprise at the same time are also users who can require from the agency to afford services. For example, the developer can require the agency for sales of their properties.

5.5.2. General Processes of the CHTVE

The general process in this virtual enterprise is: first, the service is initiated by the register of clients for required services in the agency from the website or the office; then, the search engine inside the agency searches related services and uses the credit system to decide which service providers should be selected to cooperate; after that, the WFMS engine defines workflows to fulfil the task, during which the WFMS monitors the whole procedure; at last, clients get the house with ownership certificates to end the transaction.

UML models in the following section illustrate the detail business process inside CHTVE.

5.6. Proposed Transaction Business Process Modelling

This section models proposed real estate transaction business process. Here uses the UML use case diagram to show the interaction between actors and the system, and the activity diagram to represent the order of activities of the business process.

5.6.1. Use Case Diagram

![Use case diagram of the proposed business process](image)

The use case diagram in figure 5-2 shows that the participating actors are the developer, the buyer, the broker, the bank, the insurance company, the notary, administration bureaus and ICT...
companies. All use cases for the whole business process can be grouped into pre-contracting, contract, and registration. The broker leads the pre-contracting work; the notary leads the contracting work and the registration work to end the transaction.

### 5.6.2. Activity Diagram

![Activity Diagram](image)

**Figure 5-5** Activity diagram of the proposed business process

Detailed description for the course of actions of proposed business process is in figure 5-3.

**Pre-contracting:**
1. Broker looks for the required apartment in the MLS.
2. Broker accompanies the buyer to examine the apartment, and checks the data about the developer in the credit system, and other related information.
3. Broker and the buyer negotiate with developer.
4. Sign the pre-contract and pre-pay the deposit.
5. Broker negotiates with the bank for the mortgage loan.
6. Bank checks the credit records about the buyer to decide whether to loan or not.

**Contracting:**
7. Notary prepares the contract.
8. Notary, the developer, and the buyer to sign the contract.
9. Notary verifies the contract.
10. Bank grants the loan to the notary.

**Registration:**
11. Notary submits the registration to the bureaus.
12. Bureaus inform the notary the safe arrival of the submission, and update databases of LIS.
13. Notary checks the new record in LIS.
14. After the new record is verified, notary pays out to the developer, the tax authority, the real estate agency, registration bureau, and keeps his own fees.
15. Bureaus present ownership certificate to the notary, and then the notary gives it to the buyer to end the transaction.

After the transaction, the buyer only needs to return the insurance premium each month, and ICT companies can help supplying information products and services to public users.

5.7. Proposed Structured Data Model

Combined bureaus need a structured data model to manage the cadastral information and register information (Data model of the Land Information System). Here propose the Core Cadastral Data Model. Meanwhile, automation of the business process between organizations should be guaranteed by regulated data flows to update the data inside the LIS automatically, which can reduce the manual postpone in some procedures of the business process, especially procedures inside bureaus.

5.7.1. Core Cadastral Data Model

This data model is the most important part of the LIS, because it’s the basis for business process definition and identification of responsibilities for collection and updates of the information system. The core cadastral data model[61], which is proposed in figure 5-6, which includes object, person and right which connects the object and the person.

![Figure 5-6 Core cadastral data model in UML class diagram [61]](image)

Different colours in the model represent different parts:
- Yellow: legal/administrative aspects.
- Green: person aspects.
- Blue: object aspects.
- Pink: survey aspects.

Legal/administrative aspects: show that the sources are legal documents: certificates or contracts. Specially, the property can be mortgaged as the property right as an indemnity.

Objects: can be classified into four kinds of property: building, apartment, parcel, and part of parcel. Each parcel has a geographic description, which is originated from survey documents.

Persons: are the subjects of the cadastral data model, which are specialized into natural persons and non-natural persons (organizations).

### 5.7.2. Data Flow Model and Data Transfer Schemas

![Diagram](image)

**Figure 5-7** Proposed Data flows model

As the bureau works passively, lack of competition in the real estate market, here proposes a data flow model to improve its efficiency by automating its data flows. This structure of the model is based on the business process model that proposed in section 5.6, and contents of the datasets for each participant are based on the core cadastral model in 5.7.1. As shown in figure 5-7, each organization’s datasets can be directly sent into LIS database. Moreover, certificates and registration records can be generated automatically by the LIS. The data transfer between bureau and other organizations needs XML schemas to define required fields.

