A COMPARISON OF CONTRACTOR PERFORMANCE IN JAPAN, THE UK AND THE US: SOME PRELIMINARY FINDINGS FROM A NEW APPROACH

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International comparisons of contractor performance can provide effective performance benchmarks for those companies looking to succeed in the global market place. Methods previously employed for this purpose have been categorized into pricing studies, macroeconomic studies and case studies. Each of these methods has limitations in terms of two important aspects, that is their comparability and/or their representativeness of a particular country. With the aim being to address those limitations a new approach has been developed utilizing characteristics of both pricing studies and case studies. Data collection was conducted through a semi-structured project-based questionnaire survey conducted simultaneously in Japan, the UK and the US. Results suggest this new approach to be reliable and appropriate for the international comparison of contractor performance. Preliminary statistical analysis of the response suggests there are some important differences in practice and performance among contractors in Japan, the UK and the US.

Keywords: analysis of variance, contractor performance, international comparison, questionnaire survey.

INTRODUCTION

The construction industry is one of the pillars of the domestic economy. Both the increasing world population and changing societal behaviour require more from construction products and will place greater pressure on the construction industry to perform effectively in the future (Atkin and Pothecary 1994). With the globalization of world economy, contractors are entering the international construction market to increase their long-term profitability, balance growth and make better use of resources (Abdul-Aziz, 1994). The international construction market is huge and market penetration has already become a reality. For example, according to the statistics of the Engineering News-Record (ENR, 2000), about a third of the revenue ($118.7 billion out of $368.3 billion) of the top 225 international contractors in 1999 were generated from projects outside each firm's home country. Contractors have to compete with their foreign counterparts in their domestic as well as international markets. In sum, to improve competitiveness and achieve best practice, it is necessary for contractors to benchmark their performance and practice internationally.

The Japanese and US construction industries are internationally renowned as world leaders (Levy, 1990; Flanagan, 1994). Moreover, their distinctive features in working practice may provide exciting opportunities for technology transfer and performance improvement and thus provide useful performance benchmarks for contractors.

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Notwithstanding this, when at its best, UK construction has been shown to be excellent, and capable of matching any other construction industry in the world (Centre for Strategic Studies in Construction, 1988; Egan, 1998; Flanagan, *et al.*, 1998). This research aims to evaluate and compare contractor performance and practice among contractors from Japan, the UK and the US. From such evaluation, performance-enhancing models of best practice are to be derived.

After describing the new research approach developed by the authors, this paper presents some preliminary results from a survey of contractors in Japan, the UK and the US. Then, some brief conclusions drawn from the performance analyses are made.

AN OVERVIEW OF THE RESEARCH METHODOLOGY

Comparing contractor performance is a fastidious and onerous process; a fact compounded when international comparisons are attempted (Proverbs, 1998). When comparing contractor performance and practices internationally, the key issues are to maintain comparability and representativeness of data. To achieve this, a new research approach has been developed. A comprehensive description of the research methodology may be found in Xiao *et al.* (2000a and 2000b), and therefore only an overview is now presented.

Previously, methods for conducting international construction comparisons have been categorized as pricing studies, macroeconomic studies and case studies (Edkins and Winch, 1999). Each method has its own advantages and limitations in terms of their comparability, their representativeness, and/or their resource requirements. Pricing studies are relatively easy to apply and results can be systematically analysed and interpreted. Comparability is maintained but at the expense of representativeness, or vice versa. The method relies on building prices or other (e.g. productivity) figures, which make the results highly sensitive to factors such as economic cycles, exchange rates and project characteristics.

Macroeconomic studies utilize available data, and thus are cost effective. However, they only reflect the situation on a macro level, so results have little practical value to individual contractors and as such have not been widely applied.

Case studies can be used to compare all aspects of construction projects and to demonstrate international differences between countries and why these differences exist. However, it is very difficult (if not impossible) to find matching cases in different countries because of the uniqueness of construction products and the uncertainties around the construction process. Data comparability is suspect and data collection is also extremely expensive and time-consuming.

As used by Proverbs (1996a, and 1996b) and by OECD/ Eurostat (Edkins and Winch, 1999; Vermande and Van Mulligen, 1999), this research uses an appropriate hypothetical project as the basis for a semi-structured questionnaire survey for accruing the data required to allow robust statistical analyses to be applied. Measures of contractor performance include construction cost, construction time, construction quality and sustainable development, and the questionnaire is designed around these themes. Respondents (project managers of general contractors in the three countries) are invited to answer questions related to the hypothetical project and to draw upon their previous project experience. Hard factors (such as the estimated unit price and the construction duration of the hypothetical project) and soft factors (such as their attitude to partnership and the extent to which feedback is sought from clients) are included in order to present a complete picture of contractor performance and practice.

