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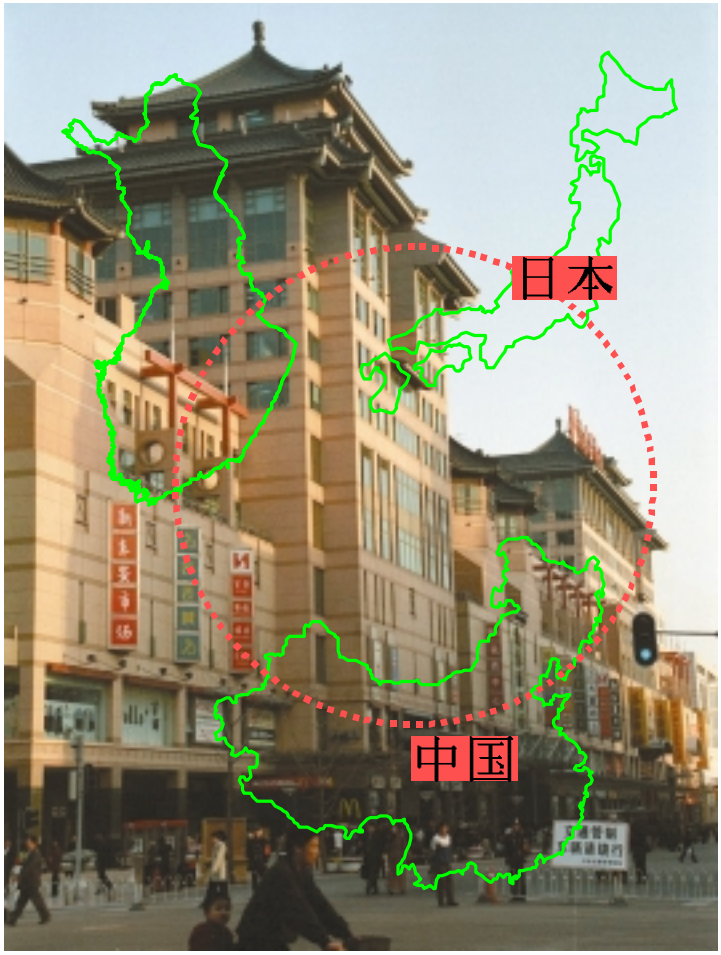
Preliminary study



TECHNICAL RESEARCH CENTRE OF FINLAND

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Abstract

The goal of this preliminary study was to perform a market study on the opportunities to transfer Finnish software technology to Japanese and Chinese construction and facilities management markets. The study forms a starting point for further actions when establishing business between Finnish and Japanese and/or Chinese counterparts.

Japan and China were chosen as target markets to the study owing both to the arising interest of Finnish companies to these markets and the importance of the two countries among Asian economies. Japan is the largest and China the second largest economy in Asia in terms of total GDP (gross domestic product). In both countries efforts have been taken to open the markets to foreign companies which add interest to look at the economies in more detail.

This study is divided into two parts. The first one deals with the Japanese and the second one with the Chinese market outlook. The study on China is restricted to cover only mainland China. Both sections include overviews of the construction and real estate markets, characteristics of construction and use of information technology, and issues to be taken into account when entering the markets. The final chapters of both sections have conclusions on the opportunities available in the markets and difficulties one is likely to expect when establishing business in these countries.

The results of both parts of the study indicate business potential for Finnish software developers. However, there are a number of country-specific factors, which need to be taken into account in order to succeed in the markets. This study serves as a basis for more detailed studies on specific areas as well as for companies and organisations which are interested in establishing business and/or research contacts in Japan or China.

Preface

Information Networking in the Construction Process (VERA) is a six-year (1997–2002) technology programme of Tekes, the Technology Agency of Finland. It aims at promoting implementation and use of IT (information technology) in the construction process as an enabling technology to re-engineer processes. This preliminary study has been conducted under this technology programme and financed by Tekes.

Information to this study has been gathered from literature, internet and interviews performed during field trips to China and Japan. The study on the Japanese market was done by Vesa Karhu, and the Chinese market was studied by Kaisu Loikkanen. Owing to the differences in available market data and earlier performed research on China and Japan, the studies of the two markets vary somewhat from each other. The study of the Chinese market has more background information on the development of the construction and real estate markets and is more general in nature, whereas, the section on Japan contains more specific data. However, both studies aim to serve as a basis for further research with Finnish companies involved.

The authors wish to thank the Tokyo office of Finpro and China Tekway Ltd, Helsinki for their contribution to this study. Special thanks are owed to the steering group members Reijo Kangas, Tekes; Matti Martola, Rapal Oy; Reijo Havonen, Vertex Oy; Youchen Fan, Alavuden Puunjalostustehdas Oy; Arto Kiviniemi, VTT Building Technology and Tapio Koivu, VTT Building Technology. The author of the Chinese section acknowledges with pleasure the useful suggestions of Abdul Kazi, VTT Building Technology, on the Chinese part of the study.

Espoo, July 2000

Vesa Karhu Kaisu Loikkanen

Contents

1. Introduction

The globalisation of markets and fast rate of new innovations are increasing competition in the software industry. Also Finnish software companies are seeking possibilities to sell their products abroad and their potential for exporting has been recognised [Autere et al. 1999].

The importance of Asia in the world economy has been growing; this was witnessed by the recent Asian crisis which had a notable impact on the rest of the world. However, it did not hamper the long-term growth prospects of the East Asian economies. On the contrary, the crisis may have helped to restructure the weaknesses of the economies. [Ali-Jyrkkö & Reilly 1999]

This study concentrates on examining two of the East Asian economies: Japan, the largest (in terms of total GDP) and most advanced economy in Asia, and China, the most populous and one of the fastest developing economies in the world in the 1990's. The study is accordingly divided into two parts: the first one provides an overview of the Japanese market and the second one of the Chinese market.

The objectives of this study are

- to give background information of the Japanese and Chinese construction and facility management sectors
- to survey existing software applications and their level in Japan and on more general level in China
- to identify potential key areas for Finnish software developers
- to suggest preliminary procedures on how to enter the markets

The report is a result of interviews in Japan and China, corresponding source material and mutual e-mail correspondence with several persons in Japan during the first half of the year 2000. The report gives background information as well as more detailed information about the market trends and construction companies. It aims to serve as a basis for further, more focused research.

Part A: Japan

2. Japanese facilities management and construction sector

The building construction process is divided into four main categories in Japan, Figure A1. Sometimes the same general contractor is in charge for both design and construction of the building project. However, specialised designers are often in charge of the "designing phase". Many organisations participate in the building project with their own technical know-how and way of designing. Thus, the way of exchanging construction data within the participants of the building project is still mostly paper based and inefficient. Integrated computerisation is being introduced to the construction industry in order to improve effectiveness.

Construction phase	1. Planning	2. Designing	3. Constructing	4. Maintaining
Working process	✓ land use planning ✓ investigation ✓ measurement ✓ estimation of cost	✓ architectural design ✓ structural design ✓ building service design ✓ data analysis ✓ estimation of price	✓ procurements ✓ management ✓ super vision ✓ estimation of cost	✓ Maintenance planning ✓ Estimation of repairing expence
Organization in charge	Client	Designing office	General contractor Subcontractor Material suppler	Client End users

Figure A1. Building construction process phases.

2.1 Overview of the market

The Japanese construction market has been characterised as a rigid, closed sector. After the economic regression in the beginning of the 1990s the Japanese construction companies have been searching for new strategies to overcome the shortcomings of the rigid market. The nominal construction investment in relation to the nominal GDP was approximately 13.8 % in 1997 and 1998 [Anon. 1999]. There has been a substantial decrease from the 18.5 % in the year 1996. The GDP was approximately 500 trillion yen in 1997 and 1998. The construction sector employs over 10 % of the working population in Japan.

A total of 66 foreign companies and Japanese subsidiaries of foreign companies had obtained licences and were doing business in the Japanese construction market by the end of March 1999.

The macroeconomic trends and forecast in Asian countries are shown in Table A1 [AsiaCon 1998].

Table A1. Macroeconomic trends and forecasts in Asian countries.

	GDP in 1997 (current price, billion dollars)	GDP Real growth (%)				
		1995	1996	1997	1998	1999
Australia	378.3	3.6	2.8	3.4	3.3	5.4
China	904.1	10.5	9.6	8.8	8.0	n.a.
Hong Kong	171.0	3.9	5.0	5.2	-2.0	n.a.
India	n.a.	7.0	6.6	5.0	n.a.	n.a.
Indonesia	134.3	8.2	8.0	4.7	n.a.	n.a.
Japan	3 883.7	2.8	3.2	-0.7	-0.6	0.2
Korea	442.7	8.9	7.1	5.5	-2.3	1.3
Malaysia	93.6	9.5	8.6	7.8	3.0	n.a.
Philippines	33.4	4.4	5.5	5.3	0.2	n.a.
Singapore	69.5	8.7	6.9	7.8	0.5-1.5	n.a.
Sri Lanka	12.5	5.5	3.8	6.4	5.3	4.6
Vietnam	26.9	9.5	9.3	8.8	9.0	9.0

The number of housing starts in Japan is estimated to decrease in 2000 from 1 246 900 units in 1999 to 1 207 200 units [RICE 1999]. It is also estimated that the total investment in construction sector will decrease 4.4 % from 1999 to 2000, and private residential building investments would decrease 1.8 %.

In the following, a number of tables are presented with actual data from source material [Moc 2000]. Table A2 summarises the estimates of construction investments in Japan for the recent years. Table A3 summarises the number of housing starts by type of investment, house and structure. Table A4 presents the number of dwellings started by owner occupant relation, by construction method, and by prefabrication.

Table A2. Estimate of construction investment in Japan for buildings (unit 100 million Yen).

Category		1991	1993	1995	1997	1999
Housing	Government	11 545	15 217	18 904	17 500	16 900
	Private sector	231 283	241 241	238 780	221 200	209 200
Non-housing	Govenrment	44 845	51 784	42 117	40 700	46 600
	Private sector	219 484	144 857	110 095	119 800	90 200
	Total	507 157	453 099	409 896	399 200	362 900

Table A3. Number of housing starts by type of investment, house, and structure (units).

Year	Total	Public	Private	Dwelling	Non-dwelling	Wooden	Non-wooden
1995	228 145	21 305	206 840	147 518	80 628	84 167	143 979
1996	259 793	23 123	236 669	168 914	90 879	98 127	161 666
1997	227 966	21 008	206 958	138 835	89 131	78 034	149 932
1998	195 997	18 030	177 967	120 482	75 515	69 436	126 561

Table A4. Number of dwellings started by owner occupant relation, by construction method, and by prefabrication.

Year	Total	Owned	Rented	Prefabricated
1995	1 470 330	537 680	553 946	224 758
1996	1 643 266	643 546	622 719	251 296
1997	1 387 014	487 741	531 220	206 532
1998	1 198 295	430 952	457 003	182 399

The value of construction orders received by the 50 largest general contractors [Moc 2000] has been still decreasing, Table 5A. The biggest decrease happened from 1997 to 1998.

