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The limits of information? A game theoretic contribution to understanding the development of an indicators policy for the UK construction industry

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The Limits of Information? A Game Theoretic Contribution to Understanding the Development of an Indicators Policy for the UK Construction Industry

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Abstract

In the UK over the last decade, benchmarking has been consistently promoted as a solution to the problems of industry and the construction industry in particular. Government support of benchmarking in construction through the development of a key performance indicators programme found justification in the public goods aspects of the innovation process and because of the presence of market failures of information facing construction clients. However, attempts to merge benchmarking approaches into a single framework did not lead to a combined programme as intended. A game theoretic analysis of the implementation of government policy is presented to account for difficulties encountered by policy actors and to explain why a suitable mechanism to facilitate mutual benchmarking could not be devised. A key performance indicator (KPI) system that supports clients and suppliers in any sector – here we consider construction - is highly problematic, not only because the types of information and types of processes that generate the information used by clients and suppliers are generally different, but because the exchange of information between

suppliers and clients and vice versa potentially leads to loss of commercially valuable information.

Keywords

Benchmarking, game theory, policy implementation.

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Introduction

The paper seeks to close a lacuna in accounts of the development of the UK construction policy over the last decade by explaining the development of benchmarking activities constituted by the UK KPIs within a framework that supplements the explicative contribution on a key distinction in benchmarking noted by Boxwell (1994) and Wolfram Cox et al (1997) with concepts from game theory. We seek to show that while the important distinction outlined by Boxwell (1994) and Wolfram Cox et al (1997) between collaborative and competitive benchmarking can help clarify some aspects of the development of UK construction policy, a more complete explanation of its evolution comes from understanding inherent difficulties in the exchange of information between suppliers and clients. We argue that recent UK policy for construction improvement comprised two parts, each of which had a sound rationale with which different forms of market failure could be corrected. However, the policy proposed by the Latham Report, and more especially in the Egan Report, that combined these two policies was not implementable in the game theoretic sense. We suggest that benchmarking by suppliers to provide clients with detailed information, a core feature of the Latham and Egan approach, was a dominated strategy that would have led to loss of control and loss of profits by suppliers. Thus, while attempts were made by government and representatives of suppliers and client interests to promote a benchmarking policy that met the requirements of both construction suppliers and construction clients, it was not in the end possible to develop a scheme that combined the initiatives and extend it across the whole sector.

This paper firstly examines the literature on the government justifications for policy. It considers what prescriptions are available for policy makers seeking to rectify market failures. The policy aims and methods are then outlined. The way in which benchmarking might contribute to the support of these government policy aims is then considered. Particular focus is given here to the distinction made by Wolfram Cox et al (1997) between internal and external benchmarking. A framework for the analysis of the development of UK Construction Key performance indicators is then presented which employs perspectives from game theory. The case study is then analyzed and conclusions for policy making are outlined. The paper's main conclusion is that in some contexts, government cannot deal simultaneously with two market failures because action that deals with one market failure prevents actions which address the other.

Literature

Introduction

This review of literature examines government policies that support benchmarking, describing their justifications and then considers how such policies could be connected or combined to exploit the potential of the information they generate to deal with market failures of information and innovation respectively. The characteristics of a combined approach are then considered and the need for a design based strategy to policy making is then outlined. Perspectives from game theory are used to enhance understanding of the potential difficulties of attempting to combine the policies. A number of predictions are then made about the outcome of the attempt to connect two forms of policy.

