Critical Success Factors for Competitiveness of Contractors: China Study

Weisheng Lu[1]; Liyin Shen, M.ASCE[2]; and Michael C. H. Yam, M.ASCE[3]

Abstract: Gaining or maintaining a "contractor's" competitive advantage is not easy as it is determined by a large number of factors. Identification of critical success factors (CSFs) allows one to reduce the vast number of factors to some manageable few but vital ones. Based on the CSFs, contractors' limited resources such as money and manpower can be allocated and aligned appropriately for yielding a maximum outcome of overall competitiveness. This paper describes the CSFs identified from a survey study carried out in Mainland China. The ranking analysis of the survey results shows that 35 factors are rated as critical for determining the competitiveness of a contractor. Factor analysis reveals that the 35 CSFs identified can be grouped into eight clusters, namely, project management skills, organization structure, resources, competitive strategy, relationships, bidding, marketing, and technology. The CSFs in this study provide a vehicle for guiding a contractor in managing its resources in order to improve competitive advantage. The study also provides insights into the management of competitiveness for contractors that are operating in the particular context of the Chinese construction industry.

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Introduction

There are a large number of factors determining the competitiveness of contractors, whose organization structures and governance have become more and more complicated. However, top managers in construction firms can only manage a certain number of factors simultaneously. The vast amount of factors needs to be reduced to some manageable few but critical ones before proper measures can be taken to enhance competitiveness. In addition, the success factors are in the nature of competing limited resources, such as money, manpower, time, management efforts, etc.; investing more on some factors often means less on others. It is necessary to identify the vital factors and allocate sufficient resources to those which are the most likely to yield a maximal outcome of overall competitiveness. Although some studies have identified success factors affecting the competitiveness of an organization, the limitations of these studies are also noted. For example, the factors suggested by Hu (2001) are comprehensive but cannot be applied directly to contractor competitiveness because no consideration is given to the unique features of the construction industry. The factors identified by Kale (2002), including organization structure, relationships, competitive strategy, and "generic resources," are incomprehensive due to the lack of a holistic view in the investigation. Further, the levels of importance of those factors in relation to the success of a contractor's overall competitiveness remain uncovered.

The critical success factors (CSFs) approach is considered as an effective way to answer the above-mentioned challenges. In his seminal work, Rockart (1979) proposed that the CSFs are ". . . for any business, the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization. They are the few key areas where 'things must go right' for the business to flourish." This study has led to the development of CSFs as a popular research approach across a wide range of disciplines. Various definitions of CSFs have been proposed from different research works (e.g., Ferguson and Dickinson 1982; Boynton and Zmund 1984; Tiong et al. 1992). Although the definitions of CSFs may vary when used in different disciplines, Benchtell (2002) suggested that *few* and *vital* are the two key words of the approach. Boynton and Zmund (1984) also suggested that the CSF methodology is a procedure that attempts to make explicit those few key areas that dictate managerial success. Based on the above-presented discussions, it can be seen that the CSF approach could be an effective method in the following two situations: (1) when the task is to reduce numerous factors to limited ones, making a complex system manageable; and (2) if a large number of success factors are competing for limited resources, the CSF approach could help to identify those vital factors that should be given more attention. There is a pressing need in management practice to identify a smaller set of vital factors among the many determinants of a contractor's competitiveness. The CSF approach is probably an effective way to meet the need.

The primary aim of this study is to utilize the CSF approach to identify a few manageable but vital factors contributing to the overall competitiveness of a contractor. The CSFs were identified particularly by referring to the Chinese mainland construction market. It is important to conduct the investigation of CSFs by

[1]Assistant Professor, Dept. of Building and Real Estate, Hong Kong Polytechnic Univ., Hung Hom, Kowloon, Hong Kong; formerly, Research Fellow, School of Construction Management and Engineering, Univ. of Reading, Whiteknights, P.O. Box 219, Reading RG6 6AW, U.K. E-mail: bswilson@polyu.edu.hk

[2]Professor, Dept. of Building and Real Estate, Hong Kong Polytechnic Univ., Hong Kong. E-mail: bsshen@polyu.edu.hk

[3]Associate Professor, Dept. of Building and Real Estate, Hong Kong Polytechnic Univ., Hung Hom, Kowloon, Hong Kong. E-mail: bsmyam@polyu.edu.hk

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referring to a specific construction market context because economic, political, social, and cultural factors will vary with location. Further, the Chinese construction industry has developed into one of the biggest markets in the world (NBSC 2004; Brown 2006; U.S. Commercial Service 2007). As big and attractive as it is, some global competitors, e.g., Skanska, are found to be less competitive in this market (Graham 2004). An in-depth examination of the market is needed to improve the understanding of construction professionals because the Chinese construction industry is significantly different from its counterparts in other geographical regions. It is expected that the CSFs could provide a sound taxonomy to break down the complex nature of a contractor's competitiveness into a few discrete factors. The study also contributes to improving the competitive advantage of a construction firm by assisting contractors in allocating and aligning their limited resources in a more effective and efficient way. By investigating the CSFs, both Chinese and overseas organizations can gain insights into the operations for achieving a competitive advantage in the Chinese construction market.