Relative figures in the form of percentages and ratios are used as much as possible to maintain the comparability of data.

The approach used here differs from pricing studies and that by Proverbs in that exact details of the hypothetical project are left to the respondents to decide, allowing them to draw upon their previous project experience and facilitate the inclusion of certain national vernacular characteristics into the design. This is considered essential in order not to impose irregular/abnormal specification details onto the respondents, as this would no doubt induce a degree of bias into the response. Unlike case studies, the new approach uses a hypothetical project for generating comparable data and removes the need to identify matching or concurrent cases. That is, the appropriate characteristics of pricing studies (i.e. comparable data derived from a hypothetical project) and case studies (i.e. drawing on the respondents' previous project experience) are utilized, while disadvantages of both methods (i.e. unrepresentativeness in pricing studies and incomparability in case studies) are eliminated.

DATA COLLECTION

In order to collect the necessary data, a semi-structured questionnaire survey was conducted simultaneously in Japan, the UK and the US. Previously established contacts with researchers, contractor organizations, professional bodies and contractors in the three countries were exploited. For this purpose, general building contractors in the fields of general buildings or commercial buildings were targeted. The semi-structured questionnaire was considered fairly complicated, demanding approximately two hours or more to complete, and a low response rate was somewhat anticipated.

In Japan, translated versions of the questionnaires were distributed to ninety-seven contractors through the Building Contractors Society (BCS). In the US, contractors were contacted by means of a large contracting body, The Associated General Contractors of America (AGC). Approximately 1500 informal enquiries were made seeking cooperation and participation in the survey. Questionnaires were sent to those who showed an interest. In the UK, companies listed in the *Kompass* Directory (Reed Business Information, 1999) and members of the CIOB (Chartered Institute of Building, 2000) were contacted by telephone for cooperation in the survey. Detailed information about the survey is shown in Table 1.

Based on feedback received from the survey participants, the hypothetical project was considered suitably international in design and relevant to the three countries, while the information provided was sufficient to allow respondents to complete the questionnaire. That is, this new research approach was considered suitable for comparing contractor performance internationally.

Table 1: Questionnaire survey

	Distributed	Received		Held back for validation		Used in analyses	
	No.	No.	%	No.	%	No.	%
Japan	97	22	22.7	0	0	22	100
UK	417	34	8.2	2	5.9	32	94.1
US	113	38	33.6	6	15.8	32	84.2
Total	627	94	15.0	8	8.5	86	91.5

PERFORMANCE COMPARISON

Six variables were used to evaluate and compare contractor performance, namely (i) unit price, (ii) construction duration, (iii) defects, (iv) client satisfaction on cost, (v) client satisfaction on time, and (vi) client satisfaction on quality. These performance measures form the basis of the following analysis.

Cost performance

Respondents were asked to estimate the unit price for the hypothetical project, assuming they were the general contactor. Unit price was chosen because it is easier to estimate, less prone to error, and can indicate trends in different countries. Table 2 presents the descriptive statistics for unit price, as provided by the Japanese, UK and US respondents (exchange rates based on £1 = $1.50 and £1 = ¥170).

Table 2: Unit price for the hypothetical project

Country	No. of respondents	Unit price (£/m²)			Standard deviation	Rank
		Mean	Minimum	Maximum		
Japan	22	1488.37	882.40	3235.30	596.16	3
UK	30	882.98	550.00	1400.00	187.89	2
US	32	724.59	359.00	1256.00	251.39	1
Total	84	981.20	359.00	3235.30	472.14	

Analysis of variance of the mean unit prices for the hypothetical project between the three countries was found to be highly significant ($F(2,81) = 31.231$, $p<0.01$). The analysis indicated that on average, US contractors could provide the lowest unit price for the same hypothetical project, followed by UK contractors. The unit price in Japan was much higher than in the UK and the US. Here, the unit price in Japan was approximately two times that in the US and about 70% higher than that in the UK.

Tukey's honestly significant difference (HSD) test was subsequently applied to determine significant difference in the unit price for the hypothetical project of the three countries. The test result showed that the unit price in Japan was significantly different from those in the UK and the US, but there was no significant difference between the unit prices in the UK and the US.