Justifications for Government Action

A role for intervention by government arises when markets fail to allocate resources effectively. This may occur when there are goods whose production either has wider social benefits or costs; and where differences in the information held by market actors leads to less efficient exchange between them. The UK Government is typical of the governments of modern advanced economies in outlining the rationales for action to rectify market failure and the limits of what that action should be. The UK Government does this in the Green Book (HM Treasury, 2003)¹,

Appropriability and Public Goods

The argument in favour of government support for firms to help them improve their products and processes stems from the expectation that those engaged in learning within and between firms will not be able to appropriate sufficient of the benefit from the effort expended to cover their costs. This expectation causes firms to under-invest in the innovation process. Innovation is a process generally thought to give rise to increased

¹ In the UK, the Government's Green Book (HM Treasury, 2003) identifies the rationales upon which its economic policies for market failure are based. The Green Book gives four sets of conditions under which market failure arises: a) public goods; b) externalities; c) imperfect information; d) market power.

social, as well as private benefit, and therefore worthy of government support, where social benefits substantially outweigh the costs to the government. Under the conditions that prevail in the innovation process² where it is difficult to prevent knowledge benefiting others (because of excludability) and where consumption of innovation by others does not reduce the overall amount left for others to consume (non-rivalry in consumption) government is justified in intervening in the economy to support firms.

When firms innovate to improve their products or their processes, they learn what to do partly from observation of what works, both internally within their own organisation and from seeing what works outside it in the population of firms operating in the same industry. They also learn significantly from clients through user driven innovation (Von Hippel, 1988). They may also learn from firms in other industries. Collective invention or innovation is a widespread economic phenomenon and has been very widely studied. Allen's study (Allen, 1983) of invention in the steel industries of the US and the UK has helped to identify one of key factors in promoting it, but despite its value, systematic comparison or "benchmarking" is difficult to employ to give significant improvements for the firm over a long period (Dawkins et al 2007).

Information Problems

Governments also seek to act where information problems occur. These are often referred to as information asymmetries and may lead to adverse selection and moral hazard, both of which affect market actors and affect their ability of transact efficiently. Adverse selection occurs in this context when efficient and appropriate use of new products and processes does not take place at the level that might be seen as objectively justified by a fully informed observer. Moral hazard refers to the phenomenon whereby some parties to a transaction possess information that other parties do not have, and then act upon that information for their benefit and to the disbenefit of the other party. Moral hazard is regarded as inherent in insurance markets or where government bailout mitigates against the consequences of failure. In dynamic markets, the extent of variety and novelty in the products and processes offered and the realistic prospect that products or processes will

² This is where knowledge has the public good characteristics of non-excludability and non-rivalrousness in consumption.

not work as expected in unfamiliar contexts provide the pre-conditions for adverse selection and moral hazard.

The Role of Benchmarking to Support Government Policy

As accurate information and its distribution to relevant parties appears central to the avoidance of market failures, benchmarking would appear to be a useful approach to employ, the more so because of benchmarking's already widespread use in industrial and commercial contexts. A number of typologies of benchmarking have been offered (Dattakumar and Jagadeesh, 2003). One of the best known, which is attributed to Camp (1995), and which appears in a number of practitioner oriented texts (e.g. by Andersen and Pettersen, 1996), describes an information management activity with two main aspects, the nature of the comparison being made, and the scope of the actors involved. Camp's analysis distinguishes three main levels at which benchmarking takes place, performance benchmarking, process benchmarking and strategic benchmarking. It also views these activities as involving four different sets of actors: a) within the firms - so-called internal benchmarking where the benchmarking is only within an economic unit; competitor benchmarking where comparisons are made between firms by each other but without any agreement; functional benchmarking where comparisons are made across a whole industry in a systematic manner; and generic benchmarking where comparisons are made by actors in different industries.

Reviewing the benchmarking literature, Francis and Holloway (2007) note that continued interest in benchmarking reflects its central importance to the productive activity of firms; but they further note a number of problems which have remained intractable, citing the work of Cox and Thomson (1998) who suggest that the often inappropriate nature of the comparisons used had led to many firms to adopt, wrongly, practices that only worked in other contexts.

Further key critical contributions to the benchmarking literature elaborating the difficulties inherent in such a popular business practice are Boxwell (1994) and Wolfram Cox et al (1997). Boxwell's earlier contribution (1994) focused on the issue of information exchange, showing that in competitive benchmarking, information flows in one direction only; whereas in collaborative benchmarking, information flows in both

directions with each party having a chance to learn from others. The analysis by Wolfram Cox et al took the distinction noted by Boxwell but showed benchmarking has a powerful metaphorical influence, often leading firms to engage in it without understanding this key distinction. Further commentators on benchmarking have drawn attention to the sensitivity of the information generated by the process of benchmarking and to questions of its dissemination and use, for example Cox and Thomson (1998). Thus, competitive benchmarking can give rise to information asymmetries.