Procedures for Identifying Critical Success Factors

Despite the wide acknowledgment of the CSF approach in previous studies, no fixed rule has been developed for the identification of CSFs. However, some studies (e.g., Chau et al. 1999; Shen and Liu 2003) have adopted systematic procedures for this purpose. The typical procedures proposed in these studies can be summarized and presented as the following five steps: (1) identify a full set of selected success factors (SSFs); (2) conduct a survey to investigate each SSF's importance by referring to a given goal; (3) calculate each factor's importance index value based on the survey data; (4) extract CSFs from the pool of SSFs according to the value of importance index; and (5) interpret and analyze the extracted CSFs.

The rationale behind these steps is that, as suggested by Chau et al. (1999), experienced practitioners involved in a particular field would have identified a set of CSFs. Researchers then present a full coverage of success factors to these experts and ask them to rate the importance of these factors. Based on the experts' opinions, the vital success factors can be identified through a certain analytical process. At the same time, the number of success factors will be reduced as noncritical factors are excluded. Several studies (Chau et al. 1999; Shen and Liu 2003) have demonstrated the effectiveness of this opinion survey methodology. This approach is particularly effective when factors cover many qualitative items such as management efforts for which hard performance data are not available. The effectiveness of this approach has convinced the writers to adopt a similar methodology for identifying the CSFs in the Chinese construction market.

Development of Selected Success Factors for Contractor Competitiveness

Definitions of Competitiveness

In order to develop a full set of selected success factors determining a contractor's competitiveness, an understanding of the definitions of competitiveness is important. Competitiveness is adopted as a powerful concept in modern economics and management science. It has become a popular concept in the areas of both economics and management when traditional economic indicators such as profitability, productivity, or market share are inadequate in enabling continuous improvement of performance. According to the IMD (2004), a discussion of competitiveness encourages sustainable growth and the capability for development over the long term, whereas focusing merely on economic performance often leads to short-term actions. Further, the concept allows for the improvement of the managerial process, whereas economic indicators can only reflect the quantitative facts about profitability, productivity, or market share. However, despite widespread acceptance of its importance, the definition of competitiveness has not received a consensus among researchers.

There are many definitions of competitiveness. According to the IMD (2004), the concept is the result of a long history of thought from classical and modern economists. The IMD (2004) summarized a list of 14 typical definitions of competitiveness that have appeared in the literature. For example, the U.S. Competitiveness Policy Council (1992) defined competitiveness as the ability to produce goods and services that meet the test of international markets while citizens earn a standard of living that is both rising and sustainable over the long run. The Ciampi (1995) suggested that competitiveness is not an end in itself or a target; it is a powerful means to achieve rising living standards and increasing social welfare. Other typical contributors to the definitions of competitiveness are IMD (2003), WEF (1996), Feurer and Chaharbaghi (1994), Ivancevich et al. (1997), etc. As far as the construction sector is concerned, researchers (e.g., Henricsson et al. 2004; Shen et al. 2006; Lu 2006) gave their definitions of competitiveness by imitating the definitions as adopted by previous studies. Nevertheless, the definitions, like others, are so inclusive that they embraced almost everything contributing to long-term performance (Flanagan et al. 2007). Thus, they provide little assistance in developing the list of SSFs applicable to the Chinese construction market, which is the focus of this study.

Theories on Company Competitiveness

Although the definitions of competitiveness are found to be less helpful in identifying the SSFs, there are good theories on company competitiveness, which indicate the potential areas for generating competitiveness. By investigating these potential areas, this study is able to develop a list of SSFs.

There are two main theories for understanding the competitiveness of companies. The first theory, Porter (1980, 1985) suggested that competitive advantage stems from the competitive strategy adopted to deal with the strengths, weaknesses, opportunities, and threats facing an organization. Three generic competitive strategies are recommended—*cost leadership, differentiation*, and *focus* (Porter 1980). In his later works, Porter (1985) engaged the *value chain* to disaggregate a company into many discrete *value activities* and proposed that the activities for implementing competitive strategy are ultimately the sources for competitive advantage. The second theory of organizational competitiveness is the resource-based and core-competence approach, which suggests that *firm-specific resources* that are *valuable, rare, nonsubstitutable*, and *inimitable*, are the sources for competitive advantage (Wernerfelt 1984; Barney 1991; Hamel and Prahalad 1994). These principles assume that an organization is "a collection of resources" (Penrose 1959). Owing to the similarity, as well as the strengths and weaknesses of the two streams of theories, researchers (e.g., Kale 2002; Dikmen and Birgonul 2003; Ambrosini 2003) suggest that they are complementing rather than contradicting each other in explaining the competitiveness of a company. These two theories provide the guidelines for identify-

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ing the candidate success factors for the competitiveness of a contractor. Success factors for the competitive advantage of an organization should cover the areas of competitive strategies, value activities, and firm-specific resources collectively.

Development of Selected Success Factors in the Chinese Construction Market

The above-presented discussions have resulted in some guidelines to develop the candidate success factors. Nevertheless, the factors found might be different when applying the guidelines in China, a country whose construction business context is thought to be unique compared to its Western counterparts. Hence, the writers explored the characteristics of China's construction industry and their implications to the development of SSFs. These examinations of the characteristics of the Chinese construction industry provided a valuable basis for developing the candidate success factors for contractor competitiveness. For example, it was found that construction management, project management, and other newly developed management techniques have been accepted and are promoted within the Chinese construction industry. As a consequence, attributes such as quality management, time management, cost management, health and safety management, and environment management were selected as candidate success factors. They are "value activities" covered by the guidelines as developed in the last section. At this stage, the candidate success factors were mainly identified from the literature, i.e., reports, research papers, laws and regulations, etc.

