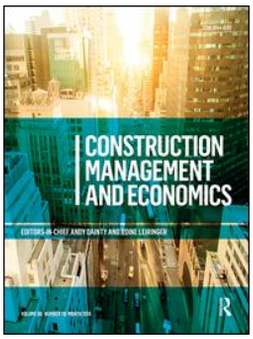

Routledge
Taylor & Francis Group

Construction Management and Economics

ISSN: 0144-6193 (Print) 1466-433X (Online) Journal homepage: https://www.tandfonline.com/loi/rcme20

Factors influencing development of construction enterprises in Singapore

George Ofori & Chan Swee Lean

To cite this article: George Ofori & Chan Swee Lean (2001) Factors influencing development of construction enterprises in Singapore, Construction Management and Economics, 19:2, 145-154, DOI: 10.1080/01446190150505072

To link to this article: https://doi.org/10.1080/01446190150505072

Construction Management and Economics (2001) **19**, 145–154

Factors influencing development of construction enterprises in Singapore

GEORGE OFORI and CHAN SWEE LEAN

School of Building and Real Estate, National University of Singapore, 10 Kent Ridge Crescent, Singapore 119260

Received 30 October 1998; accepted 11 March 1999

The literature stresses the importance of improvements in the effectiveness and efficiency of contractors if the construction industry is to fulfil its tasks in a cost-effective, timely and safe manner. Various factors are considered to be instrumental in the development of contractors. If the most important influencing factors in any country can be identified, measures can be taken to apply them in order to upgrade the contractors. The results of a study on the factors which have been important in the development of construction enterprises in Singapore are presented. A mailed questionnaire survey provided the basis for the study. The targeted respondents were local contractors, foreign contractors, and clients and consultants. It was found that the key factors could be grouped into four main categories: contractors' role; government's and institutions' help; practitioners' help and financial support; and clients' help. Recommendations are offered on measures which can improve the performance of contractors.

Keywords: Construction firms, Singapore, development factors, foreign contractors, government

Introduction

The literature

Most of the works in the growing literature on the development of contractors focus on the needs of small contractors, especially in developing countries. They discuss how such companies can be assisted to grow and to upgrade their operations (ILO, 1987; Ofori, 1991; UNCHS, 1996). The literature indicates that the process of contractor development should include various initiatives ranging from those relating to the enterprises themselves, through their resources, and the rest of the construction industry, to the contractors' operating environment (Milne, 1994). The International Labour Office (ILO, 1987) observed that developing contractors means instituting a range of policies and programmes including: (i) improving access to work, (ii) improving the business environment, and (iii) offering training and advisory services.

The United Nations Centre for Human Settlements (UNCHS, 1996) discusses contractor development programmes which have been implemented in various countries. These include indirect approaches where contractors are encouraged to adopt appropriate practices and procedures (Ofori, 1991), through the use of state-owned organizations (Andrews, 1976), to schemes offering a range of support measures such as work opportunities, training, finance and managerial and advisory services, all administered by a central organization, such as the, now defunct, National Construction Company in Kenya (ILO, 1979, 1987).

Many of the proposals by writers for developing construction firms are addressed to governments. However, other organizations can play an effective role. These include contractors, other construction practitioners, professional and trade organizations, and international agencies. The literature highlights the contribution which foreign contractors can make to the effort by host countries to improve their construction industries (Strassman and Wells, 1988). Many authors and governments expected the transfer of technology by foreign companies to lead to the upgrading of local contractors (Andrews *et al.*, 1972; Carrillo, 1994). The United Nations Centre for Transnational Corporations

ISSN 0144–6193 print/ISSN 1466-433X online © 2001 Taylor & Francis Ltd
htpp://www.tandf.co.uk/journals

(UNCTC, 1989) noted that transnational corporations can help developing countries to improve their contracting capabilities by transferring technology and helping to improve the skills of workers. Moavenzadeh and Hagopian (1984) put foreign contractors at the centre of the process of the development of a nation's construction industry. According to their model, local contractors progressively enhance their capability and capacity by working with foreign contractors, until eventually they become able to export their services. Ofori (1993) criticises this model for its concentration on the role of foreign firms. *Engineering News Record* (1994, 1995) reports that it has become necessary for international companies to establish relationships with local partners in host countries, especially in Asia. Abbott (1985) and Rashid (1990) highlight the use of technology transfer as a business tool by international contractors.