In XML the definition of a schema describes the contents of XML documents and enforces the use of defined types, thus providing criteria for validating the contents. The description elements for schemas have been selected according to the guidelines of the development of the generic model of core cadastral domain model[62].

1. **XML schema for bank**

The mortgage registration datasets defines registration items for the mortgage in the bank. Identification elements are the ID the `Mortgage_Doc_NO`. 
Figure 5-8 Proposal for bank schema

2. **XML schema for survey & mapping agency**

   Fundamental spatial datasets include four kinds of datasets: spatial framework datasets regulate the coordination, maps sheets numbers etc., which is used as the basic definition; topographic datasets show the roads, buildings etc. as the base map; ortho-images supply a geographic reference; cadastral datasets contain the description items about parcel, part of parcel, building and apartment, the identifier elements are the Parcel_NO, Part_NO, and Apart_NO.

Figure 5-9 Proposal for survey & mapping agency schema

3. **XML schema for notary**

   The title registration datasets contain owner, parcel and rights information, which regulate the legal relationship. Identifiers elements are ID, Parcel_NO and Title_NO.
4. Data schema for tax authority

Taxation datasets consist of the information of the subject (Tax_Payer), information of the object that the tax comes from, improvements information that referenced to assess the value of the object, information about the assessment and the valuation. Identifiers elements are payer’s ID and Parcel_NO.

Figure 5-10 Proposal for notary schema

Figure 5-11 Proposal for tax authority schema
As we see from the figure 5-8 to figure 5-11, there are some common elements exists in each schema, the LIS database management system can automatically identify those common elements to combine these schemas into one database. XML definition for notary schema is put in appendix 5-1 as an example. The maintenance of the database is done by ICT companies, which are also supporting the dissemination of those data.

5.8. Statement of the Feasibility of CHTVE in China

The proposed business model, which begins with the recognition of the market opportunity or a buyer demand and executed by the groupware, can’t be fulfilled by the existing process and resource in China right now. Two main reasons are: Firstly, creation of the virtual enterprise is based on many fundamental infrastructures. On one hand, although some of them have been built up, such as the legislative framework of property transaction, the telecommunication infrastructure, WANS, some LANs, they are not implementing efficiently and properly. Furthermore, many are not built up yet, such as SDI, credit system, life insurance and mortgage combination, LIS (Land Information System) based on the core cadastral model, related guilds and laws which are used to regulate and promote the development, institutional arrangement etc. Secondly, the Chinese real estate market is not mature enough to use this concept of one-stop service in property transaction. Because, right now, the competition of the real estate market is the competition of the quantity of the house resource other than the quality of service, so participants don’t want to cooperate to share the resources, which make the virtual enterprise lose the per-requisite, but with the development of the market economy, clients would play a more and more important role, consequently the quality of the service will be emphasized, so one-stop service will be definitely happen in the future.

5.9. Concluding Remarks

In this chapter, the business process has been redesign following the methodology LFA. First, the objective of this research has been analyzed by the objective tree, and the sub-objectives are listed out. Second, the involved stakeholders have been analyzed. According to objective analysis and stakeholder analysis, the logical planning framework of this research is proposed. The detail work of this framework is achieved by the proposed conceptual architecture, business process models and the data model. In the following chapter, this proposed business process will be optimized with the WFMS.
6. Optimization and Operational Guidelines

6.1. Introduction

Workflows of proposed business process are optimized with the WFMS. Workflow applications are generated and ICT infrastructure is proposed for implementation, which is based on the operational guidelines for CHTVE.

6.2. Optimization of Proposal Business Processes with WFMS

In chapter 5, proposed business process has been modelled, and components of WFMS have been defined in Chapter 3. Based on these work, a business process modelling approach is used for optimization. The software that is used to draw Business Process Map (BPM) is Action Works Process Builder which is a powerful modelling and application development tool for mapping, simulating and analyzing business processes, and it also supports implementation of BPM without the need to write a line of program code [63]. In this section, the BPM will be created, which includes all participants, workflows, linkages, constraints, and conditions for passing work from one participant to another.

