Performance Measurement of Time and Cost Predictability

Joe MARTIN, United Kingdom

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SUMMARY

In 1998 the UK government set up a Construction Task Force to report on the state of the construction industry against a background of concern in the industry and among its clients that the construction industry was under-achieving, both in terms of meeting its own needs and those of its clients.

One of the recommendations of the Task Force was that a series of National Key Performance Indicators should be set up to measure changes in the performance of the industry as a whole and provide the required matrices for management benchmarking.

This paper reports on the development of the indicators for time and cost predictability and the results of four years of data collection.

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1. BACKGROUND

In 1998 the UK government set up a Construction Task Force to report on the state of the construction industry against a background of concern in the industry and among its clients that the construction industry was under-achieving, both in terms of meeting its own needs and those of its clients.

The terms of reference for the Construction Task Force were "to advise the Deputy Prime Minister from the Clients' perspective on the opportunities to improve the efficiency and quality of delivery of UK construction, to reinforce the impetus for change and to make the industry more responsive to customer needs.

The Task Force will:

- quantify the scope for improving construction efficiency and derive relevant quality and efficiency targets and performance measures which might be adopted by UK construction;
- examine current practice and the scope for improving it by innovation in products and processes;
- identify specific actions and good practice which would help achieve more efficient construction in terms of quality and customer satisfaction, timeliness in delivery and value for money;
- identify projects to help demonstrate the improvements that can be achieved through the application of best practice.

The Deputy Prime Minister wishes especially to be advised on improving the quality and efficiency of housebuilding."

The Task Force was made up primarily of representatives of client organisations with large continuous building programmes. The report of the Task Force *Rethinking Construction* (Construction Task Force 1998), concluded that:

> "The UK construction industry at its best is excellent. Its capability to deliver the most difficult and innovative projects matches that of any other construction industry in the world.
>
> Nonetheless, there is deep concern that the industry as a whole is under-achieving. It has low profitability and invests too little in capital, research and development and training. Too many of the industry's clients are dissatisfied with its overall performance."

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It went on to state that there was scope for sustained improvement in seven key areas:

Indicator	Improvement per Year
• **Capital Cost** All costs excluding land and finance	Reduce by 10%
• **Construction Time** Time from client approval to practical completion	Reduce by 10%
• **Predictability** Number of projects completed on time and within budget	Reduce by 10%
• **Defects** Reduction in number of defects on handover	Reduce by 20%
• **Accidents** Reduction in the number of reportable accidents	Reduce by 20%
• **Productivity** Increase in value added per head	Increase by 10%
• **Turnover and Profits** Turnover and profits of construction firms	Increase by 10%

It also reported that there were no accepted industry wide performance measures against which these improvements could be measured. It proposed the setting up of National Headline Key Performance Indicators to:

- Measure improvement for the industry as a whole
- Provide tools to allow individual companies to benchmark their performance

In response to this report the Government put in train three initiatives:

- National Key Performance Indicators (KPI) to provide the benckmark tools;
- The Movement for Innovation (M4I) to promote benchmarking clubs to share best performance on individual projects;
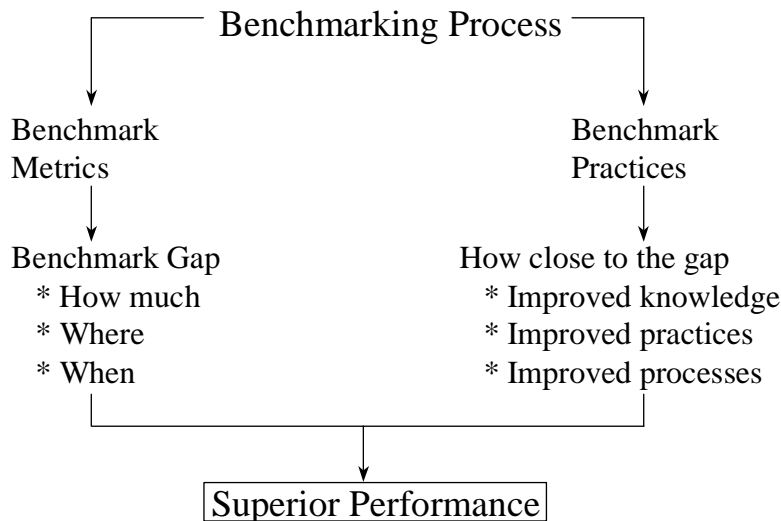- Construction Best Practice Programme (CBPP) to promote the best practice learnt from the M4I schemes.