In developing countries, attempts to improve contractors' performance have failed to yield significant results (Cattell, 1994). In particular, dedicated contractor-support agencies have not succeeded (UNCHS, 1996), and almost all of them have collapsed (Talukhaba, 1998). These agencies were able to support only a few contractors at a time, and the firms became over-reliant on the support provided. Other problems included: defaults in loan repayments, bad debts and difficulties in developing appropriate training curricula.

Research objectives

The study formed part of a larger research project on the influence of foreign construction firms on the development of local contractors in Singapore. The part of the project reported on in this paper considered the factors which have influenced the growth of the latter in the past two decades. It sought to investigate the veracity of the following points which are made about these influencing factors in Singapore:

- local contractors have improved in terms of capacity and capability since 1980 when many government incentive schemes were introduced to help contractors upgrade;
- foreign contractors have contributed to the improvement of the Singapore construction enterprises;
- local contractors can help themselves to grow by employing qualified persons, investing in equipment, and adopting management systems;
- the government should provide more help to local firms to help them upgrade, and
- clients and consultants, the contractors' association and organizations outside the industry, such as financial institutions, can help local firms to upgrade.

The objectives of the study were to identify the factors which have been instrumental in the growth of local contractors, highlight their order of importance, establish relationships among them, and recommend action by relevant key organizations.

Development of contractors in Singapore

Structural changes

The trends in, factors influencing, and features of, the development of the construction industry and construction companies in Singapore have been well researched. Chow (1990), Ofori (1993, 1994) and the Construction Industry Development Board (CIDB, 1994) discuss the management of the development of the industry. Low and Tan (1993) link changes in the industry to those in the economy, and to the government's construction industry development initiatives.

Ofori (1996) presents data which show that there have been significant changes in the structure of the construction industry of Singapore. For example, there are now more than twice as many Singaporean building contractors registered in the top financial category (G8) as foreign ones, whereas the latter had outnumbered the locals in 1986 (Ofori, 1996).

Foreign contractors have been prominent in Singapore since the early 1980s: they still dominate the large-complex project market (*The Straits Times*, 1998, p. 46). But their competitive edge is eroding (*The Straits Times*, 1994, p. 47). Ong (1997) notes that local firms 'grew rapidly in the last 30 years . . . [this] has enabled the local contractors to now compete with their once formidable rivals' (p. 2). Also, Singapore firms have become more competitive abroad: they win around US$1 billion overseas annually, after a modest start in the mid-1980s.

Factors identified by different authors as having influenced the development of local contractors in Singapore are now discussed.

Public-sector clients' influence

Public-sector clients have taken measures to help contractors to upgrade their operations in order to achieve their output targets. The initiatives of the Housing and Development Board (HDB) may be considered. The Board has built over 700 000 flats and ancillary facilities such as civic and commercial centres and car parking complexes since its formation in 1960.

Wong and Yeh (1985) discuss the earlier initiatives of the HDB in developing local contractors. These included the offer of bidding preferences for firms with good performance records, a pre-financing loan scheme, assistance with construction management,

supply of key materials, and prescription of equipment to be used. Alexander (1997) outlines the HDB's recent efforts in these regards. Its design practices enhance buildability, standardization and prefabrication, and hence, productivity. It seeks to improve the technical and managerial capabilities of contractors to ensure that they can achieve high productivity, efficiency and quality. It transfers technology and knowledge from its research and practice to the industry (for example, the work of its Prefabrication Technology Centre). It has also instituted measures to enhance site safety and promote the use of information technology by the industry. The HDB applies supportive procurement systems and procedures. It gives Special Quality Awards to its contractors.

Government's incentives and improvement of operating environment

The CIDB was formed in 1984 to oversee the continuous development of the construction industry in Singapore. Its current activities include (CIDB, 1997, pp. i–ii): (i) training and skills testing; (ii) career promotion and manpower policies; (iii) quality assessment of buildings and ISO 9000 certification of enterprises; (iv) promotion of buildable designs to encourage labour-saving methods; (v) promotion of IT applications; (vi) administration of incentive schemes for productivity; (vii) provision of awards to recognize the achievements of construction enterprises in quality and productivity; (viii) registration of contractors and suppliers; (ix) processing and dissemination of information on the industry; (x) monitoring and management of key construction resources; and (xi) assistance for export of construction services.