Combining Policies – an Ideal World

Despite its difficulties, benchmarking is, as it was noted above, an activity that is well known to many suppliers and clients and is generally approved of as a means of dealing with specific organisational and sectoral problems. It fits readily into the larger context of total quality management activities (Andersen and Pettersen, 1983) and its application by the Xerox Company (see Zairi, 1998) is generally regarded as proof of its potentially transforming effect upon organisational performance. In supporting benchmarking, governments can readily point to the evidence that benchmarking is widely acceptable to firms and can vastly improve the performance of firms; and, in the longer term, it can reduce market failures.

Given the evident likely effectiveness of benchmarking in supporting innovation amongst firms on the one hand, and dealing with market failures of information that exist for clients on the other, the case for government combining such policies into a single programme or scheme appears *prima facie* a realistic and effective use of resources. However, as we demonstrate, the attempt to combine policies, even when they individually affect closely related market failures, is a challenge of notable difficulty. Let us look at some of the issues that arise in the attempt to combine policies of this kind into a single entity.

Need for Design

Those developing a policy which combines instruments to deal both with information failures and to promote organisational learning must deal with a number of important

questions before implementing their scheme. These questions broadly concern what data is collected and how it will be used. Specifically these issues, which we discuss below, are: what are the objectives of collecting the data, what data are collected; how is the data to be analysed and made available and by whom; what is the degree of anonymisation of the data; who sees the results of the analysis and can use the data; how much data is collected and how often is it collected.

Objectives

The objectives of the data collection and analysis, which derive from the public policy goals of reducing market failures caused by public goods aspects of learning and by information failures, are 1) to provide information that helps firms learn about the most effective ways of providing the products and services they offer and 2) to give clients information allowing them to determine which firm would be the most suitable to engage to carry out particular work. The second form of information is more clearly focused on information failures.

The use of information by firms and clients can take two general forms, what we term first order and second order comparisons. First order comparisons are where either firms compare themselves with other firms or clients compare themselves with other clients. First order comparisons support mutual learning and have public goods aspects of knowledge production that justifies public subsidy. Second order comparisons occur where clients compare firms or firms compare clients. The public policy goal here is to reduce the information failures that affect the market by ensuring that clients can determine which supplier, from a large population of suppliers, would be most likely to provide the best level of service. The challenge for policy implementers is to unite these two different forms of policy within a single policy vehicle.

Data to be collected

The data to be collected to assist with these two processes in construction would, at its most detailed, comprise systematic data on the performance in all construction projects in

all sectors of the industry involving all suppliers and their respective clients³. This system would almost certainly encounter problems when suppliers and clients refused to participate on the grounds of the existence a residual right to confidentiality, as they might do in the UK. However in other countries, Denmark being an obvious example, the provision of data of this kind by a supplier is a precondition for contracting with a public sector client.

Data analysis, data availability and management

Data analysis of the projects carried out can, as we note above, take place for two purposes: for the benefit of suppliers, it can help identify and determine suitable techniques and business processes; for the benefit of clients, to help them find suppliers most likely to be able to carry out a particular kind of work and at the right level of efficiency and cost-effectiveness. The data provided for analysis can and must provide for comparisons that support the two policy goals.

A challenge for those designing a system is to decide how precise the information should be, an issue bound up with the issue of restricting the data which we consider separately below. It will be useful to consider some examples in this regard. In relation to the public goods aim of policy, how precise should the data be in determining which techniques are to be recommended generally? Also, at what level should the comparisons between the performances of suppliers be made? Should they be made between individual firms or between a firm and the industry average?