The factors for contractor competitiveness have also been explored in other countries. Kale (2002) proposed that organization structure, relationships, competitive strategy, and generic resources are the success factors for contractor competitiveness. Dikmen and Birgonul (2003) investigated 15 success factors, including financial resources and technical capability. Holt et al. (1995) adopted five categories of variables for evaluating contractors in the prequalification stage, including the contractor's organization, financial considerations, management resources, past experience, and past performance. Hatush and Skitmore (1997) proposed a set of criteria classified in five categories for assessing a contractor both in prequalification and in bid evaluation, including financial soundness and technical ability. In developing a model for assessing a contractor's overall competitiveness, Shen et al. (2003) identified 98 indicators classified under six categories of social influence, technical ability, etc. All these studies provide strong reference to the development of SSFs.

By examining both the characteristics of China's construction industry and the factors investigated in other industries, a draft set of candidate success factors contributing to a contractor's competitiveness was consolidated. To ensure the comprehensiveness and appropriateness of the identification of the competitiveness factors, several validation exercises were carried out. Two workshops were conducted in Shenzhen, China. Construction professionals, including directors and departmental managers in construction companies, were invited to comment on the comprehensiveness, suitability, and clarity of individual factors. One seminar was conducted in Beijing, with the invited attendance of ten professionals from the Ministry of Construction (MOC), Peking University, and Renming University. One of the agenda items of the seminar was to discuss the success factors for Chinese indigenous contractors. By considering the comments and suggestions received from the seminar, redefinitions and modifications were made accordingly to consolidate the set of candidate success factors. As a result, 48 candidate success factors were formulated as listed in Table 1.

Data Survey

Although all the SSFs in Table 1 have an impact to a varying extent on contractor competitiveness, there is a difference in terms of importance among the individual factors. A survey was therefore conducted to determine the importance of the factors listed in Table 1. As discussed in the section entitled "Procedures for Identifying Critical Success Factors," the CSFs can be identified based on survey opinions from experts when factors cover many intangible items or their hard performance data are not available. These assumptions are applicable to the circumstances under investigation in this study. Thus, a questionnaire was developed to gather expert opinions.

There are two sections in the questionnaire. The first part is a brief introduction of the questionnaire. In the main body of the questionnaire, respondents were invited to evaluate the individual factors listed in Table 1 in terms of the importance of determining a contractor's competitiveness. The importance level is measured on a 5-point Likert scale, where 5 denotes extremely important, 4 important, 3 neutral, 2 unimportant, and 1 negligible. To ensure a better understanding of the factors in the questionnaire and decrease the chance of misinterpretation, a brief explanation for some factors was provided. Blank space was available to respondents in case they had their own suggested factors that had not been covered in the provided questionnaire. The questionnaire was piloted in June 2004 in three cities in China: Shenzhen, Chongqing, and Beijing. Following the pilot study, revisions were made to the format and factor descriptions in the questionnaire. Given the fact that Chinese is the dominant language, the questionnaire was drafted in Chinese. Good attention was given to the translation from Chinese to English so no information would be lost in the translation. In order to increase the return rate, a web-based questionnaire was also developed by using the Active Server Page techniques, which have become a popular approach to complete questionnaires online.

The questionnaire was then administered to 300 contractors randomly selected from the Grade 1 contractors in Mainland China. A review of the selected Grade 1 contractors showed that they covered most provinces apart from Tibet, Inner Mongolia, and Qinghai. These regions are relatively less developed in terms of construction, and thus have fewer Grade 1 contactors. The Chinese construction industry has been using a qualification management approach pursuant to which only qualified contractors can enter a certain segment of the construction market. Grade 1 contractors, which are dominant in the Chinese construction market, are stronger in capacity compared with Grade 2 or Grade 3 contractors. A listing of Grade 1 contractors can be found on the website of The Information Centre of the Ministry of Construction. However, the corresponding addresses need to be identified via yellow pages, Internet, or contractor directories. The URL of the web-based questionnaire was included in the cover letter and respondents were given the flexibility of completing either a paper-based or a web-based survey. We requested that the questionnaire be completed by a senior professional within the organization who would be able to form opinions from a more holistic viewpoint.

The questionnaire was sent out in July 2004, and 92 valid responses, including five submitted from the Internet, were re-

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Table 1. Selected Success Factors for Contractor Competitiveness Considered in the Present Study

Code	Factors	Code	Factors
F1	Strategic awareness and perspective	F25	Relationship with subcontractors/suppliers
F2	An explicit competitive strategy	F26	Relationship with government departments
F3	Matching strategy to a company's situation	F27	Relationship with public
F4	Strategy implementation	F28	Market research and planning
F5	Suitability of organization structure	F29	Capability of gathering and processing information of new projects/contracts
F6	Clearly defined and allocated functions for different departments	F30	Availability of product and price information of labor, materials, plants, and other resources
F7	Communication and coordination among functional departments	F31	Logistic and supply chain management
F8	Motivation and job satisfaction	F32	Bidding strategy
F9	Interaction between management and general staff	F33	Experiences in bidding
F10	Firm's history	F34	Bidding resources
F11	Firm's size	F35	Proper decision on whether to purchase or to hire plant
F12	Organization culture	F36	Plant management
F13	Business coverage	F37	Quality management
F14	Leader's personality and capability	F38	Time management
F15	Current capacity of human resources	F39	Cost management
F16	Sustainable development of human resources	F40	Health and safety management
F17	Financial resources	F41	Environment management
F18	Financing ability	F42	Contract management
F19	Financial stability	F43	Risk management
F20	Technological innovation ability	F44	Project insurance
F21	Sustainable development of technology and R&D	F45	Claim skills
F22	I.T. application	F46	Dispute resolving skills
F23	Relationship with clients/owners	F47	Knowledge and expertise on law
F24	Relationship with designers/consultants	F48	Site management