The CIDB has striven to encourage and assist local contractors to develop their capacity and capability (Ofori, 1993; CIDB, 1994). In 1986, it started a registration scheme for contractors wishing to undertake public-sector projects. It believes that registration has contributed to the improvement of contractors by offering them targets to aim at in their development (CIDB, 1994). The CIDB administers government incentive schemes for contractors. Most of these were introduced in the early 1980s under a programme to upgrade all the sectors of the economy. Low and Tan (1993) offer a useful review. The current schemes include the Investment Allowance Scheme under which contractors can offset the cost of acquiring approved equipment against tax, with priority given to productivity-enhancing items; the Local Enterprise Technical Assistance Scheme (which assists management upgrading); and the Innovation Development Scheme (which aims to encourage innovation of products, applications and services). The Board identifies and publicizes good practice on quality, productivity and strategic technologies (such as prefabrication and IT).

An attempt was made to promote construction technology transfer in the 1980s. Under the Preferential Margin Scheme (PMS), contractors were given a tendering preference (on a sliding scale up to 5% or a maximum of US$2.5 million, depending on the proportion of local ownership) on major public projects. This was intended to encourage joint ventures between foreign and local firms. In 1989, recognizing that the industry had become relatively mature, the Board revised the PMS: the tendering preference was given to firms achieving high levels of quality of workmanship, under the Construction Quality Assessment System (CONQUAS) Premium Scheme. This scheme, in turn, was scrapped in early 1998.

The aim of the CIDB (1994) is to develop a core of large, world-class contractors. Lam (1997) outlined its future priorities as: (i) raising skills of construction personnel; (ii) improving the quality of work; (iii) addressing cost factors that make the industry competitive; (iv) removing the barriers to competition by local contractors; and (v) harnessing technology and innovation.

Industry's role

The construction industry in Singapore has played a role in the attempt to improve its performance. Singh (1990) notes that local contractors are now professionally managed, employ qualified persons, and have introduced managerial systems for quality, productivity and safety.

The Singapore Contractors' Association Ltd (SCAL) was formed in 1937. While embracing larger firms, it 'encourages all builders to upgrade their operations, become more professional and to aim for a high standard of quality in service . . .' (SCAL, 1997, p. 28). SCAL represents contractors' interests to the government and professional institutions. It organizes technical and management training programmes for its members' personnel. It has established a safety consultancy subsidiary (*The Contractor*, 1992, pp. 8–9), and developed an electronic-data-interchange network for its members. It has introduced the Singapore List of Trade Subcontractors to register subcontractors, and help them upgrade.

Foreign contractors' role

The predominant role of foreign construction firms in Singapore is noted above. Many foreign–local joint ventures were formed in the early 1980s, and especially for contracts on the initial phase of the Mass

Rapid Transit project, mainly to benefit from the PMS (Sridharan, 1995). Moreover, many local contractors have worked with foreign contractors as subcontractors. Therefore, there has been some technology transfer. The government believes that its 'open-door policy in allowing foreign companies to compete freely for projects . . .' (*The Straits Times*, 1993, p. 47) has led to improvement in local contractors' performance.

Results and persisting problems

Despite the contractor development efforts in Singapore and the relative success achieved (see below), contractors still face some problems (Economic Committee, 1986; CIDB, 1993). Labour productivity is low, site management is relatively poor, and wastage is high (CIDB, 1989). Most firms are unable to offer a wide range of services which would make them competitive (CIDB, 1994). Construction enterprises have become dependent on government assistance (Wong and Yeh, 1985). Thus, further action is necessary.

Field survey and analysis

Choice of research method

There has been a debate recently on research methods in this journal. Seymour *et al.* (1997) highlight the dominance of the 'rationalist paradigm' which is 'facilitated by various forms of survey research, which typically produce statistical data relating correlations between variables' (p. 118). They advocated the use of 'interpretive methods' because the objects of study of construction management are people. Raftery *et al.* (1997, p. 294) suggest that a variety of approaches (qualitative and quantitative) are equally valid for construction management research. Runeson (1997, p. 302) argues that whereas the positivist approach does not guarantee progress, good research or objectivity, it 'offers the best way to reduce subjectivity and to discipline undisciplined researchers'. In response, Rooke *et al.* (1997) reiterate their preference for the non-positivist approach and propose seven principles underlying the appropriate research approach which they are in the process of developing.

This study adopted a positivist method, a questionnaire-based survey. This is a suitable approach to the research problem (Raftery *et al.*, 1997; Runeson, 1997). It supplements the qualitative approaches to the explanation of the development of the construction industry in Singapore which are followed in all the works reviewed above (see, for example, Low and Tan, 1993; Ofori, 1996).

Research design

Three groups of target respondents were selected for the study. The first was local contractors in the top three registration categories (G6, G7 and G8). These larger local companies were chosen because they would have progressed through several stages of development, and been subjected to the widest range of influences. The second group was foreign contractors in Singapore, which would know the factors which influenced the growth of their direct competitors, the large local contractors. The third target group comprised clients and consultants: they would be knowledgeable on the development, over time, of local contractors.