Data anonymisation

A further question of difficulty is whether individual firms and clients should be identified in the data. The publication of the names of suppliers would give clients the information they might need to know which suppliers were the most efficient. Without anonymity, a client can decide which firms to invite to tender for work; while with anonymity, a client only knows how a particular firm performs relative to others, this performance being expressed in terms of an average or as a cumulative distribution.

³ Suppliers could of course compare themselves with other firms in the supply chain context.

Data use restriction

Related to the issue of whether the data collected can be used to identify a firm is which firms or groups should be able to view it. Can a distinction be made between different groups with, for example, clients receiving anonymized data while suppliers receive the full data set?

Data collection – extent and frequency and reporting

As data is collected from transactions between suppliers and clients the more times a supplier and client engage in projects, the more information will be generated and the more will be known by others about their activities (on the assumption of non-anonymous data). As information from benchmarking carries a value, in terms of disclosing superior techniques to other suppliers, or indicating to clients which suppliers are more efficient, those firms that engage in more work are more likely to be providing more information than they are gathering. Those classes of agent who routinely engage in many transactions will provide more information to the benchmarking processes than those who do not. It is likely that suppliers will contract more often than clients, giving rise to an imbalance in the amount of information exchanged, but this is not necessarily so as the client might be government, e.g. the NHS.

Acknowledging a problem

A combined benchmarking policy gives rise to a number of difficulties. While these may be perceived initially as merely technical matters of coverage, comprehensiveness, and the use of resources, the difficulties are, we submit, of a more substantial kind. This is because participants in benchmarking will incur costs in collecting and disseminating the information they give up and derive benefits from the information they use. Thus, for each actor affected by a benchmarking policy, a calculation needs to be made that

considers these two quantities. These balances in turn have implications for the design of the benchmarking framework.

A number of commentators have noted this and Murnighan (1994) has suggested that the behaviour of those engaged in benchmarking cannot be fully understood without reference to game theoretic perspectives as these address the strategic value of information possession and exchange. Indeed earlier work by Spendolini (1992) has already identified the sensitive nature of the information employed in benchmarking as a serious concern for those engaged in the practice. The design of benchmarking policies is therefore, a complex task. In the next section we develop the implications of Murnighan's insight and discuss the contribution that game theory could make to understanding the development of policies for benchmarking policy.

Implicating Game Theory?

The application of game theory methods to study actors within a variety of contexts, including policy contexts, is an important and expanding research area, although little has been done in the construction policy context apart from Eriksson's work applying game theory illustratively to contracting practices, his aim being to elucidate the link between the duration of contracting relationship (between client and supplier) and the expectations of payoffs (Eriksson, 2007).

Since von Neumann and Morgenstern (1944), game theory has been employed in numerous attempts to understand human and institutional interactions across a range of contexts that includes policy studies, international relations (Allison, 1969), business strategy (takeover behaviour, monopolies) (Rasmusen, 1999), including most recently attempts to understand the supply chain relationships (Nagarajan and Sošić, 2008) and contributions in economics to explain market formation, functioning and price setting and importantly, where strategies have to be set in relation to government policy activities (Watkins, 2003). Attention has also been given over a long period to general problems of collective action (see for example Hume (1739) and Rousseau (1977) on the stag hunt game) in which multiple actors may choose to collaborate for potentially shared benefits.

This area of analysis continues to lead to insight into the dynamics of collective action, and particularly new forms of business relations, such as those which occur in the field of open source software development (Myatt and Wallace, 2002) where software firms and software writers need to know whether or not to collaborate. Recently, following the work of Foster and Young (1990) and Peyton Young (1993), and inspired by the work of Axelrod (1986), an evolutionary turn in game theory has led to various attempts to explain the emergence and persistence of social systems, rules and conventions, including institutions and principles of justice (Binmore, 2005). Game theory's methods have therefore been variously developed to investigate, understand and plan for, in the sense of developing strategy for, human and institutional interactions both within a short-term frame of reference and over longer periods where the appearance and stability of conventions may be of interest.

The techniques of game theory and the various perspectives generated for the analysis of interactions can also be used in the attempt to address the question of how government should act in the design of policy. Two important areas where contributions have been made in this area are on the one hand in developing government strategy, where government is itself an actor, and on the other, where government sets the rules for interactions.