Table A5. Value of construction orders of the biggest 50 general contractors (in million Yen).

1996	20 381 160	4.8 %
1997	18 868 308	-7.4 %
1998	16 774 720	-11.1 %
1999	15 524 203	-7.5 %

2.2 Real estate market trends

The real estate market situation and trends have been analysed by Japan Real Estate Institute [REINET 2000]. The following chapters summarise the information retrieved from this source. The price index base line is 100 in 1995. Japan is divided into the following regions: Hokkaido/Tohoku, Kanto, Hokuriku, Chubu/Tokai, Kinki, Chukoku, Shikoku, and Kyushu/Okinawa. Tokyo belongs to the Kanto region.

2.2.1 Office buildings

The general trend of office rent index has been declining from 1995 to 1998. The year-over-year declining rate was -3.9 % in 1996, -0.6 % in 1997, and -1.2 % in 1998.

Regionally all regions saw increases in declining rate. The rates of the Hokkaido, Hokuriku, and Chubu/Tokai regions showed yearly declines of more than one percentage point in 1998. These three regions include cities with office oversupply such as Sapporo in the Hokkaido region, Niigata and Fukui in the Hokuriku region, and Nagano and Hamamatsu in the Chubu/Tokai region.

The Tokyo metropolitan area recorded a subtle decrease in its index-declining rate. Other areas reported increased declining rates. All cities except the second-tier nationally designated special cities registered increased declining rates.

2.2.2 Apartments

The general trend of apartment rent index has also been declining from 1995 to 1998. The nation wide apartment rent index fell 1.3 % to 96.4 in 1998 (1995 = 100). The year-over-year declining rates were -1.6 % in1996, -0.7 % in 1997 and -1.3 % in 1998.

Almost all regions witnessed either constant or increased declining rates. The declining rates of the Chubu/Tokai and Kinki regions were the two largest and showed yearly rates of more than one percentage point in 1998. These two regions include cities with apartment oversupply such as Nagano, Gifu, and Fujieda in the Chubu/Tokai region and Kobe and Nara in the Kinki region.

Only the Tokyo metropolitan area registered a subtle decrease in its index-declining rate. Other areas reported increased declining rates. The declining rates of almost all city categories by population decreased in the neighbourhood of 0.5 percentage points.

2.2.3 Return of investment in Japan

The 1998 national average of gross returns (total revenue / property value) were 6.8 % for the office sector and 5.3 % for the apartment sector. 38.6 % of the office market gross returns varied from 6.0 % to 6.9 % whereas 28.6 % of the market varied from 7.0 % to 7.9 %. The gross return of the apartment market varied from 5.0 % to 5.9 % for 43.4 % of the market and from 4.0 % to 4.9 % for 38.4 % of the market.

2.2.4 Detailed example: Detached house market in Japan

The detached houses market in units is divided as follows

- Misawa Homes Ltd 29 200
- Sumitomo Forestry 9 321
- Mitsui Home 7 970
- Aifuru Home Technology 6 500
- S x L 4 620

The total number of prefabricated houses sold in 1998 was 225 375 units. There were 111 892 units of single-family detached houses and 113 476 units of multi-family detached houses. The market share of the top 10 prefabricated housing companies is 97.8 %. The market share of top 5 prefabricated housing companies is 80.9 %. The market shares of the top five companies are

- Sekisui House 24.7 %
- Daiwa House 16.7 %
- Misawa Homes 14.6 %
- Sekisui Chemical 7.8 %

Market shares of the top five in single-family houses are

- Misawa Homes 21.5 %

- Sekisui House 19.7 %
- Sekisui Chemical 16.1 %
- Daiwa House 12.8 %
- Asahi Kasei 10.6 %

Market shares of the top five in multi-family houses are

- Sekisui House 29.7 %
- Daiwa House 20.5 %
- National Housing 7.3 %

An example of an average price of a Misawa's single-family detached house, excluding land, is 23 000 000 Yen for a house of 135 square metres (ca. 170 000 Yen per square metre ~ 1721 euro per square metre, 1000 Yen = 9.931 euro). The prices depend largely on the finishing schedule, structures, and companies. Most detached houses have a wooden frame. One can purchase a detached house in two ways; buy a lot and build a new house, or buy a lot with an existing house.

Wooden house manufacturers have internal design software and also some sort of selling software for customer relations. Further investigation of these software tools would require visits to these companies.

3. Japanese construction contractual characteristics and use of IT

3.1 Basic contractual aspects

Construction management sets requirements for contractual aspects and thus, also influences the use of information technology (IT) and data exchange. Examples of typical construction modes of operation and responsibilities are shown in Figure A2 [Takenaka 1998]. The shaded boxes denote Takenaka Corporation's responsibility in different cases. The architect's box denoted design work includes design of other disciplines such as structural engineering, building services, etc.

The use of IT in a project varies. The large five general contractors have developed their own design systems and construction systems [Sjøholt 1999]. This added with rigid long-term contracts between subcontractors has lead to a situation in which subcontractors are obliged to purchase the tools that have been developed by the general contractors [Anon. 1998]. On the other hand, many software tools are sophisticated.

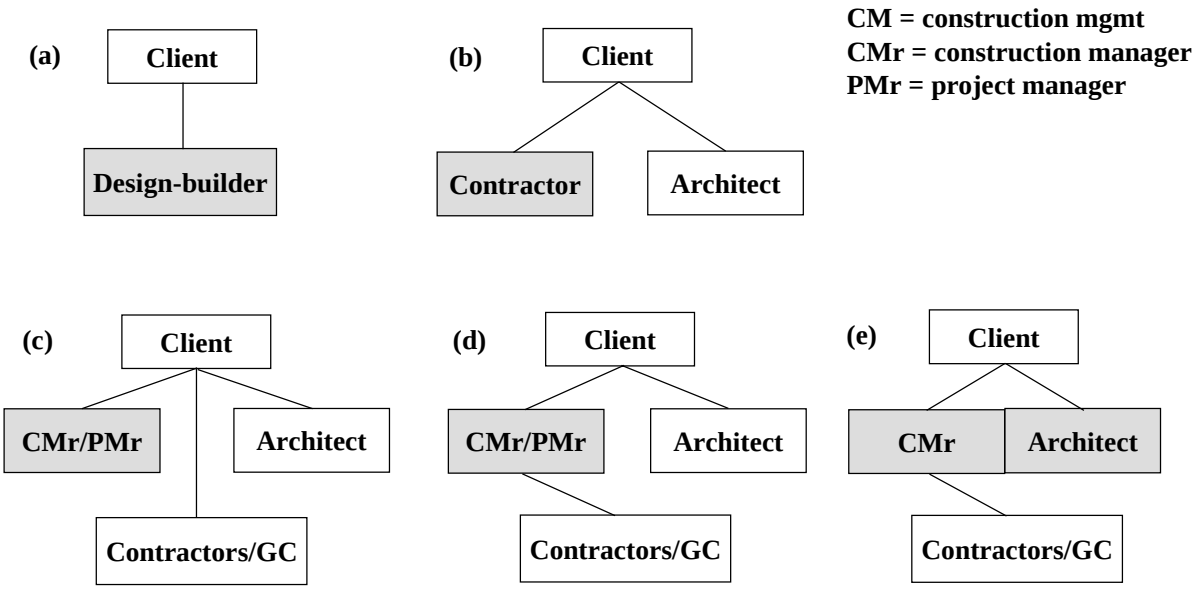

Figure A2. Examples of modes of operation in Japan.

Potential companies and users of Finnish software products are among others the general contractors, design offices, institutes, etc. Characteristic for Japanese general contractors is that they have in-house departments for architectural design, structural design, etc. Another feature clearly found in Japan is that the sub-contractors are normally long-term sub-contractors even though the economic trend during the last five

years has forced Japanese companies to seek for other solutions, i.e. to break up contracts and search cheaper contracts.

The five largest general contractors (in alphabetical order) in Japan are

- Kajima Corporation
- Kumakai Corporation
- Obayashi Corporation
- Shimizu Corporation
- Takenaka Corporation

The IAI (International Alliance for Interoperability) partners are also considered as potential customers for Finnish software developers. The IAI is an action oriented, non-profit organisation. Its mission is to define, publish and promote specifications for Industry Foundation Classes (IFC) as a basis for project information sharing in the building industry (architecture, engineering, construction, and facilities-management. The information sharing is world-wide, throughout the project life cycle, and across all disciplines and technical applications (IAI 2000).

In the following, three examples of general contractors are given.

3.1.1 Example 1: Takenaka Corporation

Takenaka Corporation is one of the big five general contractors. The number of employees was approximately 9 600 during the fiscal year of 1999. Takenaka has the largest construction R&D laboratory in the world. The corporation has a variety of software tools for various purposes. Summary is as

- Microstation customised for architectural design.
- Main frame (IBM) over 20 years for structural design but new version will be released 2000 (Austin).

The CAD tools have been developed by Takenaka. An important issue is earthquake analysis, for which Takenaka has developed its own software. The most advanced system is called SISC-T (Synthesised Information & System for Construction of

Takenaka), which is a systematic approach for exchanging data between different tools. It should be noted that it is still under development. One may also mention that Takenaka uses extranet for site management and there is no link between architectural design and other designs. It means that designs are manually exchanged.

Facility management (FM) situation in Takenaka is such that Takenaka has departments that do their own facility management. On the other hand, Takenaka's subsidiaries (like Asahi Facility Management) have been specialised on FM.

Some of Takenaka's customers require drawings and other data to be included when the building is finished but the FM concept is still under development in Takenaka.

3.1.2 Example 2: Obayashi Corporation

Obayashi Corporation is one of the big five general contractors. The number of employees was 11 584 in the end of the fiscal year of 1999. Obayashi has its own design department but 50 % of the design drawings come from outside Obayashi. Of the rest, 25 % of the designs are made with AutoCAD based applications inside Obayashi and 25 % are done with other software. One may notice that there are no standards for the data exchange, for instance, between design, detailed design, and manufacturer. The drawings are used only as graphical presentations or references in data exchange. This has also lead to a situation where the quantity take-off must be done in several phases during the project.

Some new on-going project and ideas are

- Procurement now started in internet (before VAN network), later target to use CI-NET between companies as extranet

- Project called KISS still under experimental stage but developed further. The main objective material info at one web site, others (designers, etc) may contact web site

- Interesting advanced system ABCS (automation building construction system) combined building parts (product model) with task scheduling

The procurement project collaboration is conducted between eight general contractors, but one large problem is the material encoding since manufacturers use different material encoding systems. The objective of the web-based procurement is that one can save transporting time.

Another interesting development issue is the so-called Big Canopy system that is a platform on the building during the construction phase. Building may be protected from rain, sunlight, etc, and thus, working conditions are better than on average.