2. BENCHMARKING

The Construction Task Force used the term benchmarking in two ways. In the traditional surveying sense of "*a permanent physical mark of known elevation used to provide a point of beginning for determining elevations of other points in a survey*" so that the National Key Performance Indicators will become known reference points to measure the changes in the performance of the industry as a whole. In the management sense of "*the continuous process of measuring products, services and practices against the toughest competitors or those*

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recognised as industry leaders" to promote the improvement of performance at the individual company level.

The management benchmarking model in Fig.1 requires both measurement, "benchmark matrices" and process improvement, "benchmark practices".

Fig.1

Benchmarking Process

| Benchmark Metrics | Benchmark Practices |

Benchmark Gap
  * How much
  * Where
  * When

How close to the gap
  * Improved knowledge
  * Improved practices
  * Improved processes

Superior Performance

Benchmarking Robert C Camp

The Task Force prepared a set of measures that could be common to both uses.

3. KEY PERFORMANCE INDICATORS

The first set of National Construction Industry Key Performance Indicators (KPIs) were produced in 1999 and were:

- Client Satisfaction – product
- Client Satisfaction – service
- Defects
- Predictability – cost
- Predictability – time
- Safety
- Productivity
- Profitability
- Construction Cost
- Construction Time

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Since then the suite of KPIs has been expanded to cover both Social "Respect for People" issues and environmental and sustainability issues. Indicators have also been developed for the sectors of the industry – clients, consultants, specialist contractors and product suppliers.

4. PREDICTABILITY OF TIME AND COST

Rethinking Construction sought a 20% year on year improvement in the number of projects completed on time and within budget.

> ***Predicatbility – cost:*** *measures how well outturn costs compare with original estimates.*
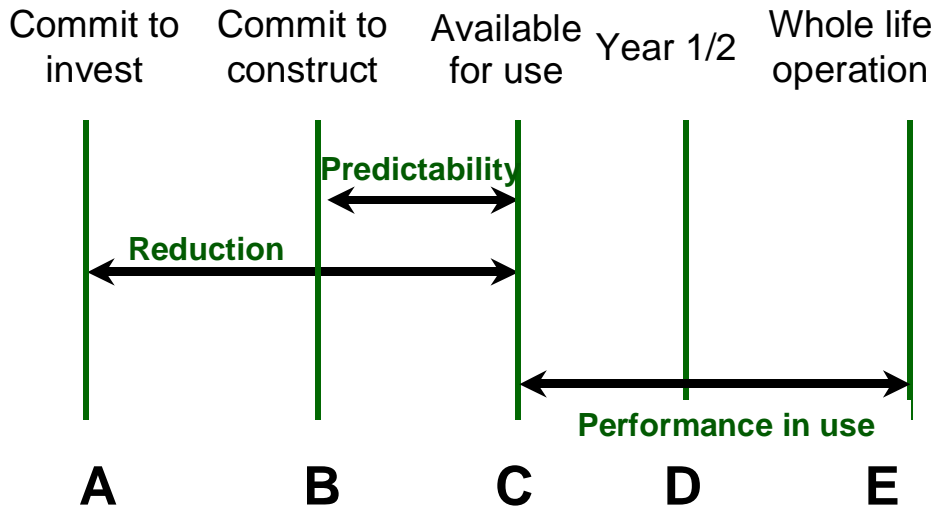
> ***Predictability – time:*** *measures how closely the project was delivered to the original time table.*

Data on time and cost on individual projects was collected at three key project stages:

A. ***Commit to Invest***: the point at which the client decides in principle to invest in a project, sets out the requirements in business terms and authorises the project team to proceed with the conceptual design.

B. ***Commit to Construct:*** the point at which the client authorises the project team to start the construction of the project.

C. ***Available for Use:*** the point at which the project is available for substantial occupancy or use. This may be in advance of the completion of the project.

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Fig.2

Definition of key stages

Data was also collected on whether the changes in cost and time resulted from changes in client requirements.

