A NEW APPROACH TO COMPARING THE PERFORMANCE OF CONTRACTORS INTERNATIONALLY

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Contractor performance has long been recognised to vary. International benchmarking offers contractors the opportunity to learn from each other and benchmark their own performance with that of their counterparts in other countries. Comparing international performance has never been an easy task, but this is compounded in construction because of the uniqueness of the industry and its products. Methods previously employed to conduct such comparisons have been categorised into one of three approaches, namely pricing studies, macroeconomic studies and case studies. Each approach has its own advantages and limitations, mainly in terms of representativeness and comparability. This paper presents a new approach towards comparing international construction performance that combines the characteristics of pricing studies and case studies. The method is based on a hypothetical project, whereby data is collected via a semi-structured international questionnaire survey of construction managers. The novelty of the method is derived from the nature of data collected and in the degree of flexibility afforded to respondents. It is argued that by using this new approach, a robust international benchmark of contractor performance can be obtained.

Keywords: benchmarking, contractor performance, international comparison.

INTRODUCTION

Construction products (e.g. buildings, highways) are unique because they are usually produced for specific clients, each with their own distinct requirements. They require substantial investment over a prolonged period involving many disciplines and specialist processes. All the various parties involved (e.g. clients, consultants, contractors, subcontractors, and suppliers) have to work together temporarily to bring the project to conclusion. Many factors, including economic, legal, cultural, technological, managerial and environmental issues to name but a few, are therefore inherent in the process. Among all the participants of the process, contractors are of particular importance, because it is they who ultimately convert the design into physical reality. Good contractor performance is therefore, vital to the success of any construction project (Holt, 1998).

This paper presents a review of international contractor performance and practices found in three leading national construction industries. Current methods used for conducting international construction comparisons are explained, followed by presentation of a new approach to compare contractor performance internationally. This new approach maintains the comparability of performance data while allowing

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international differences in performance and practice to be demonstrated. Based on this approach the intention is to develop a robust international benchmark of contractor performance.

CONTRACTOR PERFORMANCE

Contractor performance has long been recognised 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.

It has been reported that US contractors are able to complete projects faster than their counterparts from either Japan or the UK (Nahapiet and Nahapiet, 1985). This is mainly because buildings in the US tend to be larger (economies of scale), and simpler (constructability) and, greater use of standardisation is made. In the US, standard designs are used wherever possible and pre-fabricated components are commonplace. Hand-held power tools are more widely used, and are relatively inexpensive (Flanagan, *et al* 1986). The early involvement of contractors and sub-contractors in the design stage also contributes to this higher completion speed (i.e. through improved constructability). Variations (change orders) are avoided as much as possible by US clients in order to minimise delays and costs (DCMUR, 1979).

Japanese contractors cannot compete with their US counterparts for construction speed, but they do provide much more certainty regarding completion time. Greater emphasis is put on long-term relationships and mutual trust between Japanese contractors and their clients. Claims for extension of time are extremely rare in Japan.

Compared with the UK and the US, the cost of construction in Japan is much higher due to a reliance on negotiated procurement by Japanese clients. However, Japanese contractors can submit lower prices when competitive bidding is used, or when negotiating with a new client (Walker, *et al*, 1991). Japanese clients accept these higher prices in the knowledge that their finished construction product will be of the highest quality, remain within budget, and be delivered exactly on time.

The concept of quality prevails in every corner of Japanese construction sites, and everyone is assumed to be responsible for the quality of the final product. Workers are encouraged to form groups to study, suggest and practice ways to improve the quality of their operations and the final products. That is, they are empowered (*cf.* Nesan and Holt, 1999). The UK, and to a greater extent the US, rely on prefabrication and greater control in factory production to achieve quality. In comparison with Japan, work on site in the UK and the US generally suffers from a lack of care (Bennett, *et al* 1987).