In order to minimize the influence of (i.e. fluctuating) exchange rates, the unit prices were converted by using purchasing power parities (PPPs) (at the rate of UK : US: Japan = 100 :103 :70) published by the Organization for Economic Co-operation and Development (OECD, 2001) (refer to Table 3). Purchasing power parities (PPPs) are the rates of currency conversion that eliminate differences in price levels between countries. For a detailed explanation of PPPs, readers are directed to Officer (1982). Similar analyses were hence applied to the converted figures and no significant differences between the three countries were found ($F(2,81) = 2.543$, $p = 0.085$), which means contractors in the three countries achieved the similar cost level under PPPs.

Table 3: Unit price for the hypothetical project converted using PPPs

Country	No. of respondents	Unit price (£/m²)			Standard deviation	Rank
		Mean	Minimum	Maximum		
Japan	22	843.38	500.01	1833.28	337.81	2
UK	30	882.98	550.00	1400.00	187.89	3
US	32	738.60	365.94	1280.28	256.25	1
Total	84	817.61	365.94	1833.28	264.31	

These results correspond with former claims that there is no significant difference in the cost of building construction between the UK and the US (Department of Construction Management University of Reading, 1979; Nahapiet and Nahapiet, 1985; Flanagan, *et al.* 1986) and the cost of construction in Japan is much higher compared with the UK and the US (Walker and Flanagan, 1991). They also aligned with the claim that after calculation of purchasing power parity (PPP) to minimize differences in exchange rates, Japan has the lowest cost for building compared with the EC and the US (Latham, 1994).

Time performance

Construction time performance is significant to clients in that it can provide direct and indirect benefits. Because of time-related overheads and other relevant expenditure such as the hire of construction plant, contractors also prefer to shorten their stay on site as much as possible in order to maximize their profit (Building EDC, 1983). Therefore, time is an important indicator of contractor efficiency, professionalism and competence (CIDA, 1993).

In the survey, respondents were asked to estimate the construction time for the hypothetical project as a measure of their performance. US contractors required six and seven weeks longer than their UK and Japanese counterparts respectively (refer to Table 4). However, analysis of variance failed to reveal any significant difference between the three countries ($F(2, 82) = 2.030$, $p = .138 > .05$). Therefore, it may be assumed that similar construction times were achieved in the three countries.

Table 4: Construction durations for the hypothetical project

Country	No. of respondents	Construction duration (weeks)			Standard deviation	Rank
		Mean	Minimum	Maximum		
Japan	22	46.0	36	65	7.672	1
UK	31	46.9	24	78	12.731	2
US	32	53.0	12	108	18.623	3
Total	85	49.0	12	108	14.509	

Quality performance

Compared to cost and time, construction quality cannot be easily quantified and measured. Construction quality may sometimes be taken for granted and insufficient attention may be paid to it (Rad and Khosrowshahi, 1998). Latham (1994) believed that defects should not be inevitable in a building or other form of construction project and that work should be done right first time and every time. Quality accreditation and past performance ratings are considered to be suitable indicators of quality performance for contractors (Palaneeswaran and Kumaraswamy, 2000). Thus, the average number of defects on previous similar projects was used as an indicator for this purpose (refer to Table 5).

Table 5: Defects on previous similar projects

Country	No. of respondents	Defects			Standard deviation	Rank
		Mean	Minimum	Maximum		
Japan	20	2.705	.0	10	2.393	1
UK	29	47.931	.0	300	68.441	3
US	27	28.519	.0	500	96.411	2
Total	76	29.133	.0	500	72.770	

Analysis of variance of the mean number of defects indicated no significant difference between the three countries ($F(2,73) = 2.371$, $p = .101 > .05$). That is, contractors in

the three countries achieve similar quality levels. Research conducted by Flanagan, *et al.* (1986) and Bennett, *et al.* (1987) also supports this finding.

Client satisfaction

Client satisfaction should be the focus when evaluating and comparing contractor performance and practices (Latham, 1994). Respondents were asked to estimate levels of client satisfaction in regard to cost, time and quality on similar previous projects on a scale of one to ten. The results are shown in Table 6.

According to the respondents, client satisfaction was relatively high in all three countries. Nevertheless, analysis of variance displayed statistically significant differences (at the 5% level) on cost ($F(2,82) = 3.024$, $p = .054$), time ($F(2,82) = 5.189$, $p = .008 < .01$), and quality ($F(2,82) = 3.254$, $p = .044 < .05$) between the three countries. Tukey's honestly significant difference (HSD) test was then subsequently applied to determine the causes of the significant differences. Results showed that UK contractors were significantly different from Japanese contractors for cost and time client satisfaction, and different from US contractors for quality client satisfaction. In each case, UK contractors achieved lower levels of client satisfaction. There is no statistically significant difference between Japanese and US contractors for these three measures.