turned at the end of November 2004. The response rate was 30.67%, which appears to be a standard response rate for questionnaires. Also, considering that the questionnaire was completed by senior staffs members in top contractors, the response rate was considered satisfactory. A data examination was performed to test the internal consistency reliability of the 5-point Likert scale used in this survey. As supported by the literature, Cronbach's coefficient alpha was tested to determine the internal consistency among the SSFs. The coefficient alpha in this test is 0.76 (>0.5), showing a moderately high internal consistency for the SSFs.

Analysis and Discussion

In order to identify the CSFs based on the survey data, two statistical analyses—ranking analysis and factor analysis—were performed with the assistance of SPSS 10.0. Interviews were also conducted for further understanding of the survey results. Discussions and findings are presented in the following.

Ranking Analysis

By feeding the survey results into SPSS 10.0, the total score, mean, and standard deviation of each factor were generated. The success factors were then ranked according to their mean score values. If two or more factors happened to have the same mean value, the one with lower standard deviation was assigned a higher rank. The ranking results are shown in Table 2.

Although it is not practical to discuss the full implications of all factors, the top ten factors will be discussed in-depth. Considering that grade 4 in the 5-point Likert Scale implies that the factor is important, a mean value of 4.00 was applied as the criterion for identifying the critical success factors. In other words, the factors with a mean value exceeding or equal to 4.00 were accepted as CSFs. It can be seen from Table 2 that 35 factors met this criterion, and they have been identified as CSFs for a contractor's competitiveness. The paper also discusses the last five factors to investigate the reasons why they are least important to contractors within the context of the Chinese construction market.

- According to Table 2, a successful bidding strategy is ranked as the most important CSF for indicating a contractor's competitiveness, giving the highest mean of 4.52. Although China provides a huge construction market, the industry has attracted great interest, which makes competition more intensive than ever (Sjoholt 1997; NBSC 2004). Moreover, particularly in the construction business, winning a contract will sustain workloads for 1 or 2 years. Therefore, winning enough projects by adopting a successful bidding strategy is essential for contractors to survive in the current market, and progress toward the future. The importance of a successful bidding strategy to a contractor's competitiveness has been echoed by the extensive research on competitive bidding models published over past several years (e.g., Shen and Song 1998; Shen et al., 2004a; Lai et al., 2004).
- An explicit competitive strategy is the second critical success factor. The competitive strategy focuses on the long-run development of a company. The result is in line with the findings in previous studies (e.g., Betts and Ofori 1992; Warszawski 1996; Venegas and Alarcon 1997) suggesting that a clear

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Table 2. Rank of Factors for the Success of Contractor Competitiveness

Ranking	Factors	Total score	Mean	Standard deviation
1	F32 Bidding strategy	416	4.52	0.51
2	F2 An explicit competitive strategy	414	4.50	0.51
3	F26 Relationship with government departments	410	4.46	0.69
4	F39 Cost management	408	4.43	0.54
5	F16 Sustainable development of human resources	408	4.43	0.69
6	F7 Communication and coordination among functional department	406	4.41	0.62
7	F43 Risk-management	406	4.41	0.69
8	F37 Quality management	404	4.39	0.68
9	F1 Strategic awareness and perspective	402	4.37	0.57
10	F48 Site management	398	4.33	0.56
11	F23 Relationship with client or owners	396	4.30	0.51
12	F42 Contract management	396	4.30	0.55
13	F13 Business coverage	396	4.30	0.59
14	F14 Leader's personality and capability	396	4.30	0.63
15	F5 Suitability of organization structure	394	4.28	0.54
16	F6 Clearly defined and allocated functions for different departments	394	4.28	0.66
17	F8 Motivation and job satisfaction	392	4.26	0.68
18	F29 Capability of gathering and processing information of new projects/contracts	392	4.26	0.74
19	F20 Technology innovation ability	390	4.24	0.57
20	F27 Relationship with public	390	4.24	0.67
21	F4 Strategy implementation	388	4.22	0.59
22	F21 Sustainable development of technology and R&D	388	4.22	0.73
23	F30 Availability of product and price information of labor, materials, plants, and other resources	386	4.20	0.69
24	F46 Dispute resolving skills	386	4.20	0.69
25	F18 Financing ability	384	4.17	0.64
26	F33 Experience in bidding	382	4.15	0.67
27	F3 Matching strategy to a company's situation	380	4.13	0.72
28	F25 Relationship with subcontractors or suppliers	380	4.13	0.78
29	F15 Current capacity of human resources	378	4.11	0.53
30	F9 Interaction between management and general staff	378	4.11	0.60
31	F38 Time management	376	4.09	0.55
32	F31 Logistic and supply chain management	376	4.09	0.66
33	F17 Financial resources	374	4.07	0.53
34	F34 Bidding resources	374	4.07	0.61
35	F19 Financial stability	370	4.02	0.71
36	F41 Environment management	362	3.93	0.65
37	F28 Market research and planning	360	3.91	0.72
38	F45 Claim skills	360	3.91	0.89
39	F47 Knowledge and expertise on law	350	3.80	0.77
40	F36 Plant management	346	3.76	0.79
41	F12 Organization culture	342	3.72	0.69
42	F40 Health and safety management	340	3.70	0.87
43	F24 Relationship with designers and consultants	340	3.70	0.99
44	F35 Proper decision on whether purchasing or hiring plant	336	3.65	0.95
45	F22 IT application	330	3.59	0.78
46	F44 Project insurance	324	3.52	0.89
47	F10 Firm's history	318	3.46	0.84
48	F11 Firm's size	312	3.39	0.68