As far as managerial styles are concerned, teamwork, collective decision making, harmony in human relations, life-long employment and seniority systems (in which promotion is determined by one’s age and working period in a company, rather than ability or contribution to the company) are some important features of Japanese management. UK and US management styles, on the other hand, are characterised by individualism, top-down decision making, competition and privacy, and a propensity to fall back on the written contract (Sidwell, *et al*, 1988).

While new construction technologies and management concepts have been developed across the globe during the past two decades, national distinctions in terms of contractor performance and practices owe more to cultural aspects than to

technological/managerial developments. Hence, the situation is most likely much the same today.

Comparing performance internationally has never been an easy task, and it is particularly difficult in construction because of the uniqueness of products and processes involved (Proverbs, 1998). Loosemore (1999) concluded that international construction management research was still relatively rare, but would be expected to increase with the continuing globalisation of construction industries. Studies of international construction performance will provide an opportunity for contractors to benchmark their own performance with that of their counterparts in other countries. In the construction industry, no one company can claim to be better than all the others; and there are always some aspects in which a company can learn from others (Carr and Winch, 1998). The issue of international construction performance benchmarking is of great importance, especially in view of increasingly global clients and growing interpenetration of national construction industries.

When conducting international construction benchmarking studies, due consideration must be given to the comparability and representativeness of data utilised. That is, the data collected must be truly representative of each nation, and should be of a like-for-like nature. Only in this way, can an accurate international picture of contractor performance and practices be obtained, allowing respective weaknesses and strengths to be identified and encouraging improvements to be made as necessary. Now follows a review of existing approaches.

CURRENT APPROACHES TO INTERNATIONAL CONSTRUCTION COMPARISONS

Methods previously employed to compare construction performance internationally have been categorised into one of three approaches, namely pricing studies, macroeconomic studies, and case studies (Edkins and Winch, 1999). Each approach has its own advantages and limitations, mainly in terms of comparability and representativeness.

In pricing studies, experienced professionals in different countries are asked to price buildings on the basis of identical drawings, specifications and bills of quantities. This method uses planning prices and other productivity data, so to some extent solves the problem of comparability, but does not completely reflect the 'real' situation (i.e. representativeness) of different countries. This is because it may be impossible, or at least uneconomic, to build identical buildings in different countries without some adjustments for local conditions (Meikle, 1990). The results are also very sensitive to the economic cycles in different countries. A demonstration of pricing studies may be found in Proverbs (1998). Proverbs used a hypothetical project (a reinforced concrete frame) to compare planned productivity levels on site in France, Germany and the UK. A questionnaire survey of construction planners was undertaken in the three countries and productivity rates for the concreting operations involved were yielded. Additional information including overall programme times and choices of construction technique were also collected. This data was subjected to statistical analysis to provide comparative results.

Macroeconomic studies utilise available statistical data such as national accounts, national construction industry statistics, labour market surveys and other macroeconomic data sources. For instance, Roy (1982) collected relevant data mainly from Eurostat figures together with O.E.C.D. data for the US and Japan to compare

productivity at an aggregate level (GDP/worker) for the years between 1973 and 1980 among the US, the Netherlands, France, Belgium, Germany, Italy, Japan and the UK. This method is considered cost effective, and can provide a much more dynamic picture of differences in performance between national industries. However, due to the wide variety of sources and varying definitions of those data, their reliability and comparability is suspect. Such studies can only reveal the differences between construction industries at a macro level, and may therefore be said to be lacking in detail to be of any real value.

In case studies, comparable construction projects in different countries are selected and studied. Performance is actually measured against a variety of project criteria. Case studies have the advantages of being able to provide insight into how differences in performance are generated, and to provide performance improvement measures for those who seek to emulate better performance. However, it is very difficult to find matching cases in different countries and data collection is extremely time-consuming and expensive. How representative such case studies are of a particular nation's construction industry is also debatable. Flanagan *et al* (1986) selected nine pairs of similar construction projects in the UK and US for comparing performance of design and construction processes in the two countries. Through interviews, observation, perusal of project documents and other published sources, they undertook a detailed analysis of the nine pairs of projects and obtained some interesting conclusions about the construction industries of the two countries.