Table 6: Client satisfactions in terms of cost, time and quality

	Country	No. of respondents	Client satisfaction (1-10 scale)			Standard deviation	Rank
			Mean	Minimum	Maximum		
Cost	Japan	22	9.23	7	10	.81	1
	UK	31	8.39	3	10	1.52	3
	US	32	8.75	6	10	1.14	2
	Total	85	8.74	3	10	1.26	
Time	Japan	22	9.55	8	10	.67	1
	UK	31	8.42	3	10	1.59	3
	US	32	8.84	5	10	1.19	2
	Total	85	8.87	3	10	1.32	
Quality	Japan	22	9.00	8	10	.76	2
	UK	31	8.48	3	10	1.46	3
	US	32	9.16	7	10	.81	1
	Total	85	8.87	3	10	1.11	

While construction costs in Japan are much higher than in the UK and the US, their clients remain highly satisfied in this respect. This may be linked to the Japanese reliance on negotiated contracts and long-term relationships and their willingness to accept higher prices in the knowledge that finished construction products will be completed (and normally are) to the highest quality, within budget and exactly on time (Walker and Flanagan, 1991).

Performance summary

Figure 1 is a summary of relative contractor performance in the three countries. Here, the most efficient levels of performance for each of the six measures is standardized of ten, while other levels of performance are converted proportionally on a scale of 0-10.

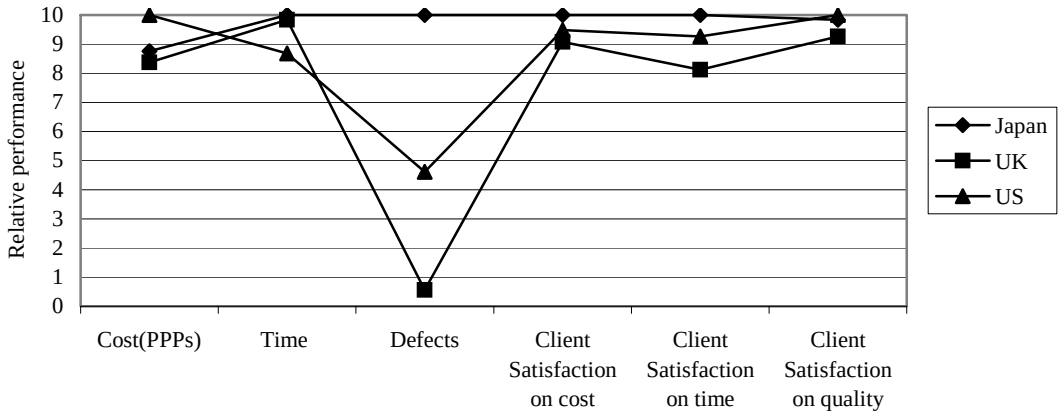

Figure 1: Comparison of relative contractor performance

Figure 1 shows that US contractors achieve superior performance in cost, while Japanese contractors are superior in regard to the number of defects (i.e. quality) and in respect to two measures of client satisfaction (cost and time).

From the above preliminary statistical analysis, significant differences in Japanese, UK and US contractor performance have been revealed. However, similar performance levels for construction time and construction quality have also been found.

CONCLUSION

Contractor performance has long been recognized to vary internationally. Japan, the UK and the US are internationally renowned as world leaders in construction (Levy, 1990; Flanagan, 1994; Egan, 1998). A comparison of contractor performance in these three countries would therefore provide a robust performance improvement benchmark for contractors across the globe.

International construction comparisons are complex, not least because of the uniqueness of construction products. Previous methods used for this purpose, namely pricing studies, macroeconomics studies, and case studies, do not fully address issues of comparability and representativeness. A new research approach has been developed to evaluate and compare contractor performance internationally by combining the appropriate characteristics of pricing studies and case studies. A carefully designed hypothetical construction project is used as a medium to obtain comparable data, utilizing respondents' previous project experience to fully explore routine international practice.

A semi-structured questionnaire survey was conducted among project managers of general contractors in Japan, the UK and the US. Results of the survey suggest this new approach to be appropriate for the international comparison of contractor performance.

Preliminary statistical analysis has demonstrated significant differences in contractor performance for four of the measures used namely, cost, client satisfaction on cost, time and quality. However, no statistically significant differences were found in terms of time performance and quality performance between contractors in the three countries. Further research is required to reveal root causes behind these performance

diversities. This would provide opportunity for contractors in different countries to learn from each other and improve their competitiveness respectively.

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