6.2.1. Workflow Analysis

First of all, identify the sub-processes that compose the business process. After that, define workflows based on the description of sub-processes. In this case, workflows are shown in table 6-1 with BP roles involved, and table 6-2 explains responsibilities for each BP role.

**Table 6-1 Workflows for commercial housing transaction**

<table>
<thead>
<tr>
<th>Name of workflow</th>
<th>Type</th>
<th>Customer</th>
<th>Performer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial housing transaction</td>
<td>Primary</td>
<td>Client</td>
<td>Service agent</td>
</tr>
<tr>
<td>Submit Request</td>
<td>Secondary</td>
<td>Client</td>
<td>Service agent</td>
</tr>
<tr>
<td>Check Request</td>
<td>Secondary</td>
<td>Service agent</td>
<td>Service assistant</td>
</tr>
<tr>
<td>Send Reject Letter</td>
<td>Tertiary</td>
<td>Service agent</td>
<td>Service assistant</td>
</tr>
<tr>
<td>Grant a Broker</td>
<td>Tertiary</td>
<td>Service agent</td>
<td>Service assistant</td>
</tr>
<tr>
<td>Define Workflow</td>
<td>Secondary</td>
<td>Service agent</td>
<td>WFMS administrator</td>
</tr>
<tr>
<td>Inform to See Apartment</td>
<td>Tertiary</td>
<td>Client</td>
<td>Broker</td>
</tr>
<tr>
<td>Inform Requirements</td>
<td>Tertiary</td>
<td>Broker</td>
<td>Client</td>
</tr>
<tr>
<td>Negotiate</td>
<td>Tertiary</td>
<td>Broker</td>
<td>Developer</td>
</tr>
<tr>
<td>Fail Negotiation</td>
<td>Quartus</td>
<td>Client</td>
<td>Developer</td>
</tr>
<tr>
<td>Sign Pre-contract</td>
<td>Quartus</td>
<td>Client</td>
<td>Developer</td>
</tr>
<tr>
<td>Negotiate Mortgage</td>
<td>Tertiary</td>
<td>Broker</td>
<td>Bank clerk</td>
</tr>
<tr>
<td>Deliver Reject Letter</td>
<td>Quartus</td>
<td>Client</td>
<td>Bank clerk</td>
</tr>
<tr>
<td>Sign Mortgage Contract</td>
<td>Fifth</td>
<td>Client</td>
<td>Bank clerk</td>
</tr>
<tr>
<td>Sign Insurance Contract</td>
<td>Fifth</td>
<td>Client</td>
<td>Insurance clerk</td>
</tr>
<tr>
<td>BP ROLE</td>
<td>DESCRIPTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client</td>
<td>Those who request to buy a new apartment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service agent</td>
<td>Receive request and deliver final product.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service assistant</td>
<td>Approve requests, and check completeness, notify information to clients.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broker</td>
<td>Look for information, negotiate with parties, and prepare pre-contract.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developer</td>
<td>Supply apartment sale service.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WFMS administrator</td>
<td>Define the Workflow for each task.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank clerk</td>
<td>Supply mortgage service.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insurance clerk</td>
<td>Supply life insurance service.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bureau officer</td>
<td>Receive registry documents; update LIS, and present certificate.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notary</td>
<td>Prepare and verify contract, perform transaction, submit registration etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICT company</td>
<td>Supply public information.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 6.2.2. BPM for CHTVE

After defining BP roles in the Process Builder, these BP roles can be granted to workflows. By defining constraints and conditions for each link, all these workflows can be linked together to fulfil the transaction task. The BPM for the commercial housing transaction VE is shown in figure 6-1. As seen in figure 4-1, the business process begins with the service agent submit the request of the client. If the service assistant found that the request is incomplete, then the reject letter will be delivered. Otherwise, the service assistant will send letter to show the acceptance of the application to the client. After that, the WFMS administrator will define the workflows and the cross-organization WFMS is triggered. The orders for the performance of the following workflows are the same as that proposed in the activity diagram, either parallel or series connection to each other. The grant of the certificate ends the performance part of the transaction. The last workflow is the acceptance part, whether the client is satisfied with the service or not is depending on the feedback.
Figure 6-1 Business process map for commercial housing transaction
6.2.3. Cycle Time