3.1.3 Example 3: Shimizu Corporation

Shimizu Corporation is one of the big five general construction companies in Japan. Shimizu had 13 908 employees during the fiscal year of 1999. Shimizu has developed all software by itself. One advanced system is called VAD (3D-CAD) that combines building parts with scheduling (originally adapted from nuclear plant analysis and modified for structural purposes). Also Shimizu has its own architectural department that uses AutoCAD based applications and a few other software platforms. The data exchange has not a standard nor is it done electronically between the various software applications during construction phases, for instance, between architectural design and structural design.

Some software systems for certain areas in Shimizu are

- Project profitability system
- Life-cycle cost evaluation system
- Earthquake Response Analysis (SERA) system
- Indoor Thermal Condition and Air Flow Analysis system
- Geotechnical liquefaction analysis code "New-Hiper"

The main factor about Shimizu is that the software tools have been mainly developed by the company itself.

3.2 Facilities management

Japan Facility Management Promotion Association (JFMA) is an organisation for FM issues. It was established in 1996. Examples of members are NTT, JR (Japan railways), Japanese IBM, Osaka Gas, Obayashi Corporation, Sony, etc.

The Japanese system for measuring the space area is traditionally based on centre wall dimensions. On the other hand, the newer trend is based on inner wall measurements. It

shall be noted that both measurement definitions co-exist. Thus, the key figures come in many variations, which makes them difficult to compare with Finnish key figures. Typical key figures are the estimation of cost per number of people or cost per space.

The levels of facilities management in Finland could be defined as

- Level 1: Accounting
- Level 2: Renting management
- Level 3: Database of tenants and facilities
- Level 4: Image processing and drawings

The levels in Japan vary from level 1 to level 3.

A typical example of a tenant-owner relationship is shown in Figure A3. Tenant signs contract with owner, for instance Mori Building, and tenant also signs separate contracts with different service providers like security, cleaning, repair, etc. The owner has some pre-contacts, and in practice, the tenant may only select between them. It shall be noted that an elevator of a building needs a separate contract as well but that is done with the owner.

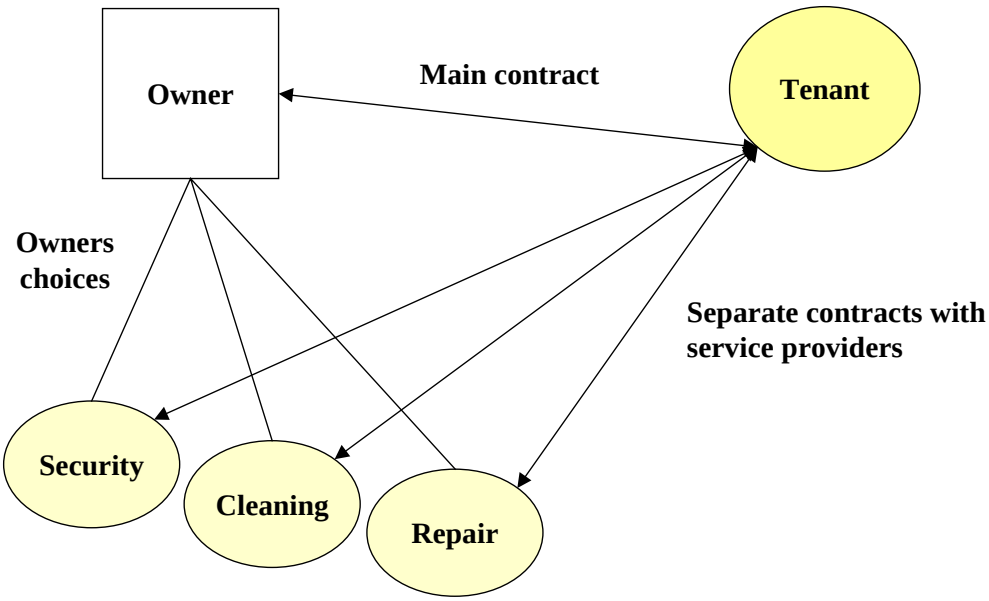

Figure A3. Example of tenant-owner relationship.

Some changes have been tried to be established to the Japanese facilities management market. For instance, Johnson (US) has introduced a one-counter-management where all service is signed through only one contract.

FM related software exists in minor scale. The main difficulty has been to establish standards, and also what should be included into the standards. The bigger companies in Japan usually have their own departments or subsidiaries for managing facilities that they use themselves (for instance Fuji Xerox or Takenaka).

The largest domestic real estate companies in Japan are Mori Building Co. and Meiwa Jisyo Co. These companies manage several buildings all over Japan. The operating expenses are usually paid by the tenant but other modes of operation exist. As is shown in Figure 3A the tenant may have one contract with the owner and it usually includes all the costs. The new headquarters of Obayashi Corporation in Shinagawa in Tokyo serves as an example. The building is owned by another company and Obayashi rents floors from 3 to 23 (situation in February 2000). The building itself was built by Obayashi. The Japanese tenant-owner contract system with all the sub-contracts is very complex.

The organisation of building projects is mainly organised through a general contractor like the five largest general contractors.

4. Software competitors in Japan

The Building Constructors Society has made a survey (June, 1999) of existing general purpose software applications in Japan, Table A6. The table summarises the software used during the construction phase on site. The company specific own-developed software is marked with "own".

Table A6. Survey of existing general purpose software applications.

Purpose	1st	%	2nd	%	3rd	%
word processing	MS Word	65	Ichitaro	23	Oasys	4
calculation	MS Excel	94	Lotus 123	6	Sanshiro	0
presentation	MS	92	MS Word	4	Hanako	3
quantity surveying	MS Excel	78	(own)	12	Lotus 123	10
cost estimation	MS Excel	61	(own)	29	Lotus 123	9
budget making	(own)	54	MS Excel	39	Lotus 123	7
budget control	(own)	63	MS Excel	37		
progress control	MS Excel	57	(own)	33	Lotus 123	10
scaffolding planning	MS Excel	90	(own)	10		
construction planning (document)	MS Word	42	MS Excel	30	Ichitaro	24
construction planning (drawing)	JW CAD	52	AutoCAD	29	AutoCad + Gaudi	8
technical manual	(intranet)	60	MS Excel	40		
shop drawing	JW CAD	57	AutoCAD	27	DraCAD	8
project management	MS Excel	32	(own)	30	CDPM	22
documentation	MS Excel	38	MS Word	26	Ichitaro	17
quality recording	MS Excel	71	MS Word	20	Ichitaro	9
access recording	(own)	57	MS Excel	24	MS Access	19
daily reporting	MS Excel	49	(own)	35	Lotus 123	7
meeting recording	MS Excel	43	(own)	35	Genba Kanri Pro	12
stock taking	MS Excel	80	(own)	20		
lifting schedule coordination	MS Excel	45	(own)	38	Genba Kanri Pro	17
access recording	MS Excel	54	Genba Kanri	17	(own)	29
environment assessment	MS Excel	71	(own)	29		
photo retouch/ collecting	Kuraemon	55	Photo Select	25		
electric notice board	(own)	46	MS Exchange	26	Nifty Manager	15
email	MS Outlook	35	MS Exchange	25	(own)	17

Japanese language environment is used in practice in all software applications. This sets requirements for software tools; the Japanese language encoding system uses eight bits. The software platform choices are shown in Figure A4.

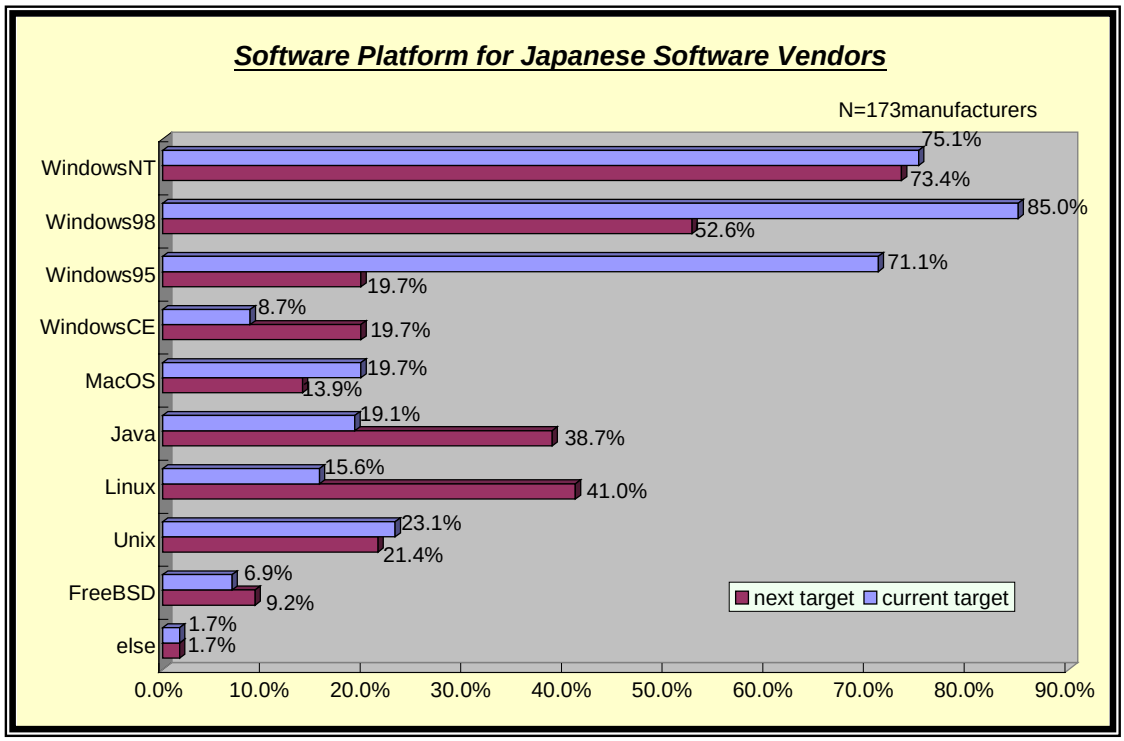

Figure A4. Software platform for Japanese software vendors.

There are several software developers that support IFC (Industry Foundation Classes) standard in Japan. Table A7 lists the situation in July 2000.

Table A7. Some software developers that support IFC.

Autodesk	✓ CAD ✓ CAD add on applications
CADEWA	✓ building services
CRC Research Institute, Inc.	✓ CAD ✓ structural analysis ✓ earthquake analysis
Chuden Computer Service Co. Ltd	✓ building services
GODAI Development Corp.	✓ CAD ✓ measurement support ✓ slope stability calculation ✓ data analysis (pile, anchor, etc)
FUJITSU FIP Corp.	✓ public works designing support ✓ building works design analysis ✓ earthquake analysis
Fukui computer	✓ architectural design
Graphisoft Japan	✓ Archicad developed on the global level
Hitachi	✓ in-house software only
Informatics	✓ architectural design
Kanematsu Electronics	✓ architectural design
KOZO KEIKAKU ENGINEERING Inc.	✓ CAD ✓ structural analysis (FEM, Frame, earthquake response) ✓ fluid analysis (thermal environment, flow analysis) ✓ GIS (earthquake disaster prevention info. system)
Microsoft Japan (VISIO)	✓ architectural design ✓ building services
NEC Soft Ltd	✓ architectural design
SECOM	✓ IFC tool development
SOGOSYSTEMCo.,Ltd	✓ documentation support ✓ public works designing support ✓ building works design analysis ✓ CAD ✓ estimation support
Sumitomo Cement System Development	✓ bill of materials
Syspro	✓ building services
Union system	✓ structural engineering

5. Ways to enter the Japanese market

First of all, according to JETRO (Japan External Trade Organization), there is no legal restriction for exporting construction software to Japan. One can export software products using normal procedures just like other items.