From consideration of the above methods, it is apparent that there is a need for a new approach towards international construction comparisons. Ideally, this new approach should maintain the comparability and representativeness of data and preferably be inexpensive and convenient to undertake. The concepts underpinning this new methodology have recently been presented (Xiao, *et al*, 2000). The following section describes this new approach developed by the authors in more detail.

A NEW APPROACH

Contractor performance can be evaluated in a number of ways, but here client satisfaction is focused upon. Normally, clients expect their projects to be constructed within budget, on time and to the level of required quality. Traditionally, cost, time and quality (acknowledging that the latter is more difficult to quantify) have been the main indicators used to evaluate contractor performance. However, the pursuit of such goals should not be at the expense of the sustainable development of contractors. That is, a variety of indicators need to be considered in the evaluation of contractor performance.

In response to Sir John Egan's report, *Rethinking Construction*, the Department of the Environment, Transport and the Regions developed Key Performance Indicators (KPI's) for the industry. These consist of ten indicators, of which seven (namely construction cost, construction time, cost predictability, time predictability, defects, client satisfaction on product, and client satisfaction on service) concern project performance, and three (namely safety, profitability and productivity) concern company performance (DETR, 2000). These indicators provide a generic framework on which construction organisations can evaluate and benchmark their own performance with their counterparts.

Performance indicators for contractors can be categorised into hard factors and soft factors. Hard factors refer to the mechanical operations of planning, scheduling,

estimating and controlling. Soft factors involve behaviour, attitudes, learning knowledge, management, and communication styles; and derives essentially from the social sciences, i.e. 'the people factor' (McCaffer and Edum-Fotwe, 1999). In comparing the performance of contractors internationally, both hard and soft factors require analysis if a full picture is to be obtained. In this research, only those factors that fall within the remit of a contractor's responsibility are considered with a view to deriving best practices that are both practical and controllable by contractors. Contractor performance is evaluated from the following aspects: (1) construction cost and cost certainty; (2) construction time and time certainty; (3) construction quality, safety and service to clients; and (4) relationships with other participants, company sustainable development policy and environment protection.

In order to obtain this information from contractors in different countries (and within the resource constraints of Doctoral research) a new approach has been developed. As used in research by Proverbs (1998), an appropriate hypothetical project is used as the basis for a semi-structured questionnaire survey. The approach used here differs from pricing studies and that by Proverbs in that the finer construction 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 approach acknowledges that detailed design aspects and specifications are different internationally and therefore offers a degree of flexibility in this regard, allowing the response to be truly representative. Unlike case studies, the approach uses a hypothetical project for generating comparable data. That is, the best characteristics of pricing studies and case studies are utilised, while disadvantages of the two methods are eliminated.

The approach was developed because international field visits and/or on-site interviews were considered too expensive and time consuming to undertake. Like pricing studies, the use of a hypothetical project provides a convenient platform on which comparable data on certain hard factors, such as the labour to be used and the unit price of the project, can be yielded. A broad, but carefully worded description of the project, including its location, gross floor area, height, and some basic technological characteristics are provided. The appendix provides an indication of the scope of this description and the rationale for the chosen design. Exact details of the project are deliberately excluded to allow for differences in national preferences and practices. This 'flexibility' represents a significant and fundamental feature of the research design. While this affects the comparability of data, relative rather than absolute measures of activity will be used as much as possible. Absolute measures refer to those which vary with the features of project, such as the cost of a building and construction duration. Relative measures refer to those which are not specific to any one project and are in the form of ratios or percentages, such as the ratio of work finished by means of machinery and the probability of finishing a project on time. These relative measures are obtained based on the experience of projects undertaken in the past three years. This strategy removes the need to identify matching or concurrent case studies.