5. DATA COLLECTION

Initially data was collected by questionnaire survey carried out by the Building Cost Information Service Ltd (BCIS) and sent to members of the Royal Institution of Chartered Surveyors (RICS) Construction Faculty. The Construction Faculty members were identified in consultants and in client organisations.

In the latest survey BCIS have extended the data collection to include engineering consultants and a wider range of client organisations. Questionnaires were sent to 13,500 organisations for the 2003 survey. The survey has also been extended to cover many of the other headline KPI's.

The Department of Trade and Industry (DTI) has extended its sample project data collection for contractors' output with a questionnaire to clients when projects are completed.

The questions relating to time and cost predictability are as follows:

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21. Project Time and Cost Profile (please consult diagram on page 4)

		Date (dd,mm,yy)	Construction Cost £'000	Consultants Fees £'000
21.1	Date of decision for scheme to proceed, anticipated construction cost, estimated fees (Commit to invest - **A**)			
21.2	Anticipated start on site date at **A**			
21.3	Anticipated construction completion date at **A**			
21.4	Actual start on site date, contract sum and anticipated fees (Commit to construct – **B**)			
21.5	Contract date for completion at **B**			
21.6	Actual construction completion date, actual construction cost*, actual consultants fees*. (Available for use - **C**)			
21.7	End of defects liability period (if known)			
21.8	Final certificate date (if known)			

(please do not fill in shaded areas)

* If the actual figure is not known, please insert your best estimate.
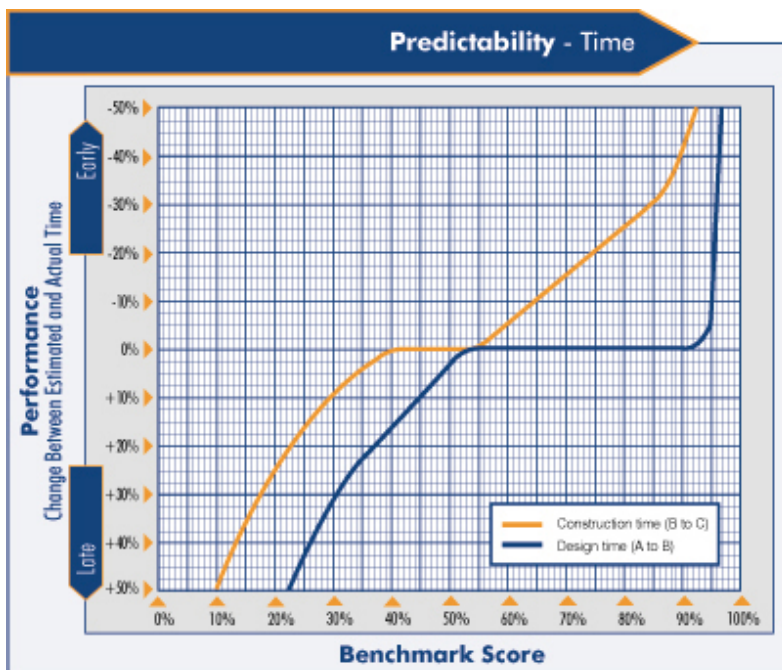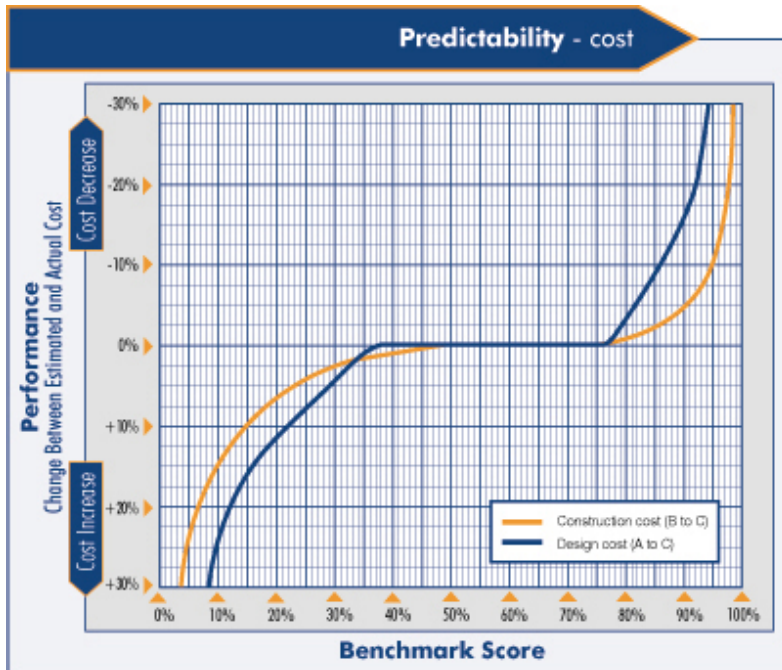
22. What delays/time saving and cost changes were due to you the client?