The distribution channels are shown in Figure A5. These distribution channels were also supported by the conducted interviews and articles in newspapers. Most software products are distributed by a distributor or a wholesaler. There are also alternatives for direct selling.

The main advantages of direct selling are

- getting reliable image in the eyes of customers as real operations are shown in front of customers

- minimising the minor trouble after the installation as the customer's demands are heard beforehand and software settings customised when delivered to the customer

Direct software sales are recommended only in the case one has enough framework to support Japanese customers on a continuous basis, for example; telephone help desk, periodical seminar and so on. Otherwise, Japanese customers tend to back away from foreign software sellers. One important factor affecting the success of a software product is the user-interface, specifically for Japanese users.

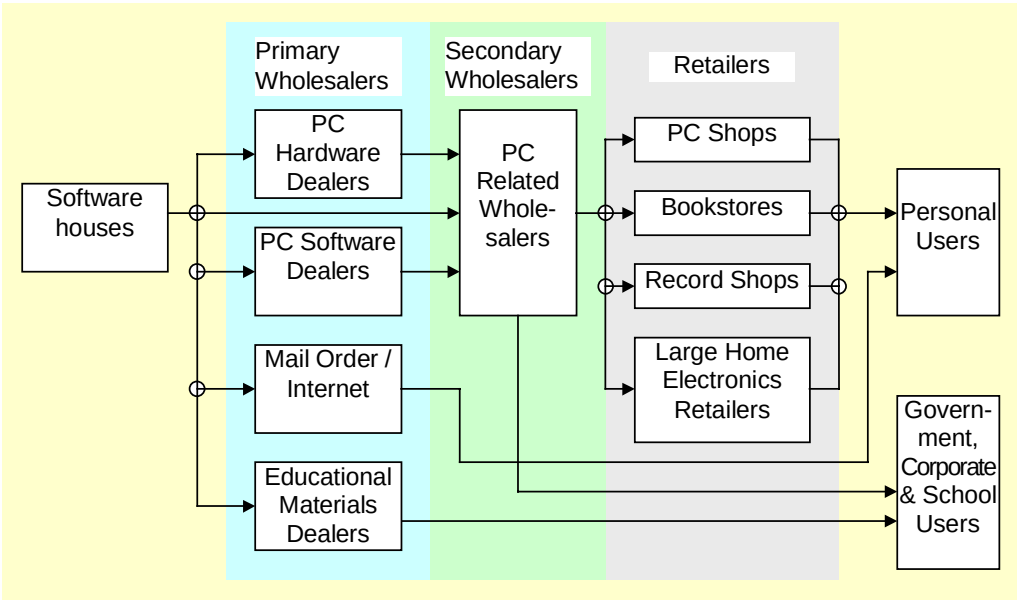

Figure A5. Distribution channels of PC software.

Important factors concerning user requirements of Japanese users are

- Customisation
- Technical support

Customisation is important since software applications should be adaptable to the Japanese way of doing business. Technical support is helpful for making a decision to buy or not. The telephone service help should be provided in Japanese.

Regarding construction software exported from foreign countries, one has to take into account the following

- localisation of software to fit Japanese language
- modification of software to meet Japanese user's taste
- setting up distribution channel

Concerning localisation, there are many software houses specialised in translating to Japanese versions, however, they do not necessarily have enough knowledge in technical terms of the construction field. Therefore, the best partner could be a company in the construction software industry.

One possibility is to make a business tie-up with a distributor. Usually, they have software development sections for translation and modification of foreign software because Japanese software business relies also on foreign software. They will take care of the whole sales promotion process in Japan provided that the software products are competitive enough. If the products are independent (packaged) software applications, this is a recommended scenario for exporting to Japan.

Another possibility is to ask Japanese construction software manufacturers for translation and modification. For example, Autodesk Japan, which is a 100 % subsidiary of Autodesk U.S.A., is considering the possibility to make business tie-ups with other countries for localisation or modification of software products. If products are add-on applications for a certain CAD platform, this kind of a business tie-up is realistic.

A list of major wholesalers is presented in the following, Table A8.

Table A8. List of major wholesalers in Japan.

Company	**attribution**	**note**
Otsuka Shokai	distributor	large scale, independent, manufacturing S/W as well
2-8-8, Misaki-cho, Chiyoda-ku, Tokyo 101-0064 Tel: 03-5280-5593, FAX: 03-5280-5605, URL; http://www.otsuka-shokai.co.jp/		
SoftBank	distributor	large scale, independent
24-1, Nihonbashi-Hakozakicho, Chuo-ku, Tokyo 103-8501 Tel: 03-5642-8000, FAX: , URL; http://www.softbank.co.jp/		
Catena	distributor	large scale, independent
2-10-24, Shiomi, Koto-ku, Tokyo 135-8565 Tel: 03-3615-3211, FAX: , URL; http://www.catena.co.jp/		
Sumitomo Shoji	distributor	large scale, independent, specialized for construction
2-2, Hitotsubashi 1-chome, Chiyoda-ku, Tokyo 100-8601 Tel: 03-3217-5000, FAX: 03-5658-3070, URL; http://www.sumitomocorp.co.jp/		
UNISYS Japan	ASP	large scale
1-1-1 Toyosu, Koto-ku, Tokyo 135-8560 Tel: 03-5546-4111, FAX: , URL; http://www.unisys.co.jp/		
BEING	ASP	medium scale, manufacturing S/W as well
1-312, Misaki-cho, Sakurabashi, Tsu-shi, Mie 514-0003 Tel: 059-227-2932, FAX: 059-227-7653, URL; http://www.beingcorp.co.jp/		
Alfaprime Japan	ASP	medium scale, subsidiary of Tokyo Electric Power Co.
3-2-1, Nishi-Shinbashi, Minato-ku, Tokyo 105-0003 Tel: 03-5777-1525, FAX: 03-5777-1526, URL; http://www.tgn.or.jp/alfaprime/		

6. Conclusions

The Japanese software market situation is summarised as

- Economic depression still affecting the Japanese construction sector.
- Initiatives to develop tools that support IFC or STEP standards have a lot of interest.
- FM is a growing market without standard procedures at present.
- Potential exists for Finnish software developers, especially for those that develop IFC or STEP supporting applications.

The Japanese software market situation is still affected by the economic depression (year 2000). Another important factor concerning software usage in construction industry in Japan is the fact that many companies have developed their own software applications for specific purposes. One example is software tools for earthquake modelling and simulation where Japanese companies have a long tradition and experience of these kinds of systems. Japanese also tend to underestimate the importance of software such as architectural design software applications, and thus, consider more important the simulation applications they have developed themselves.

On the other hand, Japanese software developers are well established in research aspects and actively participate in international standardisation efforts, such as STEP and IFC. The so-called CALS initiative in Japan has a lot of companies involved. The conclusion from this is that there is substantial potential for Finnish software developers to establish to Japanese market. The large five construction companies, according to interviews, would prefer commercial software tools instead of their own-developed software applications. This also opens the potential for Finnish software developers.

The Japanese FM situation is a growing market from the software point of view. The management procedures are still forming and this could offer a good foundation for Finnish software developers to establish to the market not only by exporting software as such but also including the export of ideas and maintenance of software (in form of Help-desk or similar). Also, there could be potential to affect procedures of how to do facilities management.

Japanese companies are known for many years' sub-contractor relationships. On the other hand, there is a tendency to renew the chains of sub-contractors. This in turn opens possibilities for new software industry to establish to the market.

Last but not least, an important factor when entering the Japanese market is that the Japanese counterpart seldom buys anything at once. The Japanese way of doing business needs many rounds of discussion and mutual trust. A good advice is to study also the Japanese language because even just simple phrases have a positive effect on the Japanese people. A good cultural background knowledge shows Japanese customers sincerity and real interest not only to money but also to having a long-term customer relationship. The cultural habits also include giving small gifts to all the persons in a meeting, starting from the person with highest rank in the meeting.

Part B: China

7. Construction and real estate market in China

7.1 Development of urban construction industry and real estate market

One has to look at the substantial changes the Chinese[1] economy and construction industry have been going through during the last decades (1949–1999) in order to understand the current situation in the construction and real estate markets.

Upon the founding of the People's Republic in 1949 China adopted a *welfare housing system* where buildings were taken under the state control. Ownership of private housing and private renting of property was cut down. In the 1950's land markets were eliminated as land in the cities became increasingly the property of the state. Land was allocated according to the development plans of the state and it had no commercial value.

Public buildings and most urban houses were provided by the state, and housing investment in cities relied on the financial budget of the government. Houses were distributed to workers at a nominal rent (around 3% of a worker's personal income). Rents were unconnected to construction and maintenance costs. As income from the low rent was insufficient for the maintenance of houses, government had to subsidise maintenance and was not able to invest enough in building new houses in order to keep up with the housing needs of the citizens. [UrbHouseCon 1999; UrbHouseRef 1999]

Construction industry was the first major industrial sector to experience post-Mao economic reforms. In April 1980, Deng Xiaoping declared that construction industry should become a so called pillar industry [Restruct 1999]. However, not until the late 1980's a set of reforms targeted on introducing market mechanisms and opening-up the market were carried out, e.g. a unit contract system under which each construction unit was made responsible of losses and profits was introduced. [Construct 1999]

The housing reform in China started in the 1980's. Rents were increased; purchase of land use rights and commercial development of land were allowed. The liberalisation of the real estate industry in the late 1980's gave builders permission to sell to anyone at market prices. Though work units continued to buy most of the residences also individuals began to buy new housing, e.g. people without access to publicly sponsored housing. [Choi 1998]

[1] This study restricts to examining only mainland China.

A number of measures, such as housing subsidies and housing loans, were carried out in the latter half of the 1990's in order to accelerate the construction of affordable residential housing to ordinary citizens. An important reform policy made was the decision to replace the welfare distribution system by a *market-oriented housing system*. People are now encouraged by the Chinese government to buy from working units or organisations the house or apartment they are currently living in.

The secondary market of housing is now being gradually developed. China is in transition of changing gradually from a subsidised housing system to a system with market elements. According to the Beijing Municipal Statistics Bureau an average home of 60 square meters in Beijing in 1999 was worth around 360 000 RMB (US$ 43 400), whereas, the average annual income of an average double-wage earner family was about 24 000 RMB (US$ 2 900). Thus, the present cost of housing is 15 times that of the average Chinese family's annual income. This coupled with low rents and wages has kept many buyers out of the market, although, the share of individual buyers is increasing. Real estate prices for ten cities in 1997 is depicted in Table B1 [Adapted from Surfchina 1999]

Table B1. Real estate price in 1997 (USD per m²).