The Workflow Cycle Times function is used to set or calculate time values for any phase of each workflow in the business process[64]. It allows to quickly analyse the time spent for each stage in a business process. In this case, many workflows time is hard to be standard. For example, some workflows like “Inform to See Apartment”, “Negotiate” and “Negotiate Mortgage”, they may take time from one day to a few days depending on how long time the BP roles will take to make decisions. So, cycle time need to be determined later and only enter into the BPM as a theoretic number.

Only the logic consistency for the linkage passed the validation, the BPM can be used to create an application. Validation of the designed BPM is done, and is verified that it’s consistent.

6.2.4. Application Creation

In the Process Builder, the business process, which is made up of workflows and the relationship between them, has been defined. Now the application needs to be created to automate the process into the organization.

The requirements for building the workflow application are BPM, application forms for initiation (figure 6-2), status report, and response form, necessary interfaces for workflow users who are participating in commercial housing transaction, and datasets for roles, responsibilities, actions and profiles etc.

When all designing parts have been completed, the Metro package can be generated. The package is a zipped file, which contains all individual files that Metro needs for the business process, which can be executed and managed by the workflow engine and be accessible to the end users via Metro.

6.3. CHTVE Operational Guidelines

The application is then installed into the Metro server, which enables people to connect to the ActionWorks system and coordinate their work via the World Wide Web, using the ActionWorks Process Administrator. The CHTVE can be created, which follows processes introduced in section 3.6.

Proposed ICT infrastructure, which is referenced to the work of Vonk [65] and the technique introduction in section 3.5 are introduced in figure 6-3.

Figure 6-3 Proposed operational system architecture
The upper part is the agency, which is working as the host of the virtual enterprise, it is responsible for selecting the involved members and monitoring and controlling the whole procedure. The lower parts are service nodes, which supply services, such as mortgage service, insurance service, notary service etc. The gateway provides a communication mechanism to handle all communication between the involved organizations.

Each organization has its local workflow management system (WFMS), which executes separate processes inside the organization. The common server shields the cross-organizational infrastructure from the WFMS specifics. The common server maps the WFMS independent contract level processes to the WFMS dependent internal level processes. This way, the cross-organizational infrastructure is independent of the underlying WFMS, which can be different for each organization. Applications in each organization are used to fulfil services, which are normally distributed in the workstations and connected by the LAN (Local Area Network).

Users’ online access will be possible through the agency by the WAN (Wide Area Network), from where all types of services and products can be available for end users.
This infrastructure is highly flexible in the sense that, besides cross-organizational transaction management, other cooperative support services, such as Quality of Service, can be plugged into it, because the infrastructure consists of a software bus to which cooperative support services can be connected to execute groupware.

6.4. Concluding Remarks

In this chapter, two tasks have been fulfilled. First, the proposed UML models have been optimized with the WFMS through the Process Builder, and the created application can be directly installed in the Metro server to operate. Second, the operational guidelines have been described from the VE creation processes and ICT infrastructure.

Up to now, the main part of the design work is finished. The following chapter will give the summary, conclusion and recommendation for the whole work.
7. Summary, Conclusion & Recommendation

7.1. Introduction

This chapter gives a summary of this research, and conclusions in this research that has achieved follows. The last part is the recommendations for related researches in the future.

7.2. Work Has Been Done

As the land belongs to the nation and collectives, the central and local governments mainly control the land market, the second-hand housing market is just at the beginning, which can’t influence the whole market much; the commercial housing market dominates in the whole Chinese real estate market right now. Large demands of the commercial housing and the information asymmetry make the market mainly controlled by suppliers but not customers; the following consequences are house price increase rate is out of control, brokers have low credit, many reputes happen during house transactions etc. Meanwhile, the geo-information products and services conducted by Geo-ICT have achieved a big success in many developed countries. Therefore, propose a reasonable business model to supply integrated geo-information services to fulfil requirements of customers to improve the transparency and efficiency of the commercial housing transactions motivated this research.