The first part of the questionnaire sought details of the responding organizations. For all categories of respondents, these included the designation of the person completing the questionnaire. More detailed information was sought on local and foreign contractors. Responding contractors were requested to indicate the company's registration. Other questions related to the company's specialization, categorized into 'building' or 'civil engineering'.

The main part of the questionnaire for the larger research project which is relevant to the study reported on in this paper was the same for all three categories of respondents. It comprised two questions. The first was a simple 'yes'/'no' question on whether local contractors have developed since 1980. In the second, respondents were requested to rank ten factors in terms of their influence on the development of local contractors (i.e. the factors were given scores from 1 'most important' to 10 'least important'). These factors included: foreign contractors; government's financial incentives; other local contractors; local firms' own initiatives; and the support of clients, and that of other construction practitioners. Respondents were requested, with space provided, to indicate other possible factors, and to rank these together with those in the list given.

The addresses of all G6 to G8 local contractors, and all foreign contractors in Singapore were obtained from the CIDB's (1997) *Register of Contractors and Suppliers 1997/98*. The names of possible contact persons were obtained from the *Singapore Contractors' Association Ltd Yearbook 1997*. The addresses of major developers in Singapore were extracted from the *REDAS Directory 1997*. The list of major consultants was obtained from the *Singapore Institution of Architects Yearbook* and other relevant publications.

The data from the survey were entered into the computer for analysis, using the Statistical Package for Social Sciences (SPSS). Various techniques were applied.

Response rate and respondents

The overall response rate was about 26% (263 questionnaire sent, 68 returned). The response rate for local contractors was 16% (178 questionnaire sent, 28 returned), whereas that for foreign contractors was 21% (44 questionnaire sent, 9 returned), and for clients and consultants, 76% (41 questionnaire sent, 31 returned). The forms for 2 local contractors; 1 foreign contractor; and 1 consultant were returned because the addresses of the companies had changed. Four members of the sample returned the questionnaire unfilled, giving various reasons. Local contractors formed 41% of the total number of respondents, foreign contractors were 13%, and clients and consultants constituted 46%.

The persons completing the questionnaires held prominent positions in their organizations. 18% of them were Directors or Deputy Directors; 27% were Chief Executive Officers, Managing Directors, General Managers, Deputy General Managers or Partners; 24% were Managers or Assistant Managers; and the rest were various types of professional.

Nearly half of the contractors responding to the survey (46%) were registered in the top CIDB category, and a cumulative 70% in the top two categories. Of these, 31% were foreign. As studies show that there were few large local construction firms in Singapore until the early 1990s (Chow, 1990; Ofori, 1993), the existing companies have grown significantly in the last few years. Thus, the contractor-respondents are appropriate subjects for the study. Of the contractors responding to the survey, 49% specialize in building and 22% in civil engineering, whereas 19% gave their specialization as both building and civil engineering.

Data of ranking exercise

In the second question of the main part of the questionnaire, respondents ranked the relative importance of the influence of ten factors on the development of Singapore contractors. For easy reference and the convenience of inputting into the computer program, the data were coded as shown in Table 1.

Table 1 Factors influencing development of Singapore construction enterprises

Factors	Coded variable
Foreign contractors operating in Singapore	D11
Government's financial incentives	D12
Other local construction firms	D13
Governments attempt to improve the industry's operating environment	D14
Local contractors, own initiatives	D15
Support of Singapore Contractors' Association Ltd	D16
Public-sector clients' help	D17
Private clients' help	D18
Help of other industry practitioners	D19
Help of others outside construction industry	D110

Analysis and results

Descriptive statistics

96% of the respondents agreed that the capacity and capability of Singapore construction companies have increased considerably since 1980. This provided a basis for exploring the factors which have contributed to this growth. The arithmetic means and the variability of the ranking scores are summarized in Table 2. The stem-and-leaf displays for the factors are plotted in Figure 1 to show their distribution patterns.

Top in the overall ranking is factor D14. It has the highest variability, indicated by the coefficient of variation of 0.74, indicating that the respondents' views are the most diverse although the majority considered this factor as most important. This is depicted in the highly skewed distribution of the stem-and-leaf display for D14 in Figure 1. Factors D17 and D12 are ranked after D14. Both these factors have relatively high coefficients of variation. The first three highly ranked factors are government-related.