City	Residential	Apartment	Office Space	Store front
Beijing	390-1460	500+	500+	470+
Shanghai	260-880	200-1010	470+	760+
Tianjing	130-720	220-950	320+	560+
Guangzhou	190+	220+	260+	550+
Shenzhen	210-470	490+	880	310-880
Xiamen	170-620	310-630	360-880	330-500
Zhuhai	240-500	260-700	280	310-1320
Dalian	180-730	370-900	500-1100	280-340
Hangzhou	160-310	240+	390-620	440-520
Chongqing	140+	170-440	230-540	280-900

7.2 Construction in national economy

Construction was not officially regarded as a separate industry until 1983; design and construction activities were not perceived to add financial value to the national economy [Chen & Wills 1999]. At present, the vision Deng Xiaoping declared in 1980 has realised and the construction industry is regarded as having reached the status of a so called pillar industry in the Chinese national economy. As a pillar industry construction is to receive major investments. Energy-saving technologies, electronic information

technology, reduction of power consumption and environmental protection technologies have been listed as focus areas of the pillar industries.

General economic indicators [World Bank 2000, China Statistical Yearbook 1999] on China are found in Table B4, Appendix A. According to Chinese official statistics, construction's share of GDP in 1998 was 6,6% (1985: 4,7%, 1990: 4,6%, 1995: 6,5%). The changes in the structure of GDP between 1994 and 1998 [EIU 1999] are depicted in Figure B4, Appendix A.

According to the Chinese government statistics there were over 90 000[2] construction enterprises and over 12 000 prospecting and designing institutes in 1998 in China. Gross output value of construction companies is depicted in Figure B1 [China Statistical Yearbook 1999]. The share of state-owned construction enterprises was 10% in 1998, however, the group accounted for 33% of the gross output value of the same year. Large national projects are typically handled by state-owned enterprises which generally have advantages in experience and technology compared to collective-owned enterprises and rural construction teams.

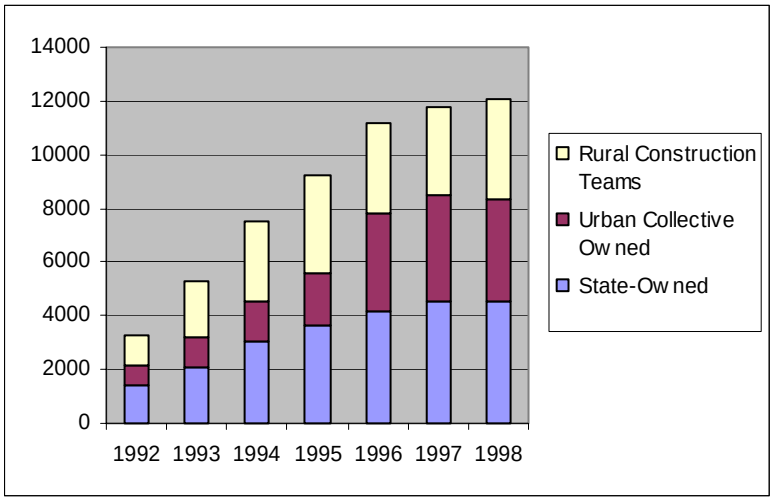

Figure B1. Gross output value of construction enterprises 1992–1998 (100 million RMB) a) includes statistical discrepancy.

The reform of privatising residential housing has been fuelling the construction industry during the past years. The Chinese Government has decided that construction of residential housing in urban areas will be a new growth area. According to the Ninth Five-Year Plan (1996–2000) China intends to build 240 million square meters annually in urban areas. In addition, 2.79 billion square meters of housing in countryside and rural towns are to be completed during the same time period in order to speed up

[2] Contractors and subcontractors defined as construction enterprises in China

urbanisation. [China Economic Digest 1998]. According to the Ministry of Construction (MOC) China is spending around US$ 25 billion annually on residential housing. Infrastructure investments on roads, ports, railways, power, oil and gas, are also high on priority list. According to World Bank estimates China will spend USD 750 billion on infrastructure over a ten-year time span 1995–2004. It is difficult to quantify the need all the development will create for engineering and construction services in China.

7.3 Ownership structure of construction enterprises

Construction companies and enterprises were all state-owned organisations from the founding of the People's Republic of China until the late 1980's. Currently, state-owned enterprises [3] are still the main players in the Chinese economic development although their importance is decreasing, as can be seen in Table B2 [China Statistical Yearbook 1998]. Collective[4] and private-owned construction companies, though rather small in size, are actively involved as subcontractors in the building industry.

Table B2. Structure of gross output value of construction companies.

Type of construction company	1985 (%)	1990 (%)	1995 (%)	1997 (%)
- State- Owned	48.2	48.0	39.5	36.3
- Collective-Owned	20.4	21.0	20.0	31.5
- Private				0.4
- Joint-Owned			0.1	0.2
- Share Holding			1.5	3.5
- Foreign Funded			0.3	0.6
- Funded by Entrepreneurs*	31.5	30.9	38.2	26.8
- Others			0.4	0.5
- Rural Construction Teams			0.01	0.2

*)from Hong Kong, Macao and Taiwan

MOC is the central organisation responsible for the infrastructure development in China. The Ministry has several bureaus in charge of specific construction fields and businesses, e.g. the Bureau of Technology Development, Bureau of Building Industry, Bureau of Surveying and Planning, Bureau of Standards, Bureau of City Construction, Bureau of Real Estate Industry, Bureau of Rural Construction, Bureau of International Cooperation.

[3] State-owned enterprises are under direct control of the government.
[4] Collective-owned enterprises are not regarded as being owned by the state although owned by people (for example by provinces, municipalities and cities).

As the major building and construction companies are state-owned, they subordinate to different ministries, provinces and cities. The building business market is further divided into territories of different ministries, local provinces, cities and even counties. For example, China Railway Construction Bureau Group of China Ministry of Railways takes almost all national railways, bridges and even road building and construction business, whereas, China Construction Bureau (Group) of MOC takes most building and construction projects on national level. Building and construction companies on provincial and city levels take in turn the main market of provincial and city infrastructure projects, including hotels and residential buildings.

Some examples of leading construction companies in China [China Enterprise Catalog 1998] are presented in Table B3. Foreign companies have access to the Chinese construction market only under certain conditions (please see chapter 8.2 ”Participation of foreign companies in construction”).

Table B3. Examples of leading construction companies in China.

Ministry of Construction:
- China Construction Bureau (Group)
- China Civil Engineering Construction Corporation
Ministry of Railway
- China Railway Construction Bureau Group
Ministry of Communications:
- China General Corporation of Road and Bridge Constructions
Beijing City:
- Beijing City Construction Group
- Beijing Municipal Engineering Co. (Group)
- Beijing Municipal – Rural Construction Co. (Group)
Shanghai City:
- Shanghai City Construction Group

Almost all design institutes are state-owned and large state-owned construction companies have in-house design and engineering capabilities. According to the law design of major projects must be approved by state-owned design institutes.

7.4 Land administration

In China land is in principle owned by the State (Chinese Government). Land use reforms were introduced in 1988 through ”transfer of Land Use Rights”. Right to use land for a designated period can be bought and used for commercial development of land. The ownership of Land Use Rights is the main form of property ownership applicable to foreign investors.

All Chinese local governments and authorities at e.g. provincial, city and county level can grant land rights for value. Land Use Rights are allowed to be transferred, assigned, leased and mortgaged. The Ministry of Land and Resource is the central organisation of national land and resource management.

Due to the Chinese economic reform and development, international investors are allowed to have land leasing rights typically for 50–70 years against up-front premium and annual ground rent. The current national standard for the maximum period Land Use Rights can be granted is:

- 70 years for residential use
- 50 years for comprehensive and industrial use
- 40 years for commercial use

[Jones Lang LaSalle 1999]

7.5 Real estate business

Real estate and property ownership started to establish after the economic reforms launched towards the end of 1980’s. However, foreign investors are allowed to only purchase property which are labelled as “for sale on the overseas market” [Jones Lang LaSalle 1999]. Land is still owned by the state or government.

Domestic investors or real estate companies in China are mainly big companies from different levels of Chinese government and ministries. Loan and credit are received and obtained mainly from banks in China. For example, the loan from China Construction Bank for resident buildings by the end of 1999 was 244 billion RMB (about 30 million USD) [Conference 2000].

Foreign investors are mainly from Hong Kong, the United States, Taiwan and Southeast Asia. Foreign investment has spread from commercial and service facilities and luxury apartments to ordinary residential buildings and increasingly to renovation of old districts. Foreign investment in real estate from the year 1992 until 1998 is presented in Figure B2. [Beijing Review 2000] Real estate business got overheated in the first half of

the 1990's, and as a result of the property bubble there has been much overcapacity in the main cities.

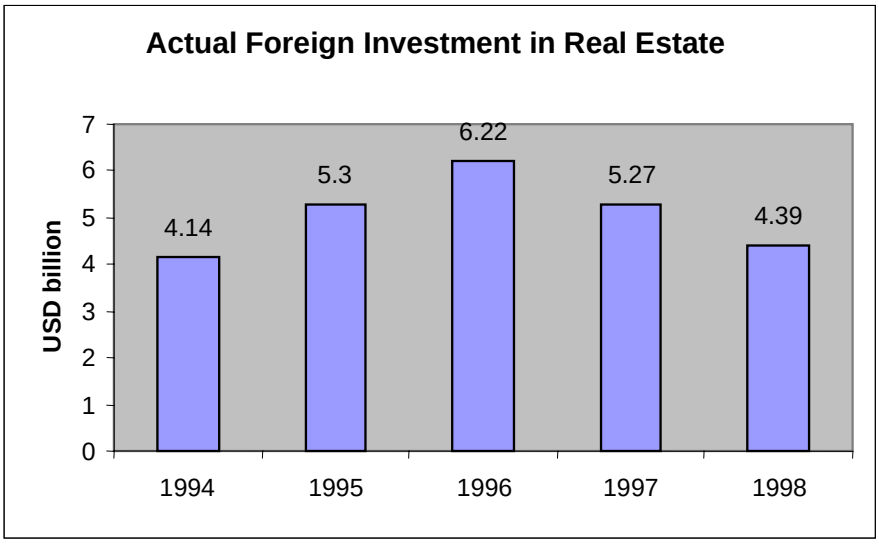

Figure B2. Actual foreign investment in real estate1994–1998.

Investment trusts were created in the mid-1980's; they are state-owned. The largest one is China International Trust & Investment Corporation (CITIC). With headquarter in Beijing, CITIC has branches all over China (further information at: http://www.citic.com). China's second largest financial-trust company, Guandong International Trust & Investments Corp (GITIC), filed for bankruptcy in 1998 after having failed to repay foreign and domestic loans. Pension funds are still a very new business sector and are not yet well established. The business started in 1998 with the reforms of state-owned enterprises, which in turn resulted in huge amount of unemployment.