Where government is considered a key actor within the game setting, there have been two important forms of contributions: in the area of two-level games; and in the context of linked games. In the context of linked game settings, an important distinction introduced by Putnam (1998) is the two-level game. In two level games, an actor at one level, usually the government, may simultaneously be involved with actors in other games (at other levels), with the implications for what happens in one game affecting the second game. The related notion is that of linked games. In such games, actors involved in a variety of interactions with different potential outcomes combine their separate games to attain optimum outcomes that would not be achievable under games considered separately. Examples have been extensively explored by Coleman & Tangemann (1998); Coleman & Tangemann, (1999); Just and Netanyahu (2000). The use of game theory to understand the choices available to policy actors - and thereby the means by which successful implementation of policy can be accomplished - has been undertaken by a variety of scholars, (Frisvold and Caswell, 2000; Eleftheriadou and Mylopoulos (2008).

O'Toole calls for researchers in policy implementation to recognize the importance of interaction between actors for successful policy implementation (O'Toole, 1995) given the dependence of policy implementation upon more than one actor.

Of equal significance is the contribution game theory has made to the consideration the problems of policy implementation, both to develop policy responses to existing dilemmas or to implement policy in wholly new areas. Implementation theory in the context of auctions is one such relatively new application of the game theoretic approach and it has yielded some significant results. One of the best known examples of its use is the auction of the UK Radio Spectrum (Binmore and Klemperer, 2002). The contribution made by game theoretic approaches to the design of policy - so-called "mechanism design", whereby sustainable, albeit second best solutions to economic and social problems (Binmore, 2007) can be sought - has in fact been developing for around three decades. The study of how to implement policy – implementation theory – within the game theoretic paradigm of mathematically based economics parallels the concern of "implementation theory or implementation studies" within the context of political studies. While game theory explanations seek to identify strategy and outcomes based on payoff systems, implementation theory seeks to find answers to the question of how games themselves should be designed (Jackson, 2001). Commonly, the approach here in the context of economic mechanism design is to start with an assumption of how the game should end and then to work towards establishing rules by which those involved in the mechanism should be permitted to act.

The aim of combining two policies is to improve client knowledge and support client innovation independently is, in our view, dependent upon how those affected conceive of, assess, and realize the benefits and the costs of so combining them. As the combination of policies involves interaction between actors of each group in terms of an exchange of information, our approach has been to adopt a game theoretic perspective to understand how such policies might be implemented.

Applying Game Theory to Construction Benchmarking Policy Development

The design of a practical policy must ensure that individual actors of each group (suppliers and clients) are able to participate and they will only do this if benefits exceed costs. Those involved in the negotiation of the details of policy must create a policy,

which is a set of rules, permitting those they represent to operate by the rules. Negotiators and representatives must assess the benefits and the costs experienced by those they represent, which is not an easy as group members are large in number and diverse in character (either suppliers or clients).

In the foregoing discussion the important issues relevant to the design of a benchmarking policy, the nature of the data collected, the analysis of the data, its availability, the anonymisation of data, and the flow and restrictions on the use of the data were examined. All of these aspects affect the potential benefits and costs for those whose interests are represented by the body which carries out the negotiation and proposes versions of the rules. It is clear that the process of policy development has elements of a game theoretic problem: there are players, players have choices, in the form of rules that will affect those they represent, the rules are mutually impacting or influencing, and the various rules have different payoffs.

Playing the Benchmarking Game – Possible Rules

The possible rules for benchmarking schemes are numerous. In all 16 possible combinations of benchmarking and exchange of information are possible where two groups can benchmark, and potentially exchange information within or beyond groups. At one extreme, where there is no benchmarking, no information is exchanged. At the other extreme, all client and supplier information is available to all other parties, for example each supplier's information is available to all other suppliers and to each and every client, there is no anonymisation of data, data are available at individual level and can be analysed at any level and any form of comparison is possible. Where, however, government has determined certain aims for the scheme, i.e. using benchmarking to increase the supply of public goods on the one hand and to remove information asymmetries in the market for construction services on the other, the main rules of the game are defined. It is then for the players, who are the representatives of the groups, to consider the payoffs for those they represent and then to determine their respective strategies.