Contractors themselves take measures towards corporate development. The respondents rank the importance of this factor, D15, immediately after that of the government. The rest of the factors are ranked in this order: D18, D19, D11, D16, D110 and D13. There is no consensus with respect to the importance of D18 and D19 because almost all the scores are represented in the stem-and-leaf diagram. The ranking for D11 and D16 also is not consistent. The most frequent score given to D11 is 6 while many respondents awarded a score of 10 to D16. The mean ranking score for D110 is 7 and Figure 1 shows that the data cluster around very high scores of more than 8, with a few respondents holding different views. Factor D13 has the highest mean score of 7.35 but the lowest variability indicated by the coefficient of variation. The views of the respondents are more homogeneous and the stem-and-leaf display shows clustering around very high scores that are above 7.

The mean score (and rank) for each factor by the groups of respondents are presented in Table 3. These data show that the different types of respondent are in broad agreement on the first four most important factors. They were unanimous with regard to the top ranked factor (D14). It is pertinent that even foreign contractors ranked their influence (D11) only sixth, while local contractors ranked it ninth and clients

Frequency	Stem &	Leaf
3.00	1 .	000
3.00	2 .	000
3.00	3 .	000
5.00	4 .	00000
6.00	5 .	000000
12.00	6 .	000000000000
7.00	7 .	0000000
8.00	8 .	00000000
5.00	9 .	00000
9.00	10 .	000000000

D11

Frequency	Stem &	Leaf
10.00	1 .	0000000000
10.00	2 .	0000000000
6.00	3 .	000000
8.00	4 .	00000000
8.00	5 .	00000000
7.00	6 .	0000000
3.00	7 .	000
2.00	8 .	00
5.00	9 .	00000
2.00	10 .	00

D12

Frequency	Stem &	Leaf
1.00	1 .	0
1.00	2 .	00
4.00	3 .	0000
2.00	4 .	00
6.00	5 .	000000
5.00	6 .	00000
11.00	7 .	00000000000
11.00	8 .	00000000000
11.00	9 .	00000000000
10.00	10 .	0000000000

D13

Frequency	Stem &	Leaf
18.00	1 .	000000000000000000
12.00	2 .	000000000000
10.00	3 .	0000000000
6.00	4 .	000000
3.0	5 .	000
2.00	6 .	00
5.00	7 .	00000
2.00	8 .	00
3.00	Extremes	(>=9.0)

D14

Frequency	Stem &	Leaf
12.00	1 .	000000000000
7.00	2 .	0000000
5.00	3 .	00000
7.00	4 .	0000000
10.00	5 .	0000000000
5.00	6 .	00000
7.00	7 .	0000000
1.00	8 .	0
5.00	9 .	00000
2.0	10 .	00

D15

Frequency	Stem &	Leaf
1.00	1 .	0
5.00	2 .	00000
7.00	3 .	0000000
3.00	4 .	000
5.00	5 .	00000
7.00	6 .	0000000
8.00	7 .	00000000
8.00	8 .	00000000
4.00	9 .	0000
13.00	10 .	0000000000000

D16

Frequency	Stem &	Leaf
9.00	1 .	000000000
12.00	2 .	000000000000
10.00	3 .	0000000000
8.00	4 .	00000000
6.00	5 .	000000
5.00	6 .	00000
2.00	7 .	00
5.00	8 .	00000
2.00	9 .	00
2.00	10 .	00

D17

Frequency	Stem &	Leaf
4.00	1 .	0000
8.00	2 .	00000000
5.00	3 .	00000
5.00	4 .	00000
2.00	5 .	00
9.00	6 .	000000000
9.00	7 .	000000000
3.00	8 .	000
6.00	9 .	000000
10.00	10 .	0000000000

D18

Frequency	Stem &	Leaf
1.00	1 .	0
1.00	2 .	0
7.00	3 .	0000000
7.00	4 .	0000000
7.00	5 .	0000000
7.00	6 .	0000000
7.00	7 .	0000000
13.00	8 .	0000000000000
7.00	9 .	0000000
4.00	10 .	0000

D19

Frequency	Stem &	Leaf
1.00	1 .	0
.00	2 .	
2.00	3 .	00
9.00	4 .	000000000
7.00	5 .	0000000
4.00	6 .	0000
4.00	7 .	0000
11.0	8 .	00000000000
10.0	9 .	0000000000
13.00	10 .	0000000000000

D20

Figure 1 Stem and leaf plots of the ranking of importance (scale 1 = most important to 10 = least important) given by the respondents to the ten factors influencing contractors (coded D11–D10, see Table 1).