Typically, state-owned real estate development and management companies make project proposals to investors. Investors can as well entrust these companies to make proposals. Investors are usually state-owned companies, banks, investment trusts or international investors. Project proposals have to be approved by the local government authorities according to the characteristics of the investment and functions of the construction. After the evaluation and examination, the land-leasing right is granted. Real estate development and management companies will subcontract the project to subcontractors to accomplish the building work.

There are two main property management types. The first one is that investors or owners of the real estate entrust property management companies, which generally are part of real estate development and management companies, to do property management. The second one is that investors establish their own property management companies. The second type is common in the current property market of China.

Facilities management is currently regarded as part of property management in the real estate business.

Real estate management, property management and facilities management markets are currently not open for international companies. As China will become a member of World Trade Organization, this market will be opened up gradually to international real estate management and property management companies.

The real estate market is at the moment immature from the western point of view. Local regulations and local practices often predominate over national laws. Unclear definitions and lack of protection of property rights is currently hurting development of the real estate market. However, as the regulatory framework improves, the market looks promising.

8. Characteristics of Construction Process and use of IT

8.1 Characteristics of construction process

The tendering system has been introduced due to the demand of both international and domestic investors. In principle, the best building or construction company can be selected through tendering, however, administrative system and personal relations still influence heavily the decision-making process. In addition, foreign companies are not allowed to bid on many projects not funded by international investors.

Architectural and design works are mainly carried out by state-owned design institutes. Government works provide the main income to the institutes while private projects remain as a secondary source. Private consultants are increasing, however, the monopoly of the state-owned prevails. Senior management level is occupied by experienced professionals, whereas, the lower level occupies many designers of poor quality and the middle level of professionals are claimed to be missing. [Lan & Jackson 1999] The missing middle level of younger generation professionals may become a problem for companies when the senior level engineers start to retire.

Chinese design institutes and construction enterprises are classified by MOC into four classes: A, B, C and D. The ones classified into ”A” and ”B” grades are allowed to undertake design and construction administration of buildings anywhere in China. Ones belonging to either ”C” or ”D” classes are permitted to engage in smaller projects at the administrative region they belong to. Private design companies need to be examined and approved by the MOC in order to receive a qualification certificate. [Fan 1999]

Under the previous centralised control regime the main contractor performed all the work on a given project. Currently, it is normal to have a general contractor in a building project that will find subcontractors to do the work. This gives opportunities to collective and private-owned companies to participate in construction projects. However, as the system for governing subcontracting is not yet developed the relationships between contractors and subcontractors are unclear; importance of personal contacts prevails [Lan & Jackson 1999]. In addition, contractors are often too specialised and are not capable of offering diverse enough range of services. [Asian Development Bank 1998]

Consultant services which focus on non-technical issues, for example, on winning contracts, are mainly offered by private individuals. The business is mainly built on the

good personal relationships (especially with various authorities) of the service provider. [Lan & Jackson 1999]

According to Asian Development Bank report of 1998 the industry does not yet meet international standards in e.g. bid preparation and contract execution. Delays in project implementation, cost overruns and poor quality control are due to the deficiencies in pricing structure, working methods, scheduling, resourcing and construction management.

8.2 Participation of foreign companies in construction

Foreign contractors are limited to work only on certain types of projects in China:

- projects funded totally by foreign investment.

- projects financed by international organisations with international tendering or bidding process (for example World Bank projects).

- Chinese-foreign joint venture projects where advanced technology is required or where technology transfer occurs during the project.

- Domestically invested projects where the domestic investor is not able to find a suitable designer, engineer or architect. For example, foreigners are often better in handling issues related to complex and tall buildings [Chen & Wills 1999].

Foreign contractors are not allowed to establish wholly-owned subsidiaries in China; they must establish either a joint venture, or a representative office or a collaboration agreement with a Chinese design institute. All construction design by foreign companies has to be ultimately approved by a Chinese design institute. Thus, a foreign company needs to have a local partner in order to make sure that their submission for doing business in China is approved. [Lan & Jackson 1999]

Foreign design consultants have been used in some large infrastructure projects where experiences and design tools can be passed to the Chinese counterparts. Additionally, foreign electrical and mechanical contractors are actively involved in construction projects because Chinese engineers in many cases are not able to design complicated systems that are needed. [Chen & Wills1999]

Commercial office buildings have not been very typical in China (e.g. many foreign companies have established their offices in hotel rooms). However, the need is growing

and there are increasingly opportunities for foreign contractors who are able to provide the advanced technology that is required. Foreign contractors have also been able to enter residential building projects, aimed at building homes for overseas Chinese and expatriates. [Chen & Wills 1999].

8.3 Computer and software market

There are no statistics available neither on construction software available in China nor on the IT spending of the construction industry. Thus, only general statistics on computer market and software can be looked upon.

China has a relatively low PC penetration. There are somewhat differing views on the size of the PC market but undoubtedly it is growing at a fast rate. According to estimates by IDC[5] around 5 million PC units were sold by the end of 1999 and the figure should reach six million in the year 2000. The annual computer sales were estimated to reach 175 billion RMB in 1999 (18.2% increase to the previous year). The growth of PCs in the past years and estimate for 1999 [IDC 1999] is shown in Figure B3.

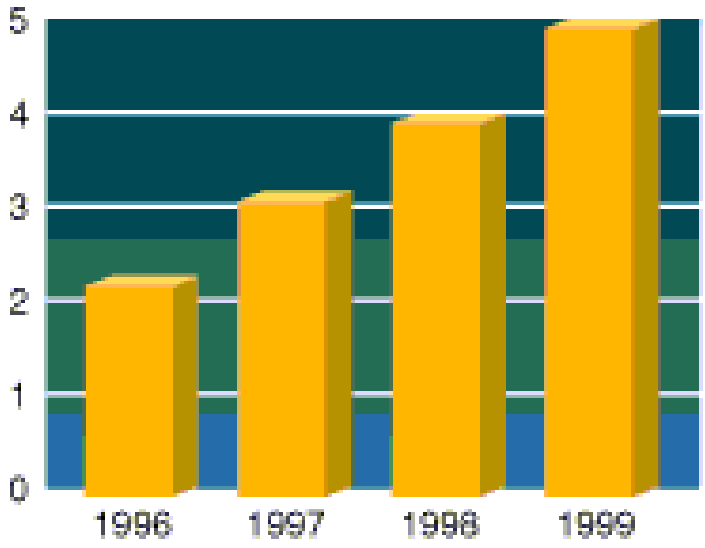

Figure B3. PC sales (millions of units).

In 1998, local assembler Legend surpassed IBM as the leading PC vendor in China. In the first half of 1999 domestic brand computers accounted for 49,9% market share as opposed to 25,8% for foreign brands and 24.3% for domestic compatibles [IDC 1999,

[5] IDC is a division of International Data Group (IDG), a media, research and exposition company.

CCID statistics 1999] Small local assemblers assemble brandless clones and provide services and support to local users which is intensifying price competition in the market. Foreign companies have been speeding up localisation and sharpening prices in order to keep up with competition. However, the WTO membership of China will help foreign manufacturers in competition as tariffs on imported PCs will be gradually diminished.

Commercial computers accounted for 65.5% and home PC 34.4% of desktops in the first half of 1999. The growing number of available Chinese language applications is regarded as being a factor behind the growing consumer sales. [CCID statistics 1999, Dedrick & Kraemer 1997]

According to CCID statistics the sales volume of the software market was 16 billion RMB in 1999, a 20% increase to the previous year. The sales on software market are estimated to be between 19 and 20 billion RMB in 2000. China's National Statistics & Information Bureau reports that sales of China's information technology companies increased from less than USD 1 billion to USD 38 billion between 1991 and 1998.

Market share figures for individual products are lacking. One should also note that most software is pirated and thus not indicated in official statistics. Simplified Chinese version of Windows 95 has been the main seller of Microsoft. Its success is partly due to the large numbers sold to original equipment manufacturers. IBM's OS/2 operating system has also sold well in the Chinese market. Owing to the local control of OS and security reasons the open –source OS Linux operating system has been recently praised by the Chinese government officials. The popularity of open source software can be at least partly explained by the free right of use.

Computers and related hardware products are becoming more and more commonly used in companies. Problems or difficulties are the limited functions of software and interface structures of the whole system. In general, Chinese users are not very willing to pay for services; they should be included to the price of hardware [Dedrick & Kraemer 1997].

Computer networking and Internet use are at an initial stage, but growing fast. China Internet, a nationwide intranet, is under development. According to the January 2000 CNNIC (China Internet Network Information Center) report there are 3.5 million computers connected to internet and 8.9 million internet users (in 1998 only 1 million users). E-mail, search engines and software down/uploading were listed by survey respondents as the three most frequently used services. The forecast increase for the year 2000 is 47% and by the year 2002 it is estimated that there are over 30 million internet users, which will rank China as third in the world. Chinese government has been strongly promoting and encouraging Chinese companies to use www-technology.

Chinese www-technology's functions, applications and ability to access are far behind international development. Most web pages are only registered net names or addresses. Well-known www-technology players in China are SOHU, 8848, 168China. They are still facing critical financial difficulties. The rapid development of the industry has brought about a number of internet-related lawsuits, the ruling of which has been difficult under the existing laws.

8.4 IT in construction and facilities management

A short visit to Beijing was conducted in the spring 2000 in order to learn about the current status of information technology in the Chinese construction sector and the operational environment, and to open channels for possible further collaboration between the visited institutes and Finnish companies and research organisations.

One university (Tsinghua University), one Academy (China Academy of Building Research), three design institutes (TongFang Artificial Environment Company, HuaTe Design, Beijing Institute of Residential Building Design & Research) and one construction site were visited. In addition, two managers of Finnish companies operating in China and a representative of an international research & consultancy were interviewed. The following sections are based mainly on field interviews.

8.4.1 Use of software

National statistics on the use of software, particularly construction software, are lacking. According to Xinhua, the state news agency of China, over 90% of China's key firms in engineering design have adopted CAD technology. Large state-owned construction enterprises either have in-house design and engineering capabilities or share close relationship with one or several design institutes. As explained in chapter 8.1 "Characteristics of construction process", design institutes in China are classified in four classes: A, B, C and D. Institutes in class A use CAD 100% in design work, class B 80% and class C 60% respectively.

Design institutes in the highest grade ("A") are at the moment in the process of connecting PCs together. Advantages of networking even inside a company are not yet fully realised. Designers are used to working independently rather than sharing data. Internet is mainly used for searching and collecting information.

All state-owned construction companies (10% of total in 1998) are claimed having been computerised. In Beijing roughly 40–45% of construction sites are computerised. (The

leftovers are either operated by weak construction companies or the projects are regarded as small.)

P3, Primavera Project Planner, is popular in project management, and other relating tools such as MS Project, Excel and Access are used by big Chinese construction and management companies. In some areas LAN has been used in the building and construction site to share and process the database and local project management.