Playing the Benchmarking Game – Payoffs and Dominant Strategies

Benchmarking within groups supported by government that supports learning and the dissemination of public goods provides a beneficial outcome for both suppliers and clients. However, the issue for group representatives is whether exchange of information between groups is desirable. In the following table, the choices are defined.

In the figure shown above, the options for each group are intra-group benchmarking, where benchmarking only takes place within the group itself, and intra and inter-group benchmarking, where information is exchanged within the group and with the other group. The default intra sectoral benchmarking policy option is that of the top left box. The strategy choice that corresponds to the twin policy aims of supporting public goods by disseminating learning outcomes and providing clients with information about suppliers is the bottom left box. Government policy therefore defines the choices and in this context, limits the choice faced by the players to one option only, shown in bold type.

This option (Option 3) is preferable to Option 1 for clients as it not only supports their own internal benchmarking but provides them with information about suppliers. But Option 3 is not likely to be the preferred option for suppliers as they stand to lose information about themselves to clients. Whether actual assessments of utility or preferences are used, Option 3 is clearly a dominated strategy within the limited game.

		Client	
		Intra Group Benchmarking	Intra and Inter Group Benchmarking
Supplier	Intra Group Benchmarking	Within group benchmarking only Option 1	Option 2
	Intra and Inter Group Benchmarking	Clients and suppliers both benchmark but	

<p>suppliers also give clients information about themselves</p> <p>Option 3</p>	<p>Option 4</p>
-----------------------------------------------------------------------------------------	-----------------

Figure 1

Predictions – Combining Policies – an Impossible World

The strategy for any policy actor - supplier or client representative - is to avoid establishing a policy framework that creates a negative payoff for the type of organisation it represents. Policy actors must attempt to create frameworks that benefit those they represent. Frameworks need to guarantee cooperation in the sense of ensuring or to incentivizing collaboration between all parties. Dominant strategies should be those that give rise to collaboration. The presence of policies that require one group to follow a dominated strategy cannot work. Without this condition being met, policies clearly fail either at inception or beyond it, or at some later point when incentives are made explicit.

Our conjecture is that no representative would be willing to accept the rules of a scheme that gave away vital information to another group on a systematic basis. Therefore while a government policy to promote benchmarking within groups might be acceptable, a policy to promote exchange of information from one group to another would appear to be a dominated strategy.

Case Study: The Development of Construction Benchmarking Policy

Introduction

The case presented here is of that part of UK construction policy for improvement based on benchmarking of the performance of suppliers and use of benchmark data by suppliers

and by clients. The case provides an opportunity to examine the operation of government policy on indicators that was co-produced by government, industry and client interests. The case shows that initial policy aims were unrealizable.

UK Construction Policy – Changing Emphasis

UK construction policy has, over the last 80 years, consistently focused upon the need to improve the quality of the built environment. Because of the longevity of the output of construction and concerns about the capabilities of the industry itself, successive governments endorsed an approach based on support to industry through a standards and advice regime, grounded in research, and organized by an advisory body of specialists employed within a purposely created research organisation. The earliest manifestations of a governmental commitment to address this concern came with the creation, in 1920, of the Building Research Station or BRS (Courtney, 1997). The BRS, which eventually became the Building Research Establishment (BRE), became the government's and industry's key research body, its work underpinning both government policy and industry practice. Even after the publication of the Rothschild Report in 1971 (Cmd. 4514, 1971), which required relationships between government and organisations relying on public money for support, as BRE did, to take on a more commercial form, the industry still received significant help from government. The manner in which government provided assistance to industry continued a very similar way from around 1920 until 1995. In 1995 the privatization of the BRE began a general attempt to produce policies consistent with a more laissez-faire form of capitalism.