In this research, the main objective is to design and validate a transaction business model to improve the transparency and efficiency of the commercial housing transaction in China by making use of the concept of virtual enterprise and techniques of workflow management system.

To achieve this objective, several methodologies have been conducted. Firstly, trends of real estate transactions have been deduced through publications in some famous serial seminars or publications such as COST G9, ITC academic outputs etc. Secondly, related concepts, business methods, techniques and tools have been reviewed through publications of technological organizations WfMC, ActionWorks, Altova etc. Thirdly, the current situation in China has been surveyed through the fieldwork, modelled by the UML, and compared with developed countries based on the criterion that is published by the World Bank which deduced the problem analysis about the current situation. Fourthly, a new business model, which includes the business process model and data model based on the publications of FIG, is proposed through the methodology LFA. Finally, this model is optimized and verified by Actionworks softwares and Altova XMLSpy; applications have been generated, which can be directly used in the Metro Server; and operational guidelines for the virtual enterprise are introduced.

7.3. Conclusions

After completing this research, answers for all research questions have been found out, which are listed in the following conclusions:

- As the real estate belongs to the immovable commodity, characteristics of which can cause the information asymmetry to impact the market, proper information services are important to reduce the negative impact of the information asymmetry. Moreover, compare to decentralized mode, the centralized transaction mode which is connected by agencies can better facilitate transactions by reducing the maximum number of contacts.
With the increase of using ICT in real estate information services, the tendency for real estate transactions in developed countries is one-stop information services. As the policy of market economy has a long history in developed countries, the real estate business is mature and healthy; the competition in the market is focusing on the quality and efficiency of services, one-stop service is the way for participants to satisfy customers with a small budget but large benefit.

To achieve the one-stop service way, participants are trying to hire modern business theories and high techniques to improve their capacities in the competition. Available concepts and technologies to support the cooperation and collaboration tendency of the real estate information services include the development of SDI and the future trend GSI, E-commerce, virtual enterprise, core cadastral model domain, cost of real property transactions, groupware applications such as WFMS, and transaction business process modelling techniques such as UML.

Compared with some developed countries, the Chinese real estate market is not such well developed. First, it can be reflected in the low transparency, including the complication of procedures, the lack of professional standards, and redundancy of institutional arrangements. Second, it can be reflected in the high cost of expense and duration.

Reasons for the low transparency and high cost of Chinese current real property transactions are the pre-sale policy, separated management of the land bureau and house bureau, the lack of ICT support such as credit system and the workflow inside bureaus, improper professional standards for brokers and notaries, and the lack of cooperation between relative organizations such as insurance company and bank.

The architecture of the virtual enterprise has been proposed by using the LFA methodology. Based on this methodology, initiate all analysis which are important for the framework planning of the redesign of the business process model, which include the goal and purpose of this research, the interest and responsibility for stakeholders, communication between involved actors, important assumptions for the success of this research, inputs, outputs and indicators to measure the performance of this research.

The UML has been selected as the business process and data modelling tools, which is supporting the implementation. And the XML schema has defined the schema for data transfer between different organizations.

The proposed business model can't be fulfilled in current China, as the CHTVE should base on the necessary changes in policies, institutional arrangements, professional standards, and ICT supports. These changes will happen in the future with the development of the economy, policy, culture, society of China.

Base on the business process model, the workflows has been generated and has been optimized with the WFMS, which prove that the WFMS is an appropriate tool to create and manage virtual enterprises supporting the design, integration, operation and control of processes which are provided as services by multiple enterprises.

The formation of the virtual enterprises should consider the business method to define an objective and final product or service, select the right partners, and define the business processes and the ICT infrastructure to accomplish them. And participants should have a common belief, share the common value and trust each other.
7.4. Recommendations

- The business process model and data model is just two aspects of the CHTVE. As an enterprise, the virtual enterprise should also include in the resource management, quality management, organizational management etc, which cover domains of culture, social, legal, technical, economic etc. These aspects need further researches for the CHTVE. And further investigation about tools to support other aspects of the CHTVE should also be taken into account.