Table 2 Mean scores of factors by all respondents

Rank	Variable	*N*	Mean	Standard deviation	Coefficient of variation
1	D14	67	3.40	2.52	0.74
2	D17	67	3.93	2.49	0.63
3	D12	65	4.28	2.63	0.62
4	D15	65	4.40	2.74	0.62
5	D18	66	5.79	2.90	0.50
6	D19	65	6.22	2.27	0.37
7	D11	65	6.43	2.54	0.40
8	D16	61	6.51	2.75	0.42
9	D110	65	7.14	2.37	0.33
10	D13	63	7.35	2.12	0.29

Table 3 Mean scores (and ranks) of factors by major respondent groups

Factor	Clients/ consultants	Local contractors	Foreign contractors
D11	6.18 (7)	6.90 (9)	5.63 (6)
D12	3.82 (2)	5.03 (4)	3.13 (2)
D13	7.74 (10)	6.86 (8)	7.86 (8)
D14	3.07 (1)	3.83 (1)	3.11 (1)
D15	4.31 (4)	4.76 (3)	3.29 (3)
D16	6.88 (8)	5.71 (5)	8.29 (10)
D17	4.03 (3)	3.97 (2)	3.44 (4)
D18	6.10 (6)	5.86 (6)	4.38 (5)
D19	6.07 (5)	6.28 (7)	6.57 (7)
D110	6.97 (9)	7.07 (10)	8.14 (9)

placed it seventh. The help of others outside the construction industry (D110) was ranked very lowly by all categories of respondents (at ninth or tenth). Since the sample size for the groups varies substantially, accurate interpretations can be made only if comparisons are made with an appropriate statistical method. This is done in the next section.

Kruskal–Wallis test

The Kruskal–Wallis test provides a non-parametric method for comparing the mean values of two populations based on independent random samples. No assumptions regarding the normality or variances of the sampled populations are required. The Kruskal-Wallis technique was used to test the hypothesis that the mean ranking scores of individual factors among the three major types of respondents are the same. The test statistics used is chi-square. Results of the test, with computed chi-square values and the corresponding p values are as shown in Table 4. It reveals no significant difference in their means at 5% significance level. However, the differences in mean ranking scores for D17 is significant at 10% level.

Factor analysis

The factor analysis technique is used to determine the number of factors shared in common by variables in the study (Kim and Mueller, 1978). These common factors which account for the correlation among the variables are extracted. This results in a reduction of a large body of variables. The common factors are referred to as 'components' in this study. They explain most of the variance observed in a much larger number of manifest variables. After the extraction, the components are uncorrelated.

Numerous methods are available for the extraction of components. The 'principal components' method was used in this study because of its simplicity. It produces the initial selection of components which then can be rotated and, through iterative calculations, generate the final solution for the problem. The rotation procedure used in this study is the orthogonal varimax method.

Four factors emerged from this analysis on the basis of the eigenvalues greater-than-one rule, and together they account for 65.5% of the total explained variations. The percentage variations explained by the four components are 21%, 16%, 16% and 13%, as shown in Table 5.

The grouping of variables is based on their factor loadings. A factor loading indicates the degree of association of a variable with the component and the percentage variance of the component that is explained

Table 4 Results of Kruskal–Wallis test[a]

Factors	Chi-square value	$p >$ Chi-square
D11	1.164	0.559
D12	3.214	0.200
D13	4.103	0.129
D14	2.697	0.260
D15	1.324	0.516
D16	1.527	0.466
D17	5.862	0.053*
D18	0.488	0.784
D19	2.251	0.324
D110	0.295	0.863

[a]The asterisk denotes averages that are statistically different at the 10% level of significance.

Table 5 Total variance explained

Component	Rotation sums of squared loadings	
	% variance	Cumulative %
1	20.571	20.571
2	16.093	36.664
3	15.903	52.568
4	12.940	65.508

by the variable. A variable which appears to have the highest loading in one component belongs to that component. The four components and their common factors (bold) are as shown in Table 6. Three variables, D11, D13 and D15 come under component 1 which appears to be associated with 'contractors' role'. Component 2 comprises factors D14, D16 and D17, which may be referred to as 'government's and institution's help'. Component 3 represents 'practitioners' help and financial support' and factors that have the highest loading here are D12, D19 and D110. Factor D18, that is 'clients' help' is a unique variable classified under component 4.