Under this new approach, the locus of UK government policy for construction moved away from direction, direct help and regulation towards an approach more characterized by the use of information to guide the choices made by those engaged in development activities and in market transactions. Government limited its role in construction as in other areas to the correction of so-called market failures. Policies to support the creation and dissemination of information became the principal tool. In this new framework, benchmarking has gradually emerged as an important activity, supporting policies for learning and for market decision making.

Benchmarking in the New Policy Context

The use of benchmarking and an information received further emphasis with the publication of The 'Latham' report, "Constructing the Team" in 1994. The Latham Report (Latham, 1994) proposed major changes to the regulation of the industry, including the creation of the Construction Industry Board, a significant new entity which had an important role in developing of indicators with which to monitor progress. At the early stages, the Board expected that the target of the report, of a 30% reduction in the real costs of construction, could be achieved by 2000. The focus at this stage was upon supplier benchmarking.

Progress using the indicators did not take place as quickly as originally hoped. The Construction Task Force, established by the Deputy Prime Minister, John Prescott, argued for major changes and implied a strong link between the performance of the industry and the satisfaction levels of its clientele: "the construction industry is under-achieving, both in terms of meeting its own needs and those of its clients." (Egan, 1998; page 6).

The argument that client expectations should be used to leverage improvement in the performance of the sector grew in force: "Our experience tells us that ambitious targets and effective measurement of performance are essential to deliver improvement. We have proposed a series of targets for annual improvement and we would like to see more extensive use of performance data by the industry to inform its clients (paragraphs 19-22)", thereby giving clients the ability to "recognise increased value and reward companies that deliver it" (Egan, 1998; page 14.) Egan proposed an industry wide scheme that would be of great benefit to clients in which information would be used to drive up standards.

(Paragraph 21 of the report) announced:

'Construction must put into place a means of measuring progress towards its objectives and targets. The industry starts with a clean sheet in this respect. It has a great opportunity to create an industry-wide performance measurement system

which will enable clients to differentiate between the best and the rest providing a rational basis for selection and to rewards excellence.’

The Egan Report therefore saw performance indicators not only as means of monitoring the industry’s progress towards overall performance targets, but also as a tool to assist clients in their procurement decisions. The report underlined the importance of leverage, noting that:

‘In addition to objectives and targets, the Task Force would like to see:

The construction industry produce its own structure of objective performance measures agreed with clients; construction companies prepare comparative performance data and share it with clients and each other; a system of independently monitored company ‘scorecards’, measuring companies’ progress towards objectives and targets, instead of simple benchmarking. The names of the best performers would be made public and every company would be privately informed of where it stood in relation to its competitors.’

The report therefore foresaw a managed system not beholden to any interest group and operating with such a degree of thoroughness that the veracity of its data would not be open to challenge. While the system did not at this stage promise league tables of the best performing suppliers, it is clear that what was proposed would, almost certainly lead to their creation.

Finally, the report (paragraph 27), implied, interestingly, that, as there might be some reluctance on the part of industry to devise indicators about client satisfaction, it might be necessary for clients to create their own to measure their levels of satisfaction:

‘We think it essential that any comparative data takes account of user satisfaction with the buildings they occupy and with

the services of the design and construction team'. (Egan, 1998; page 17.)

Consequently, measures of customer satisfaction became an element of the KPI that emerged from the Egan process, despite the fact that Egan had set no actual targets of this kind.

The KPI Working Group

Following the publication of the Egan Report, a joint industry/government initiative created the KPI Working Group in 1998 to develop appropriate indicators, monitor progress and make recommendations. The group put forward various targets in the following areas: capital cost; construction time; predictability; defects; accidents; productivity; and turnover and profits. It also addressed itself to how progress should be made and what mechanisms would be important in achieving the goals set out. While the Group emphasized that suppliers would use benchmarks to improve performance “to identify strengths and weaknesses, and assess their ability to improve over time”, the Group also foresaw that benchmarks would be central to the procurement decisions of clients: “Clients, for instance, assess the suitability of potential suppliers for a project, by asking them to provide information about how they perform against a range of indicators. Some information will also be available through the industry’s benchmarking initiatives, so clients can see how potential suppliers compare with the rest of the industry in a number of different areas.