competitive strategy is vital for contractors in enhancing their competitiveness in an increasingly dynamic construction industry. Porter (1980) suggested that every firm competing in an industry has a competitive strategy, whether explicit or implicit. The survey result shows that contractors in the Chinese construction market have developed an awareness of the primary importance of competitive strategy in pursuit of competitive advantage. In comparison, the factor of effective implementation of strategy (F4) was ranked relatively low (No. 21). It seems that managers of Chinese construction companies are not fully aware of the importance of effective implementation of strategy in improving competitiveness. Per-

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haps developing a competitive strategy is easy, whereas implementation of the strategy on a daily basis is more difficult. Interviews revealed that development departments in head offices of many construction companies have been set up to develop the medium to long-term strategy. However, the formulated competitive strategy is not implemented well by most contractors.

- The relationship with government departments is ranked as the third important CSF. Although the importance to a contractor of seeking a good business environment by maintaining good relationships with parties including governments, designers, owners, vendors, and the public has been widely accepted (e.g., Shen et al. 2003; Kale 2002), the contractors in the Chinese construction market place special emphasis on the relationship with government departments. Synonymous words such as network or "guanxi" are prevailing among Chinese contractors or those new incoming overseas participants. One of the reasons for establishing guanxi is that a large part of the construction works were commissioned and funded by the government (Walker et al. 1998), hence winning its trust can increase the possibility of winning contracts. Further, the Chinese government still plays an important role in overseeing the construction market in line with the framework of the country's socialist market economy. The government supervises the construction market in various ways, such as controlling the national fixed capital investment (Low and Jiang 2003), improving the legal system (Lam and Chen 2004), and supervising the majority of construction companies (Walker et al. 1998). Shen et al. (2001) reported that the policy risk is one of the major risks in undertaking construction business in China, and the risk can be mitigated by developing a good relationship with government departments. Nevertheless, it appears that respondents have different views on this factor, evidenced by the large standard deviation value (0.69). The in-depth interviews supported this result by suggesting that contractors have radically different opinions on this factor; some of them enjoy the relationship, whereas others are more negative when considering their dissatisfaction from dealing with government departments.
- Other critical success factors in the top-ten list include the effective cost controlling methods (F39), the sustainable development of human resources (F16), communication and coordination among functional departments (F7), strategic awareness and perspective (F1), and effective site management (F48). The importance of these factors has also been addressed in other studies (e.g., Shen et al. 2003; 2004a; Chau et al. 1999; Dikmen and Birgonul 2003).
- It is surprising to see that financial-related factors such as financial ability (F18), financial resources (F17), and financial stability (F19), which have been considered as important in other construction contexts (e.g., Dikmen and Birgonul 2003), were ranked fairly low by China's contractors although they were included in the CSF list. Interviews showed that there are different opinions on the financial factors compared with those of more established construction markets. In China, building project developers usually require contractors to input finance in advance as a condition for awarding the contract. This practice is a common phenomenon in the current Chinese construction market although it is prohibited by regulation. Under these circumstances, financial resources or financial ability are important. However, when projects are funded by the government, the requirement for financial resources is not so important.

The factors considered the least important in this survey include: F35 (proper decision on whether to purchase or to hire plant), F22 (I.T. application), F44 (project insurance), F10 (organization history and experience), and F11 (organization size).

- The history and size of a construction firm are the two factors at the bottom of the list presented in Table 2. This indicates that the firm's history and size are not necessarily obstacles for achieving competitive advantage. In the Chinese construction market, the size of contractors varies greatly. Large contractors, most of them stated owned such as the China State Construction Engineering Corporation, have developed into huge companies with more than 10,000 employees. Although enjoying the advantages of history, size, and experience, they have to face problems such as management bureaucracy and the burden of overstaffing (Shen et al. 2001). Conversely, newly set up companies, despite having a short history and relatively small size, found a competitive niche and built reputations by adopting more flexible strategies, such as focusing on local markets, limiting service scopes, merging, or formulating joint ventures.
- It is interesting to observe that the application of information technology (I.T.) ranked as one of the factors at the bottom of the list. The small standard deviation value indicates that respondents share this view with strong consistency. This appears to differ from the findings of researchers who have advocated for improving competitiveness by applying I.T. (e.g., Betts et al. 1991; Love et al. 2004). One of the major problems suggested in the interview is that the adoption of I.T. often means significant investments at a time while the benefits are still vague, and the costs and benefits are difficult to estimate. Keen (1991) reported that managers would not continue with I.T. investment unless definitive evidence on performance was established. In the Chinese construction industry, I.T. has been widely applied to some "routine" areas or activities such as office automation, finance management, and communication by email. There is still a long way to go before I.T. is used as a genuine decision-support tool for helping achieve a contractor's competitiveness. There are many reasons for the limited application of I.T., including few I.T. trained staff, an absence of I.T. awareness, poor I.T. infrastructure, and the incapability of software development.