Conclusion

The study indicated that Singaporean contractors have grown over the past two decades. There was no significant difference in the ways in which the three types of respondent viewed the importance of the ten identified factors which influenced the development of Singaporean contractors. Moreover, all the ten selected factors appear to be relevant, although they differ in importance. The analysis shows that the growth of the contractors has been influenced by four broad categories of issues: (a) contractors' role; (b) government's and institutional help; (c) practitioners' help and financial assistance from outside the industry; and (d) clients' help.

Among the factors influencing the development of contractors in Singapore, the government's role appears to be the key. The attempts made by the government to improve the industry's operating environment; the help provided by public clients; and the incentive schemes offered by the government were all ranked very highly. Thus, it is not surprising that contractors continue to request such help, although Wong and Yeh (1985) and Ofori (1991) have warned about a dependence mentality among the contractors if such help is excessive. Such help should be monitored continuously, and fine-tuned where and when necessary. In this respect, those leading the industry, in this case, administrators, especially in the CIDB, require much vision.

The results of the study gave much importance to the contractors' role in their corporate development. Unlike the Moavenzadeh–Hagopian (1984) model, the role of foreign contractors did not emerge as the decisive factor influencing the development of local contractors in Singapore: even foreign firms did not rank this highly. However, foreign firms can have a major influence on their local counterparts owing to the predominance of subcontracting in the industry in Singapore. Also there is scope for more strategic alliances between foreign and local contractors, as in joint ventures.

Initiatives of the contractors' association were not perceived as important, even by local contractors, despite the vision which SCAL has shown in implementing innovative developmental measures. There is scope for greater value-adding activity by the Association. There is also potential for more joint action between the Association and the government for the benefit of the industry (and, ultimately, the economy). The help of others outside the construction industry, such as financial institutions, was ranked very lowly by all three groups of respondents. This shows that the construction cluster is not benefiting from the strength of other industry sectors in Singapore. Thus, the industry is not taking advantage of Singapore's 'total resources' to enhance its capability and performance, as suggested by Ofori (1994).

Several factors affect the development of contractors in each country. This study assessed the views of practitioners on the relative importance of some of these factors in Singapore. It was found that the government's role appears most important among the influencing factors. There is scope for local contractors to do more to help themselves. Moreover, the construction industry should utilize the support of other sectors of the economy, and thus, benefit from Singapore's accumulated industrial and commercial experience and strengths.

Table 6 Factor loadings[a]

	Components			
	1	2	3	4
D11	**0.804**	–0.037	–0.067	0.105
D12	0.365	0.198	**0.714**	–0.060
D13	**0.245**	0.011	–0.752	0.120
D14	0.299	**0.773**	0.148	–0.033
D15	**0.219**	0.129	–0.629	–0.103
D16	–0.066	**0.112**	0.106	–0.872
D17	–0.276	**0.625**	0.112	0.508
D18	–0.671	–0.101	0.164	**0.445**
D19	–0.738	–0.212	**0.081**	0.004
D110	–0.073	–0.704	**0.190**	0.189

[a]The values in bold denote common factors in each component.

Acknowledgement

The authors gratefully acknowledge the grant provided by the National University of Singapore which made the research study possible.

References

Abbott, P.G. (1985) *Technology Transfer in the Construction Industry*, The Economist Intelligence Unit, London.

Alexander, T.M. (1997) Initiatives of the HDB for developing the construction industry in Singapore, in *Proceedings, First International Conference on Construction Industry Development*, Singapore, 9–11 December, pp. 92–100.

Andrews, J., Hatchett, M., Hillebrandt, P.M., Jaafar, A.J., Kaplinsky, S. and Oorthuys, H. (1972) *Construction in Overseas Development: A Framework for Research and Action*, University College London Environmental Research Group, London.

Andrews, J. (1976) The State Construction Corporation, unpublished report for the Minister of Overseas Development, UK.

Carrillo, P. (1994) Technology transfer: a survey of international construction companies, *Construction Management and Economics*, **12**, 45–51.

Cattell, K.S. (1994) *The Effectiveness of the Institutions Supporting South African Small-Scale Construction Enterprises*, Research Paper Series, Department of Construction Economics and Management, University of Cape Town.

Chow, K.F. (1990) *The Construction Agenda*, Construction Industry Development Board, Singapore.

(CIDB) (1989) *Report on the Cost Competitiveness of the Construction Industry in Singapore*, Construction Industry Development Board, Singapore.

(CIDB) (1993) *Report of the Task Force on Construction Productivity*, Construction Industry Development Board, Singapore.

(CIDB) (1994) *10th Anniversary Commemorative Publication*, Construction Industry Development Board, Singapore.

(CIDB) (1997) *CIDB Register of Contractors and Suppliers*, Construction Industry Development Board, Singapore.