Construction site management can include:

- document management
- scheduling
- procurement planning
- task management

Demand for construction software from the client side is weak. Costs are dominating. Chinese software companies are very active in promoting their software products through demos and presentations to construction companies. Reasonable price, demonstration and payback-time calculations of a new software are needed in order to prove the superiority of a new software. Based on the small field survey it can be roughly concluded that the ”grade A” design offices in China are at least five years or more behind Finnish counterparts in IT usage.

8.4.2 Examples of software providers and applications

China Academy of Building Research (CABR) claims that software (CAD programs) developed by the institute are used by 80% of design institutes in China (around 10 000 institutes). CABR is affiliated to the MOC, and thus has been enjoying an influential position over design institutes in China. Until 1990 only around one fourth of R&D activities were performed by enterprises [Gu 1994].

PKPM series CAD system, developed by CABR, is said to be the most popular domestic CAD software program in use in China. The system covers architectural, structural and equipment (water supply and drainage, heating, ventilation and electric apparatus) design. The program enables the user to form an optimised construction schedule and flow chart, estimate budget, manage quality control during and after construction. Data can be exported to Microsoft Project. The software series has been made into English versions and localised and exported to Hong Kong and Singapore with the help of local partners.

Another popular CAD software series of the institute is called ABD series which is a three-dimensional building CAD developed on AutoCAD platform. It has CAD software for architecture, electric equipment, engineering budgetary estimation and budget. A third software in wide use, is developed for structural design of multi-storey and tall buildings. The package comprises foundation software, shear wall analysis and steel reinforcement software, dynamic time-history analysis software, staircase and curtain wall design software and figure library for tall buildings. It is possible to post-connect the software package with other structural design CAD softwares in order to complete construction drawing design.

An increasing amount of software development in China is done by New Technology Enterprises (NTEs) which are spin-off companies of universities and research institutes. In the mid-1980´s government funding for R&D institutes was decided to be decreased. Spin-off companies can be seen as the outcome of both the changes in the science & technology system and reforms of the economic system. [Gu 1994] Some of the leading high-tech companies are spin-offs, for example, PC maker Legend is a spin-off from the CAS Institute of Computing Technology.

DeST, an integrated simulation system for HVAC, is an example of an advanced software development by a university spin-off company. The simulation program takes into account different stages of design process and applies different simulations into different phases of design. DeST runs on Win95/98/NT, and it has been used in tens of buildings thus far. For more information please visit at url: http://www.dest.com.cn/.

Programs for bidding, cost management and scheduling are under development in universities and in design companies. The missing common standard interface is also a problematic issue in China. Tsinghua University has been active in developing STEP standardisation work, but since the work has not progressed enough the university has relied on its own work. The university has expressed its interest to follow or participate in the IAI (International Alliance for Interoperability) work, but has not been actively involved thus far.

Students from top universities are selected to develop software in the NTEs. Programmers are skilled and numerous in China, but are lacking experience in project management and/or other functions of higher level [Dedrick & Kraemer 1997]. A large number of talented Chinese have immigrated and stayed abroad since the beginning of the reforms, and the availability of human resources in the future depends on whether the country is able to keep its best people.

8.4.3 Facilities management

The Chinese system for measuring space area is defined in the Chinese Construction and Building Standard [1997]. Space utilisation is counted by square meters and height. Construction area or square meters are calculated from the edge of the outside wall. The usable area or usable square meters are then the area left after subtracting the wall area. Areas with a height lower than 2.2 meters do not count as a construction area. Such area can be used for equipment and other housing facilities

Computer-aided facility management (CAFM) started mainly from hotel business in the middle of the 1980's when joint venture hotels with foreign investors were allowed to be operated in China. CAFM was introduced to China by investors mainly from Hong Kong and Taiwan. Along with the boom of real estate and hotel business, most star hotels have adopted CAFM. Commonly, a hotel buys some general software program and then develops its own applications. The functions and applications are mainly limited to customer management.

In general, the level of software applications in facilities management is still very low. Most applications are limited to fee collections of gas and electricity.

9. Operational environment in China

9.1 Key areas of software industry

Beijing is the area where software industry develops fastest. It takes the lead in the development of software industry in the whole of China. There are about 4000 high-tech and information technology companies in Beijing Haidian District, which is called “the silicon valley” of China. Particularly, both Beijing Municipal Experimental Zone for the Development of New Technology Industry and Beijing Shangdi Information Industry Base locate in this district. [Introduction 1998] Business partners can be found in these two areas.

The Software Area in Shanghai (Z.J.) Hich-Tech Park is a representative area from the southern part of China. It is situated in Pudong New Area, and is a new and high technology development zone of China state level approved by the China State Council and China Science and Technology Commission. [Investment Guide 1998]. In Shenzhen, near Hong Kong, a new high-tech park called CyberCity, is attracting major computer, software and information technology companies to establish their base in southern China to this area. First phase of the park is opening in spring 2000. [McGill 1999]

9.2 Establishing business

China is a huge market and it should not be simply regarded as one, instead as many smaller markets. A comprehensive market research (including a target regional analysis) and project feasibility study should be performed in order to ensure that suitable products and technology will be sold to right customers or transferred to right business partners. Marketing expertise, product distribution and after sales service are all essential parts of market and partner research. It is recommended that the help of a Chinese business consultant is used in conducting such business activities.

An essential issue in setting up business in China is to find correct ways to build up effective business connections with Chinese companies and authorities in question. A local partner, who knows how the market operates and how to deal with officials and bureaucracy, is necessary in order to succeed in the market. Entering the Chinese market successfully requires a long-term commitment.

9.2.1 Forms of market entry

In software industry foreign companies are allowed to have different forms of investment or business establishment. Common ones are:

- wholly-owned foreign enterprise
- equity joint venture
- contractual joint venture
- sales and representative office

It is risky and difficult to establish a wholly owned IT company in China. In a joint venture the Finnish partner is likely to provide the technological expertise and the Chinese partner knowledge to the local regulations and to the way the market operates. A representative office is relatively easy to set up, but expensive to maintain.

If a Finnish company would like to export its software to China, a qualified local software company or trading house should be identified as a business partner. If a Finnish company wants to establish a software production or service base in China, a local software or IT company is then needed as a partner.

One possibility to gain foothold and build relationships in the market is to take part in a single project as a consultant or subcontractor to a local design institute. There is, however, the risk of ”losing” software expertise if the Chinese design institute learns to copy the software programmes of the Finnish company.

It is possible to find a partner, for example, among the NTEs or research institutes in the Beijing district. It is recommended that Finnish companies utilise the expertise of a Chinese business consultant when establishing business to China. Contacts and www-addresses related to real estate and construction fields in China are listed in Appendix B.

9.2.2 General procedures in establishing Finnish-Chinese joint venture in China

The following procedures are needed:

- Letter of intent (project proposal)
- Approval by local government or Chinese Ministry of Foreign Trade and Economic Commission
- Approval of Feasibility study report
- Approval of Contract and articles of Joint Venture
- Business registration

- Business license
- Start of business operations

Practical information on establishing enterprises with foreign investment can be found, e.g. at: http://www.business-china.com/invest/index.htm

9.3 Problems and difficulties in doing business in China

9.3.1 Intellectual property right infringement

Copyright, patent, trademark, license of technology are issues of concern to a foreign company when conducting business in China. Particularly for IT companies it is difficult to protect intellectual property in China. Although there is the Law of Copyright in China, the implementation of the law is ineffective and court cases take time to get through [Intellectual 1998]**.** There are signs that piracy is not only hurting foreign companies but also hindering the development of domestic software companies. Hopefully this, as well as China's forthcoming entry to WTO, will speed up construction and implementation of the legal framework.

9.3.2 Cross-cultural business communication

There are significant differences in ways of doing business in Finland and China. Finnish business people intend to make a direct business-to-business approach. They like to put forward their business terms and conditions straight away while Chinese business people tend to emphasise first business and even personal relations with the Finnish party involved. Finnish business people should understand that western business practices have not been adopted by the Chinese business community. If mutual understanding and mutual trust have not been established between the Finnish and Chinese partners then there will simply be no business [Ali-Yrkkö & Reilly 1999].

Due to differences in language, all information and introduction materials should be prepared in Chinese language, even presentations, brochures and business cards. Chinese business people generally do not make clear and direct answers or replies to issues raised by Finnish business people. This makes Finnish business people feel that doing business in China is inefficient and time consuming. This is reflected in stages of negotiating and signing the contract.

9.3.3 Contract and agreement

There are quite different understandings of the concept of business contract and agreement. Finnish or westerners intend to make business contracts and agreements as detailed as possible, whereas, Chinese consider them more like a statement of general business intent, a symbol of the harmonious relationship: friends. To Chinese, business contract and agreement are changeable due to the changes in the environment or surroundings. They do not want to have legal responsibilities, rather, a commercially mutual understanding. This is confusing, even frustrating, for western people.

The weak legal support and legislation system in current China makes Chinese business people less committed to paper than words. Although Chinese business people intend to make a simple agreement, they know that they have to sign the contract and agreement with Finnish business people in the end. This is one documentation procedure required by higher authorities in order to establish business with foreign companies.

When drawing up a contract or agreement with Chinese, it is recommended that the contract should cover every contingency as possible. Contracts should be made also in Chinese so that the Chinese side fully understands the contents. One should be ready for a change in the contract raised by the Chinese side and prepared for real action when the contract is approved by higher authorities. Careful follow-up should be made during the whole contract and agreement process.

9.3.4 Marketing

Exhibitions in China are a popular and effective channel to get to know business partners, competitors and customers. Upcoming exhibitions are listed in Appendix C.

Making contact with associations and societies in IT industry is also a way to learn about potential business partners and get current information about specific business sectors. Publications by associations are good marketing channels for Finnish IT companies. It is very difficult to get general statistics from state organisations in China; some information and statistics can be obtained from publications of associations and societies.

10. Conclusions

China has a large and growing construction market and a developing construction software market. Based on these factors there is enough capacity for both domestic and foreign construction software. Although the market for construction IT is lagging behind Finland, at least 5 years by rough estimation, it is developing fast and one is unlikely to succeed in the market in the long term with a strategy of dumping ”old” software programs.

There is market potential for advanced software for structural design (especially of tall and complex buildings), energy-saving technological solutions, project management, systems integration and networking. Infrastructure development, which is receiving major investments from the government, offers some possibilities for foreign companies. In addition, there is a need to establish a standard interface for the industry.

For facility management the market is still undeveloped, which makes the market lucrative and difficult at the same time. Early entrants need to educate the market first. Office buildings, hotels, and high-class apartment buildings offer some possibilities for introduction and adoption of advanced facility management systems.

A Finnish company could be likely to gain access to the market through a Chinese partner who is familiar with local regulations and market characteristics. Demonstrations are needed in order to convince the Chinese users of the superiority of the programme and advantages to be gained (e.g. cost-benefit analysis). It is important to remember that all construction design must be approved by a Chinese design institute. Chinese companies have better connections and knowledge on how to deal with government officials in order to run business smoothly. In practice, relations to a domestic partner are needed in entering the market.