- In this research propose many changes on the policy, institutional arrangement, and professional standards for participants, supported mechanisms etc. But there isn’t a detail implementation procedure for each of them. So further researches about the feasibility for each change, and the operational guidelines should are needed.

- This thesis only focuses on business process of the commercial housing transaction. In the future, the concept of VE should combine other types of property transactions, such as land transaction, and second-hand housing transaction, in order to use the same architecture to facilitate more businesses, to achieve the goal of one-stop services.
Appendix

Appendix 5-1 XML Definition for Notary Schema

<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSpy v2006 rel. 3 sp2 (http://www.altova.com) by system (International Institute for Geo-Information Science and Earth Observation (ITC)) -->
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  attributeFormDefault="unqualified">
  <xs:element name="Title_Registration_Datasets">
    <xs:annotation>
      <xs:documentation>Root element</xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:sequence>
        <xs:element name="Owner">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="Name" type="xs:string"/>
              <xs:element name="Type_of_Person">
                <xs:complexType>
                  <xs:attribute name="Non_Natural_Person"/>
                  <xs:attribute name="Natural_Person"/>
                </xs:complexType>
              </xs:element>
              <xs:element name="ID" type="xs:integer"/>
              <xs:element name="Address" type="xs:string"/>
              <xs:element name="Date_of_Birth" type="xs:date"/>
              <xs:element name="Nationality" type="xs:string"/>
              <xs:element name="Gender">
                <xs:complexType>
                  <xs:attribute name="Female"/>
                  <xs:attribute name="Male"/>
                </xs:complexType>
              </xs:element>
              <xs:element name="Religious" type="xs:string"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="Parcel">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="Title_NO." type="xs:integer"/>
              <xs:element name="Parcel_NO." type="xs:integer"/>
              <xs:element name="Type_of_Parcel">
                <xs:complexType>
                  <xs:attribute name="NPRegion"/>
                  <xs:attribute name="ServingParcel"/>
                  <xs:attribute name="RegisterParcel"/>
                </xs:complexType>
              </xs:element>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
<xs:element name="Address_of_Parcel" type="xs:string"/>
<xs:element name="Parcel_Area" type="xs:float"/>
<xs:element name="Parcel_Use">
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    <xs:attribute name="Residential"/>
    <xs:attribute name="Commercial"/>
  </xs:complexType>
</xs:element>
<xs:element name="Neighborhood_Parcels" type="xs:integer"/>
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  <xs:complexType>
    <xs:sequence>
      <xs:element name="Real_Rights">
        <xs:complexType>
          <xs:sequence>
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            <xs:element name="Subdivision" type="xs:string"/>
            <xs:element name="Mortgage" type="xs:string"/>
            <xs:element name="Sell" type="xs:string"/>
            <xs:element name="Easement" type="xs:string"/>
            <xs:element name="Leaseholde" type="xs:string"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="Date_of_Registration" type="xs:date"/>
      <xs:element name="Commencement_Date" type="xs:date"/>
      <xs:element name="Expire_Date" type="xs:date"/>
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  <xs:complexType>  
    <xs:sequence>  
      <xs:element name="Restriction_Doc._NO." type="xs:integer"/>  
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  </xs:complexType>  
</xs:element>  

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      <xs:element name="Type_of_Doc." type="xs:string"/>  
    </xs:sequence>  
  </xs:complexType>  
</xs:element>  
</xs:schema>
Reference

7. Ministry of Construction, P.R.China., Announcement about the Fund Transfer of Real Estate Agencies, R.E. Department, Editor. 2006.


**Internet Resources:**
http://www.doingbusiness.org/
http://www.realtor.org/
http://www.owners.com/
http://costg9.plan.aau.dk/
http://www.cin.gov.cn/
http://www.fig.net/
http://www.actiontech.com/
http://www.wfmc.org/
http://www.kadaster.nl/international-english/default.html