Economic Committee (1986) *The Singapore Economy: New Directions*, Ministry of Finance, Singapore.

Engineering News Record (1994) The top international contractors: international contracts rise on the crest of an Asian wave, 29 August, 26–36.

Engineering News Record (1995) Going global: construction – global links count. 28 August, 30–1.

ILO (1979) *National Construction Corporation: An Approach to the Development of an Indigenous Construction Industry*, International Labour Office, Geneva.

ILO (1987) *Guidelines for the Development of Small-Scale Construction Enterprises*, International Labour Office, Geneva.

Kim, J.O. and Mueller, C.W. (1978) *Factor Analysis: Statistical Methods and Practical Issues*, Sage, Beverly Hills, CA.

Kirmani, S. (1988) *The Construction Industry in Development: Issues and Options*, World Bank Discussion Paper, The World Bank, Washington, DC.

Lam, S.W. (1997) Construction industry development into the 21st Century, in *Proceedings, First International Conference on Construction Industry Development*, Singapore, 9–11 December, pp. 11–13.

Low, S.P. and Tan, S.P. (1993) *The Relationship Between Construction, Marketing and Economic Development*, Royal Institution of Chartered Surveyors, London.

Milne, J.C. (1994) *Guidelines for Emerging Contractor Development*, Development Bank of South Africa, Pretoria.

Moavenzadeh, F. and Hagopian, F. (1984) The construction industry and economic growth, *Asian National Development*, June/July, 56–60.

Ofori, G. (1991) Improving the performance of contractors in developing countries: a review of programmes and approaches, *Construction Management and Economics*, **9**, 19–38.

Ofori, G. (1993) *Managing Construction Industry Development: Lessons from Singapore's Experience*, Singapore University Press, Singapore.

Ofori, G. (1994) Formulating a long-term strategy for the construction industry of Singapore, *Construction Management and Economics*, **12**, 213–7.

Ofori, G. (1996) International contractors and structural changes in host-country construction industries: case of Singapore, *Engineering, Construction and Architectural Management*, **3**(4), 271–88.

Ong C.W. (1997) Foreign contractors and the impact on the local construction industry, B.Sc. dissertation, National University of Singapore.

Raftery, J., McGeorge, D. and Walters, M. (1997) Breaking up methodological monopolies: a multi-paradigm approach to construction management research, *Construction Management and Economics*, **15**, 291–7.

Rashid, A.A. (1990) Global strategies of construction firms, Ph.D. thesis, University of Reading.

Rooke, J., Seymour, D. and Crook, D. (1997) Preserving methodological consistency: a reply to Raftery, McGeorge and Walters, *Construction Management and Economics*, **15**, 491–4.

Runeson, G. (1997) The role of theory in construction management research: comment, *Construction Management and Economics*, **15**, 299–302.

Seymour, D., Crook, D. and Rooke, J. (1997) The role of theory in construction management: a call for debate. *Construction Management and Economics*, **15**, 117–9.

SCAL (1997) *Singapore Contractors' Association Ltd. Yearbook 1997*, Singapore Contractors' Association Ltd. Singapore.

Singh, G. (1990) *Building a Nation: 25 Years of Achievement in Singapore*, Supplement to Building Construction News, Singapore.

Sridharan, G. (1995) Cultural influences on joint venture performance: a study of the Singapore MRT project, Ph.D. thesis, University of London.

Strassman, P.A. and Wells, J. (1988) *The Global Construction Industry*, Unwin Hyman, London.

Talukhaba, A. (1998) in *Proceedings, First Meeting of the CIB Task Group 29: Construction in Developing Countries*, Arusha, Tanzania, 21–23 September, pp. 55–61.

The Contractor (1992) Annual dinner 20 November 1991: President's speech, Singapore, **9**(1), 8–9.

The Straits Times (1993) Construction firms benefit from govt's open-door policy, 18 September, 47, Singapore.

The Straits Times (1994) Local firms "ready to take on big boys", 15 January, 47, Singapore.

The Straits Times (1998) Shimizu gets Ardmore Park contract, 5 March, 46, Singapore.

UNCHS (1996) *Policies and Measures for Small Contractor Development*, HS/375/95E, United Nations Centre for Human Settlements, Nairobi.

UNCHS (1989) *Transnational Corporations in the Construction and Design Engineering Industry*, United Nations Centre for Transnational Corporations, United Nations, New York.

Wong, A. and Yeh, S.H.K. (1985) *Housing a Nation: 25 Years of Public Housing in Singapore*, Maruzen Asia, Singapore.