In considering the design of the hypothetical project, industrial buildings were considered to be more function-oriented, and dwelling house construction to be highly localised. However, office buildings fall somewhere between these classifications (Meikle, 1990), and are more comparable than the other two types of buildings, hence representing a suitable choice for the hypothetical model project. Steel, concrete and composite framed structures are all widely used for office buildings in Japan, the UK

and the US. Concrete, however, is still the most common structural type in the three countries. Furthermore, a concrete framed structure is more demanding for contractors in terms of technical and managerial measures, and may therefore offer greater insight in to contractor practices and performance. Considering all these, the hypothetical project was designed as a six-storey concrete frame office building. As site location affects contractors' performance (Bresnen, *et al* 1987), the hypothetical project was said to be located on a vacant lot in a suburb area.

Some closed as well as open-ended questions are included in the questionnaire to allow hard and soft issues to be investigated. A high level of flexibility is offered to respondents in order that differences in national construction practices can be demonstrated. For example, respondents are able to make certain structural decisions (i.e. precast or insitu) in line with their national tendencies. Respondents are told to assume no design responsibility and that the project is to be constructed in their own country, locally and that they are to represent the main contractor. The project is said to be for a private client with moderate requirements in terms of price and duration, and a high level of quality is needed. The contract is said to be the standard form widely used and respondents are encouraged to choose their preferred choice of plant, equipment and construction methods as well as the deployment of labour.

The survey targets construction managers located at head office. Such personnel have access to several projects at one time, are knowledgeable about day-to-day practices, deal with various project interfaces, and therefore can provide the information needed for the research. Statistical analysis of the data collected will reveal possible causes and effects of any performance disparity found, and used as the basis for subsequent performance modelling work.

Adopting this methodology, representativeness of the data collected is maintained and differences in performance and practices can be determined from the analysis. By means of combining the characteristics of pricing studies and case studies and through careful research planning and design, this new research approach is considered feasible for the international comparison of contractor performance.

CONCLUSION

Contractor performance is influenced by many factors including economic, legal, cultural, technological, managerial and environmental issues. International variations in these factors make comparisons onerous but not impossible, so long as due account is taken of them when designing such research. On the contrary, such comparisons can provide novel solutions or approaches, which may lead to performance improvements for contractors across the globe.

Previously, international construction comparisons have been categorised as pricing studies, macroeconomic studies and case studies. Each of these methods has its own advantages and limitations in terms of comparability, representativeness of the data collected, cost and time effectiveness.

A new research approach for the international comparison of contractor performance, combining the characteristics pricing studies and case studies, has been developed and presented. Data is collected via a semi-structured questionnaire survey based on a six-storey concrete framed hypothetical project. A high level of flexibility is provided to the respondents in order that different national construction practices and performance can be demonstrated. Hard and soft measures of contractor performance are collected based on the respondent's experience and plans for the hypothetical project. This

efficient method will provide data that is both comparable and representative, while enabling disparities in practice and performance to be incorporated into data collection.

REFERENCES

Bennett, J., Flanagan, R. and Norman, G. (1987) *Capital and Counties Report: Japanese Construction Industry*, Centre for Strategic Studies in Construction, University of Reading

Bresnen, M. L., Haslam, C. O., Beardsworth, A. D., Bryman, A. E., and Keil, E. T. (1987) *Performance on Site and The Building Client*. The Chartered Institute of Building, London

Carr, B. and Winch, G. (1998) *Construction Benchmarking: An International Perspective*. University College London, London

DCMUR (1979) Department of Construction Management, University of Reading (1979) *UK and US construction industry: A comparison of design and contract procedures*, The Royal Institute of Chartered Surveyors

DETR (2000) Department of the Environment, Transport and the Regions *KPI Report for the Minister for Construction*. Department of the Environment, Transport and the Regions, London

Edkins, A. and Winch, G. (1999) *The Performance of the UK Construction Industry: An International Perspective.* University College London, London

Egan, J. (1998) *Rethinking construction: report of the construction task force on the scope for improving the quality and efficiency of UK construction.* Department of the Environment, Transport and the Regions, London