The factors in the higher ranks are more critical to a contractor's competitiveness. They should be given priority and sufficient resources such as money, manpower, time, and management input. The identification of the CSFs provides a vehicle for guiding contractors in utilizing their competitive resources more efficiently in order to improve their competitive advantage.

Factor Analysis

The statistical analysis in the previous section has led to the identification of 35 CSFs for a contractor's competitiveness. However, a list of 35 CSFs is still not considered to be a "clean and concise" answer to the central question—*what are the CSFs for a contractor's competitiveness?* In fact, many factors in Table 2 are interrelated. In order to obtain a "concise" list of CSFs under these circumstances, an effective method is to utilize the factor analysis to identify a smaller set of uncorrelated factors (e.g., Shen and Liu 2003; Liu 1997).

Factor analysis is a statistical technique for identifying a relatively small number of factors that can be used to represent relationships among many interrelated variables (Paul 1994). The

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Table 3. Results of Factor Analysis to the CSFs for Contractor Competitiveness

Cluster	SCSF	CSFs	Cluster	SCSF	CSFs
1	SCSF1 project management	F48 Site management F39 Cost management F37 Quality management F38 Time management F42 Contract management F46 Dispute resolving skills F43 Risk management F31 Logistic and supply chain management	4	SCSF4 competitive strategy	F2 An explicit competitive strategy F3 Matching strategy to a company's situation F4 Strategy implementation F1 Strategic awareness and perspective
			5	SCSF5 relationship	F23 Relationship with client or owners F25 Relationship with subcontractors or suppliers F26 Relationship with government departments F27 Relationship with public
2	SCSF2 organization structure	F5 Suitability of organization structure F7 Communication and coordination among functional departments F6 Clearly defined and allocated functions for different departments F9 Interaction between management and general staff F8 Motivation and job satisfaction F14 Leader's personality and capability	6	SCSF6 bidding	F32 Bidding strategy F33 Experiences in bidding F34 Bidding resources
			7	SCSF7 marketing	F29 Capability of gathering and processing information of new projects/contracts F30 Availability of product and price information of labor, materials, plants, and other resources F13 Business coverage
3	SCSF3 organization resources	F15 Current capacity of human resource F16 Sustainable development of human resources F17 Financial resources F18 Financing ability F19 Financial stability	8	SCSF8 technology	F20 Technology innovation ability F21 Sustainable development of technology and R&D

factor analysis technique allows for a combination of the interrelated variables into a smaller extracted set of new common dimensions (factors or constructs) and minimizes the loss of information during the extraction process (Hair et al. 1994; Field 2000). Thus, if there was a requirement to predict how well a subject would perform in the future, it could be achieved by using the identified factors. It is not necessary to know all the factors. Factor analysis consists of a number of statistical techniques the aim of which is to simplify complex sets of data. The statistical techniques are not easy to clearly explain in one or two pages, and are quite complex for the huge amount of calculations. However, with the advent of powerful computers and the dreaded statistical packages that go with them, factor analysis is available even to people with little statistical training (Paul 1994).

The survey opinions of the 35 CSFs were entered into the SPSS 10.0 for conducting the principal component analysis. The results of the analyses show that the Bartlett test of Sphericity is 373.103 and the associated significance level is 0.0000, suggesting that the population correlation matrix is not an identity matrix. The value of the KMO is 0.504, larger than 0.5, which suggests that the sample is acceptable for factor analysis (Kaiser 1974). The principal component analysis generated an eight-factor solution with eigenvalues greater than 1.0, explaining 89.73% of the variance. The factor grouping based on the varimax rotation is shown in Table 3. According to a suggestion by previous researchers (e.g., King and Teo 1996), only the factors with loading exceeding 0.50 were selected to evaluate the factor patterns. It can be noticed that all 35 CSFs are selected, and each factor belongs to only one of the eight clusters generated by factor analysis.

For further interpretation, each cluster shown in Table 3 will be given a name, which can be viewed as a supercritical success factor (SCSF) comprising a combination of the CSFs. The eight clusters are Project Management (SCSF1), Organization Structure (SCSF2), Organization Resources (SCSF3), Competitiveness Strategy (SCSF4), Relationships (SCSF5), Bidding (SCSF6), Marketing (SCSF7), and Technology (SCSF8).

Cluster 1 (SCSF1): Project Management

Table 3 shows that all eight CSFs formulating Cluster 1 are relevant to Project Management. Porter (1980, 1985), found that firms ultimately gain and sustain competitive advantage by successfully delivering their products or services, but the failure of a single construction project can cause serious damage to contractors. Therefore, it can be seen that managing a construction project as a product is vital to achieving competitive advantage. It can also be found from the survey that the respondents emphasized the importance of project management to a contractor's competitiveness.

By considering project management areas such as quality, time, cost, risk, and contract management, all relevant factors are rated as critical in affecting a contractor's competitiveness, except for the environment management factor (F41). According to the survey, environment management is not recognized as important, ranked at 36th on the list. This is in line with several investigations (e.g., Chen and Chambers 1999; World Bank 1998), reporting that environment protection has not been implemented systematically in China, and short-term actions usually prevail when development and protection of the environment cannot be achieved simultaneously in construction. Further, it is interesting to note from Table 3 that *F46 Dispute resolving skills* has been selected as a CSF, whereas the *F47 Knowledge and expertise in law* has been excluded. Contractors in the Chinese construction market prefer to rely on dispute resolving skills rather than the court when settling disagreements that occur during the construction process. This is probably because dispute resolving skills

such as negotiation, communication, and compromise are more effective in a market supervised by a legal system that has not been well established.