Chinese researchers are interested in co-operation with Finnish companies and research institutes. Chinese are fast in learning and absorbing new products and applications and the country does not have a burden of old systems. There is a large base of skilled engineers and programmers in China, but qualified people with experience of higher level functions are lacking.

Chinese are aware of the latest advances of IT and Chinese co-operation partners can be ”demanding” in their requests. Software intended to the Chinese market needs to be localised (inter alia Chinese language versions). In addition, one has to take into account how will the customer support be handled.

One has to be very careful when transferring technology to China owing to the current weak protection of intellectual property rights. Laws and regulations lag behind the development of the IT industry. In addition, public awareness of intellectual rights needs heightening in order that software piracy can be cut down in practice. Customised solutions offer better protection against piracy as opposed to generic solutions.

Entering the Chinese market requires long term commitment. It is risky for a small or medium-sized software company with limited resources and only one or several programs, and/or programs which can be rather easily copied, to enter the Chinese market under the present circumstances. However, the market is developing fast and as the regulatory framework improves, the opportunities the large market offer can be increasingly benefited also by foreign SMEs.

Entering a project as a subcontractor in a role of a design consultant, could be a way to get further insight and first foothold to the market (through foreign investors, for example). Finnish parties could also help China in establishing regulations and standards and developing softwares such as structure, logic and interface. The second development of Finnish software and their applications locally in China could then have even higher market returns.

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Appendix A: Economic indicators on Chinese economy

	1997	1998	1999
Population (Billion)	1.236	1.248	n.a.
GDP in Billion US$	903.1	960.9	991.3
GDP (% change, previous year)	8.8	7.8	7.1
Unemployment rate (%)/1	3	3.1	3.1
Real wage growth	0.5	-0.6	n.a.
Trade balance ($US Million)	40 420	43 590	29 213
Exports of goods ($US Million)	182 790	183 760	194 786
(% change, previous year)	21	0.5	6
Imports of goods ($US Million)	142 370	140 170	165 401
(% change, previous year)	2.5	-1.5	18
Current account balance ($US Million)	34 544	32 539	n.a.
(percent GDP)	3.8	3.4	n.a.
Foreign Direct Investment (US$ Billion)/2	45.3	45.5	40.4
Domestic credit (%change, previous year)	19.7	20	13.4
Total External Debt (% GDP)	14.6	15.2	n.a.
Exchange rate USD-RMB (end-period)	8.2798	8.2787	8.2783

Table 1. China Economic Indicators 1997 - 1999.

1. Official unemployment rate not including laid-off workers. 2. Gross FDI

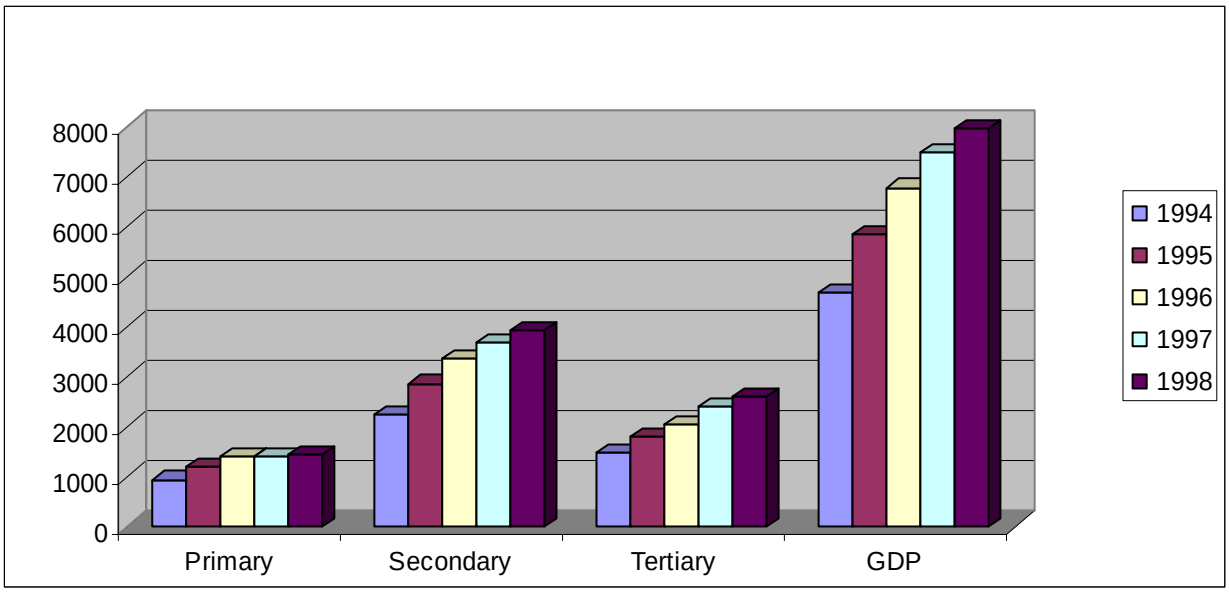

Figure 1. Structure of GDP 1994 - 1998 (Rmb, bn; current prices).

Appendix B: Contacts and links in real estate and construction fields in China

Contacts in Asia and China:

ACECOMS
Asian Institute of Technology
P. O. Box 4
Klongluang, Pathumthani 12120
THAILAND
Phone: +66 2 524-5533, +66 2 524-5539
Fax: +66 2 524-6059
http://www.acecoms.ait.ac.th

Beijing Institute of Architectural Engineering
No.1 Zhanlan Lu, Chaoyang, Beijing 100044
Tel. (86-10) 6832 2383

China Academy of Building Research
No. 30 Sanhuan Donglu, Beijing, 100013
Tel. (86-10) 6420 2233, Fax (86-10) 6422 1369

China Academy of City Planning
No. 9 Sanlihe Lu, Haidian, Beijing
Tel. (86-10) 6834 9944

China Association of Building Industry
No.9 Sanlihe lu, Haidian, Beijing
Tel. (86-10) 6831 8329

China Association of Control and Management for Building and Construction
No. 9 Sanlihe lu, Haidian, Beijing
Tel. (86-10) 6834 6598, Fax (86-10) 6839 4507

China Association of Real Estate Industry
Fu Xing Lu, Beijing, 100036
Tel. (86-10) 6828 6524, Fax (86-10) 6828 1299

China Council for the Promotion of International Trade (CCPIT)
China Chamber of International Commerce (CCOIC)
No.1 Fuxingmenwai Street, Beijing, 100860
Tel: (86-10) 6801 3344(Operator), (86-10)6803 4830, Fax: (86-10)6803 0747, 6801 1370
E_mail: ccpitweb@public.bta.net.cn
http://www.ccpit.org

FinPro Beijing Trading & Technology Center
Kerry Center, South Tower, Level 26
1 Guanghua Road, Chaoyang District, 100020
Tel: (86-10) 8529 8625, Fax (86-10-1350 1276305

Contacts in Finland

China Tekway Oy Ltd
Helsinki World Trade Center
P.O. Box 800 (Aleksanterinkatu 17)
Tel: (09) 6969 2048, Fax: (09) 6969 2049

The Embassy of the People's Republic of China
Commercial Department
Vähäniityntie 4
00570 Helsinki
Tel: (09) 6849 641, Fax: (09) 5849 595

Internet pages:

Beijing Software Industry Association:
http://www.bsia.org

China Internet Network Center:
www.cnnic.net.cn

China Statistical Information Network:
www.stats.gov.cn/english

News media:
http://chinadaily.com.cn.net
http://english.peopledaily.com.cn
http://www.xinhua.org/english/

News, travel and business directories:
http://www.asiagateway.com
http://www.business-china.com
http://www.ccpit.org
http://www.virtualchina.com

Yellow Pages:
http://www.gtmart.com.cn/index_e.cfm

Appendix C: Exhibitions relating to construction, real estate, IT and software industry

Asian IT Expo 2000
The 11th Asian Information Technology Exhibition
Hong Kong , September 27-30, 2000
Hong Kong Convention & Exhibition Centre
http://www.itexpo.com.hk/

2000 Beijing International Real Estate Exhibition
Beijing, Oct 9-15, 2000
China International Trade Center, CCPIT Beijing Sub-Council
http://www.realestatebj.com

China Hi-Tech Fair / ComNet Shenzhen 2000
Shenzhen, Guangdong, Oct 11-17, 2000
China Hi-Tech Fair Exhibition Centre
http://events.asiagateway.com

25th China House Property Fair (Property China 2000)
Shanghai, Oct 19-22, 2000
Shanghai International Exhibition Center

China Computer Infrastructure
Dalian, Oct 25-28, 2000
Dalian Xinghai Convention & Exhibition Centre

The 8th China International Building & Construction Exposition (CHINABEX2000)
Shanghai, Oct, 2000
Shanghai Everbright Convention and Exposition Center

Internet World Asia @ Hong Kong 2000
Hong Kong, Nov, 1-3, 2000
Hong Kong Convention & Exhibition Centre

CA World Asia 2000
Shanghai, Nov 6-9, 2000
Shanghai International Convention Center
http://www.caworld.com/asia/welcome/htm

Building China 2000
Beijing, Nov 8-11, 2000
China International Exhibition Centre
http://adsaleexh.com/date.htm

CTC Construction Technology China 2000
The 7th International Exhibition on Construction Equipment and Building Materials Machinery
Nov 8-11, 2000
China International Exhibition Centre, Beijing
http://adsaleexh.com/date.htm

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Title

Japanese and Chinese construction and facilities management software markets

Preliminary study

Abstract

The goal of this preliminary study was to perform a market study on the opportunities to transfer Finnish software technology to Japanese and Chinese construction and facilities management markets. The study forms a starting point for further actions when establishing business between Finnish and Japanese and/or Chinese counterparts.

Japan and China were chosen as target markets to the study owing both to the arising interest of Finnish companies to these markets and the importance of the two countries among Asian economies. Japan is the largest and China the second largest economy in Asia in terms of total GDP (gross domestic product). In both countries efforts have been taken to open the markets to foreign companies which add interest to look at the economies in more detail.

This study is divided into two parts. The first one deals with the Japanese and the second one with the Chinese market outlook. The study on China is restricted to cover only mainland China. Both sections include overviews of the construction and real estate markets, characteristics of construction and use of information technology, and issues to be taken into account when entering the markets. The final chapters of both sections have conclusions on the opportunities available in the markets and difficulties one is likely to expect when establishing business in these countries.

The results of both parts of the study indicate business potential for Finnish software developers. However, there are a number of country-specific factors, which need to be taken into account in order to succeed in the markets. This study serves as a basis for more detailed studies on specific areas as well as for companies and organisations which are interested in establishing business and/or research contacts in Japan or China.

Keywords

construction, facilities management, market studies, software, Japan, China, Finland, information technology, real estate, computer programs

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