Flanagan, R. (1994) The features of successful construction companies in the international construction market. *Proceedings of the A. J. Etkin International Seminar on Strategic Planning in Construction Companies*, Haifa, Israel, 304-318

Flanagan, R., Norman, G., Ireland, V. and Ormerod, R. (1986) A *Fresh Look at the UK and US Building Industries*, Building Employers Confederation

Holt, G. D. (1998) Which contractor selection methodology? *The International Journal of Project Management*, **16**(3): 153-164

Levy, S.M. (1990) *Japanese Construction: An American Perspective.* Van Nostrand Reinhold, New York

Loosemore, M. (1999) International construction management research: cultural sensitivity in methodological design. *Construction Management and Economics*, **17**

McCaffer, R. and Edum-Fotwe F. (1999) Moving on from the crossroads: an agenda for research development in construction management. *ARCOM Fifteenth Annual Conference*, Liverpool John Moores University

Meikle, J.L. (1990) International comparisons of construction costs and prices. *HABITAT INTL* **14**(2/3): 185-192

Nahapiet, J. and Nahapiet, H. (1985) *The Management of Construction Projects: Case studies from the USA and UK*, The Chartered Institute of Building

Nesan, J. and Holt, G. D. (1999) *Enpowerment: the way forward for construction process improvement.* Research Studies Press, Somerset

Proverbs, D.G. (1998) *A best practice model for high-rise insitu concrete construction based on French, German and UK contractor performance measures.* Ph.D. Thesis, University of Wolverhampton

Roy, A. (1982) Labour Productivity in 1980: An International Comparison. *National Institute Economic Review*, (101).

Sidwell, A.C., Van Metzinger, W.A. and Tucker, R.L. (1988) *Japanese, Korean, and U.S. Construction Industry*, The University of Texas at Austin

Walker, A. and Flanagan, R. (1991) *Property and Construction in Asia Pacific: Hong Kong, Japan, Singapore*. BSP Professional Books, Oxford

Xiao, H., Proverbs, D., Shaw, T. and Holt, G. (2000) A conceptual methodology for international comparison of contractor performance. *Proceedings of Bizarre Fruit Postgraduate Research Conference in the Built and Human Environment in the UK*, University of Salford, 9-10 March, 188-197

APPENDIX

Hypothetical Project Design Rationale

Item	Features	Rationale for choice
Type of building	a typical of speculative office building	Office building is simpler in function and less localised, therefore easier to compare.
Structure	Concrete framed	Concrete framed building is more common and involves more technical and managerial factors in construction.
Size of building	six-storey with a gross floor area of 5500 m² (40.30m by 22.80m) and a storey height of 3.00 m	In Japan, all concrete framed buildings taller than 20 meters need special approval. The building should be big enough to have sufficient repeat work and close to real project.
Location of building	Vacant lot at a suburb area	Allow ready-access with ample space for storage of materials and site set up facilities and less abnormal restrictions such as transportation.
Construction time	During summer	No extreme climate conditions are anticipated, and therefore exclude those uncontrollable outer factors.
Foundations	Reinforced concrete pad footings	It is the conventional foundation of this kind of building at normal subsurface conditions.
External envelope	Lightweight concrete block wall with plaster	It is good for earthquake-proof (in Japan) and it is also widely used in office buildings in the three countries.
Floors	Concrete slabs	It is the conventional type floor. Respondents can choose insitu concrete or prefabricated.
Roof	Concrete slab with insulation and waterproof covering	Ditto.
Internal partitions	Light gauge steel gypsum boards	It is good for earthquake-proof (in Japan) and for reduction of the upper load. This is also a conventional design for internal partitions.
Finishes	Inner walls and ceilings plastered	The simplest finish is chosen, for different clients may have totally different requirements on finish.
Level of services	Basic M&E installation including hot and cold-water services, electrical installation and a lift	The focus of this research is building itself. Besides, the prices of service equipment may vary greatly, which is out of contractor's control.