Cluster 2 (SCSF2): Organization Structure

The six CSFs in Cluster 2 are relevant to Organization Structure. It provides the framework in which a business can operate. Channon (1973) suggested that the organization structure of the firm is the framework within which both competitive strategy and strategic management occur. Although there is no standard organization structure for construction firms, there are key elements in formulating an organization, which are the driving force for promoting a contractor's competitiveness. Typically, these include making the structure suitable (F5), clearly defined and allocated functions for different departments (F6), and the collaboration and communication between departments (F7).

The appropriateness of organization structure has special significance for Chinese contractors. Most state-owned contracting companies used to be overstaffed and have a bureaucratic organization structure developed from the old planned economic system (Li 1998). These firms were then required to adapt their organization structure to the fast-changing market economy and gain competitiveness advantage by reforming themselves to be more commercial (Flanagan and Li 1997). The "lay-off" policy is such an instance resulting from optimizing a contractor's organization structure by removing those uncompetitive departments and less productive staff. A "modern enterprise system" was required to be developed in the state-owned enterprises (SOEs) and collectively-owned enterprises (COEs) to make them more commercial and more competitive.

Cluster 3 (SCSF3): Organization Resources

CSFs in this cluster concern organization resources such as people and money. Obviously, organization resources are deemed important for enhancing the competitiveness of a construction organization. The notion is particularly emphasized by the resource-based theory of competitive advantage, which suggests that firm-specific resources are the sources of competitiveness and development of the resources is therefore the strategy for enhancing an organization's competitiveness (Grant 1991; Barney 1991).

Factors 15 and 16 in Cluster 3 cover the current capacity and future development of human resources, respectively. The central role of human resources has long been stressed by writers on construction management (e.g., Griffith 2004; Fryer 2004). In the Chinese construction industry, the state of human resources presents significant problems for the national economy and for the efficiency of the construction industry. At the lower end of human resources are the laborers from rural areas. Although the low cost of laborers has been the major source of competitive advantage for Chinese construction firms, the lack of formal job training makes it difficult for contractors to enhance their competitiveness (Sha and Jiang 2003). At the opposite end of the human resources are the entrepreneurs and managerial staff. In line with the "open-door" policy, in particular its entry into the World Trade Organization, the Chinese construction industry was developed toward an international operation. Contractors are keen to recruit professionals with management skills, a good understanding of construction techniques, and communication skills in a foreign language that will improve global competitiveness (MOC 2004). Further, Factors 17, 18, and 19 emphasize the importance of obtaining finance for a construction business, which usually requires a large amount of financial resources. Nonetheless, as mentioned previously, the factors were ranked relatively low perhaps because contractors have different opinions on the financial issues in undertaking different types of projects.

Cluster 4 (SCSF4): Competitive Strategy

The CSFs falling in Cluster 4 are related to a contractor's competitive strategy. The need for a strategic perspective and plan for construction companies has long been stressed by many previous studies (Warszawski 1996; Betts and Ofori 1992). Various approaches to formulating competitive strategy, e.g., the strategic planning school (Ansoff 1984), the competitive advantage school (Porter 1980, 1985), have been introduced. However, none of them can be the panacea in fully dealing with strategic management in construction. This study also identifies the major factors for a successful competitive strategy, namely, an explicitly defined competitive strategy (F2), matching strategy to a company's situation (F3), and effective strategy implementation (F4). These factors enable contractors to focus on the key aspects when competitive strategies are to be formulated and implemented in order to achieve competitive advantage.

Cluster 5 (SCSF5): Relationship

A collaborative culture has proved increasingly important in the construction industry. The initiatives for contractors to maintain good relationships are multifaceted. First, as mentioned previously, they help to build a good business environment. Second, good relationships and trust between other parties will encourage potential job opportunities. Third, good relationships with other parties involved can be used to mitigate risks existing in the long and complex project process. Finally, good relationships between project parties are important to ensure that the construction project can be completed on time, within cost, and meet the quality standards. From Table 3 it can be seen that relationships with clients, subcontractors, suppliers, government, and the general public in Cluster 5 are all ranked as critical factors for a contractor's competitiveness. The result has been echoed in a study by Shen et al. (2003), suggesting that good business relationships contribute to the business competitiveness. This point is further echoed in the study by Kale (2002) suggesting that good relationships with parties should be included as the core competence of a contractor.

Cluster 6 (SCSF6): Bidding Technique

The CSFs in Cluster 6 are related to bidding technique. Good bidding technique will enable contractors to win more contracts, which in turn helps to sustain a contractor's competitiveness. To win enough project contracts is important in the Chinese construction market, partly due to the intensive competition and the low profitability in the industry due to excessive competition. On the other hand, bidding is a process for a contractor to show competence through organizing its resources effectively (Shen et al. 2004b). Contractors may not win in a bidding process if its resources are not properly organized even though they are very competent. Critical factors contributing to improving a contractor's bidding technique include experience (F33), professional resources in bidding (F34), and a proper bidding strategy (F32), which are grouped in Cluster 6.