These are not easy questions to answer but your best estimate would be appreciated. Of any change in cost or time, how much was attributable to major changes in the scope of the work you required, i.e. changes in size or level of specification. Exclude changes in specification or design due solely to the development of the original brief.

a) **Design phase:**
Weeks (+/-) ……………………
Consultants fees (+/-) £……………………
Construction cost (+/-) £……………………

b) **Construction phase:**
Weeks (+/-) ……………………
Consultants fees (+/-) £……………………
Construction cost (+/-) £……………………

6. RESULTS

The headline benchmark graphs for 2002 were published in the Construction Industry Key Performance Indicator pack (Department of Trade and Industry, 2002). The graphs for cost and time predictability are shown below.

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Predictability - cost

Predictability - Time

There was much discussion about how to present the results. To be consistent with all the other KPIs they have been presented as 'S' graphs with the implication that "poor predictability" only relates to time and cost overruns. This indeed may be the client's perception. However, to a construction economist over-estimating is as bad as under-estimating.

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The annual performance report produced by the DTI still reports the movement of predictability in terms of "on target or better", i.e. on target or under. However, the ??? of projects delivered within 5% of the original estimate.

Results are reported both separately for the design (A-B) and construction (B-C) phases and for the project as a whole (A-C).

The data collection also allows for further analysis by:

- Sector
    - New Build Housing
    - New Build Non-Housing
    - R&M and Refurbishment Housing
    - R&M and Refurbishment Non-Housing
    - Infrastructure

- Value
    - <£1 million
    - £1 million - £2.5 million
    - £2.5 million - £10 million
    - >£10 million

- Contractor Selection
    - Negotiated
    - Partnering
    - Single Stage Tendering
    - Two Stage Tendering

- Procurement
    - Construction Management
    - Design & Build
    - Design Managed & Contract
    - Management Contracting
    - Traditional Lump Sum

A summary of the results for the past 4 years is given below.

Headline KPI	Measure	Performance in Year				Trend	
		1998	1999	2000	2001	1 yr	4 yrs
Cost predictability - design	on target or better	65%	64%	63%	63%	→←	↓
Cost predictability – construction	on target or better	37%	45%	48%	50%	↑	↑↑
Cost predictability – project	on target or better	-	50%	46%	48%	↑	↓
Time predictability - design	on target or better	27%	37%	41%	46%	↑↑	↑↑
Time predictability – construction	on target or better	34%	62%	59%	61%	↑	↑↑
Time predictability – project	on target or better	-	28%	36%	42%	↑↑	↑↑

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BIOGRAPHICAL NOTES

Joe Martin is Executive Director of the Building Cost Information Service Ltd (BCIS Ltd). He is a Fellow of the Royal Institution of Chartered Surveyors and a Member of the Chartered Management Institute. He has been responsible for setting up and developing the BCIS Ltd information data bases for capital and running cost of buildings, including the BCIS *Online* service which provides online access to price information on over 15000 projects. He has been involved in the development of price deflators, Key Performance Indicators, and capital and whole life cost benchmarks for the UK Government. He has been involved on many industry bodies including the Consultative Committee for Construction Industry Statistics, The Steering Group for Unified Classification for the Construction Industry, International Construction Information Society Working Group 3 on Elemental Classification, The DTI Working Group on Indices, RICS Construction Design and Economics Practice Panel. He presented Workshops on Construction Cost Information to the Commonwealth Association of Surveying and Land Economy (CASLE) in Ghana (1987), Nigeria (1987) and Kenya (1989).

CONTACTS

Joe Martin DMS, FRICS, MCMI
BCIS Ltd
3 Cadogan Gate,
London, SW1X 0AS
UK
Tel. +44 0207 1500
Fax +44 0207 1501
Email:jmartin@bcis.co.uk
Web site:www.bcis.co.uk

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