Cluster 7 (SCSF7): Marketing

The CSFs in Cluster 7 are factors indicating the marketing ability of a construction business. As suggested by Langford and Male (2001), marketing provides a key role in the strategic management of construction firms when trying to achieve a competitive

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advantage. Marketing in construction has different implications from that of other industries as construction clients are not "uniform" organizations. It is worth noting that in the survey "market research and planning" (F28) marketing was not considered a major contributor to contractor competitiveness. This is echoed by Langford and Male (2001), who suggest that market research does not show its significance largely due to the lack of necessary support from senior management. However, other factors such as availability of market information are regarded as vital for enhancing a contractor's competitiveness.

Cluster 8 (SCSF8): Technology

The technology cluster (SCSF8) comprises two CSFs: technological innovation ability, and sustainable development of technology and research and development (R&D). The technology, R&D, and innovation all are important competitive resources for businesses as they offer the possibilities for adopting the "differentiation" strategy in the construction industry. The importance of considering technology and R&D as organizational competitive resources has been well addressed in previous studies (Slaughter 1998; Hampson and Tatum 1997). However, there are barriers and risks for a contractor when investing in technology and R&D, as the outcomes are uncertain, and this often makes managers refrain from investing or adopting new technology.

The investigation shows a contradictory situation. On the one hand, contractors acknowledge that technology is the critical success factor for enhancing their competitiveness, especially when the contribution rate of science and technology is very low (about 15%) in the Chinese construction industry (MOC 2004). On the other hand, as discussed previously, they are not willing to invest in I.T. continuously, which has been advocated as the most promising area for generating competitiveness of construction firms in a new era.

Further Discussion on CSFs for Contractor Competitiveness

The above-presented examination shows that there are eight clusters of supercritical success factors, with each comprising its own CSFs, contributing directly to the competitive advantage of a construction business. The eight SCSFs can further be grouped into three categories in terms of their attributes. Among the eight SCSFs as shown in Table 3, SCSF4 is related to the strategy of a construction firm. SCSF2, SCSF3, SCSF5, SCSF6, SCSF7, and SCSF8 define the organizational infrastructure and operations. SCSF1 is concerned with operations at project level. The three categories of SCSFs cover the areas of strategy, tactics, and operation which generate the competitiveness for a contractor.

The research findings are in accordance with Porter's (1985) value chain, which is a widely adopted tool for identifying the sources of competitive advantage. However, Porter's value chain cannot be a substitute for the CSFs described here, and vice versa. Value chain was proposed based on the analyses of general firms, and its value activities should be further elaborated if applied to the construction industry. Unfortunately, there is no such study to identify the value activities which focus on the construction industry. The CSFs identified in this study can be used partly as the value activities forming a value chain tool within the Chinese construction context. Further, the CSFs provide a wide range of factors that contribute to a contractor's competitiveness ranging from strategy to actions. The importance of each factor is investigated in detail, which provides quantitative information for decision making. The set of CSFs is useful for finding the correct subsequent decisions for enhancing competitive advantage under Chinese construction market conditions. In using the CSFs, the senior management of a construction firm may conduct a self-assessment of its CSFs. The management efforts have been saved at this stage because it is only necessary to focus on critical factors rather than on all the factors which relate to competitiveness. By combining the assessment results and the quantitative information as shown in Table 2, the most crucial areas can be identified, and the limited resources such as money, manpower, time, and management efforts should be secured to these core areas in the first instance in order to yield a maximum outcome of a firm's overall competitiveness.

Conclusion

The competitiveness of a contractor is determined by a large number of factors. It is difficult to satisfy all the factors at the same time as management practices always have to face limited resources such as money, manpower, time, and management efforts. Therefore, identifying a list of critical success factors is valuable for helping contractors to be more focused in order to develop their competitiveness but at the same time working with limited resources.

It has been found that there are 35 success factors contributing to enhancing a contractor's competitiveness in the Chinese construction market. Those most important factors include "winning enough contracts by adopting successful bidding strategy," "having an explicit competitive strategy," and "developing a good relationship with the government." It is interesting to note that factors such as "I.T. application" and "firm size and history" are least important for helping to improve a contractor's competitiveness in the current Chinese construction market conditions. The factor analysis generates eight clusters from the 35 CSFs identified by the ranking analysis.

These clusters represent supercritical success factors affecting a contractor's competitiveness, namely "project management," "organization structure," "resources," "competitive strategy," "relationship." "bidding," "marketing," and "technology." The eight factor clusters provide a structured framework for examining individual CSFs and their different levels of contribution to a contractor's competitiveness. The framework helps to identify the correct subsequent decisions required for resource allocation. The findings from this study can help both domestic and overseas practitioners to gain insights into the management of competitiveness for contractors within the context of the Chinese construction industry.

The SCSFs and CSFs identified reflect the current situation in the Chinese construction industry and the market competition taking place. However, it should be recognized that the CSFs may change radically as China's construction industry is rapidly developing, and turbulent. Managers should investigate the CSFs periodically to reflect the latest development of the market as well as the management of competitiveness in construction enterprises. The CSF approach provides a useful tool for conducting this investigation, and the CSFs identified in this study provide the reference against which the changes of CSFs can be perceived as time goes by.

It also should be noted that the CSFs in this study were identified by focusing on the Chinese market. The research findings may not be applicable to construction markets in other countries. For example, I.T. application is not considered important as a

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CSF in the Chinese construction market. This indicates that a study on the competitiveness of a contractor must refer to the specific market in which that contractor operates because different markets will have individual characteristics, and contractors operate differently when the markets have different social, economic, political, technological, and cultural backgrounds. This indicates that there is a need to investigate CSFs for a contractor's competitiveness when it operates in other construction markets.

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