Ultimately the Group decided in favour of a “scorecards” based approach. These became an internal rather than external monitoring tool. Additionally, an EFQM (Business) Excellence Model was proposed as ‘the most effective tool for analysing all aspects of an organisation’s operations’.

The Group also chose to emphasize a new policy area, waste and environmental performance. This was an area in which Egan (1998) had made fewer recommendations than were expected. Nevertheless, the report did focus on the main general areas that were of concern to clients at the time, notably delivery.

The KPI Working Group attempt to develop a framework for assessing project performance led to a focus on measurement at five 'Key Project Stages' - points in the development and implementation of a project at which budgets, time estimates etc should be recorded. These were: a) at the point of committing to invest; b) at the point of committing to construct; c) availability for use; d) end of defect liability period; and e) end of lifetime of project. The Working Group also developed new targets and KPIs at three levels that exceeded Egan's recommendations. There were headline measures of a very general nature but giving some indication as to the profitability of the firm; b) operational measures that would help management decide if there was need for improvement in any particular area; and c) diagnostic level KPIs that aimed to discover changes in the other two sets of indicators.

Responding to the Development of the Indicators

The development of the KPIs provided an important window through which other actors in government and in Parliament reviewed the progress being made by the construction industry. In 2001 The National Audit Office reviewed the government's initiatives to improve construction producing a report, "Modernising Construction". This dealt with the effect upon the public sector of poor supplier performance (NAO, 2001). However, if there had been some expectation that the government itself would promote the use of indicators that measured suppliers across the public sector, the conclusions of Modernising Construction indicated that practice fell short of the ideal. Page 49 of the report noted that:

'The Government Construction Clients Panel and the Office of Government Commerce have developed a series of six input and 12 output key performance indicators to measure performance during the life of the project. A software system for collating and analysing the data is being piloted. The system will be rolled out across central government in early 2001.'

At this early stage, therefore, the Office of Government Commerce (OGC) were developing their own indicators and they have continued to operate a separate performance monitoring system for government projects, although with exchange of data with the KPIs.

The NAO commented (page 49) that:

‘The Key Performance Indicators have been particularly useful to organisations with unsophisticated performance measurement systems. Some companies have used the indicators selectively to measure aspects which are important to their business and to the clients, and have used them to supplement their own performance measurement systems. The Key Performance Indicators are not a substitute for more comprehensive performance measurement systems and benchmarking, which can provide more reliable assessments. They do, however, enable companies to gauge their performance in relation to other companies. The indicators are less suitable as tools to manage projects, suppliers or companies or as criteria for evaluating tenders or in evaluating the success of construction project in reducing the operational costs of a building. The Department of the Environment, Transport and the Regions recognises that more needs to be done to develop objective and comprehensive measures to demonstrate construction performance, and in particular to promote further improvements by both departments as clients and construction firms.’

The NAO recommendations further noted that the industry should create more detailed and “sophisticated measures... [and that while] These measures [i.e. the KPIs] are

an important first step”.. “further development” [was required]. Other indicators that were needed included the following:

“The operational – through life - running costs of completed buildings to determine whether efficiency improvements which the original design was intended to deliver were achieved and to learn lessons for the future. The cost effectiveness of the construction process such as labour productivity on site, extent of wasted materials, and the amount of construction work that has to be redone. Quality of the completed construction and whether it is truly fit for the purpose designed and if not what are the lessons for the future, and Health and safety indicators that are measures of success rather than just failure.’

Accelerating Change and further developments but without clients

When the achievements of Rethinking Construction were examined in 2002 by the Strategic Forum, their report paid relatively little attention to the KPIs (Egan, 2002). The report focused on what evidence the KPIs provided – i.e. their use as a general policy tool – noting that, as a result of their creation it could be said that the Movement for Innovation and Housing Forum demonstration projects were better than the industry average, and that data from 2001 KPIs showed the first evidence of an improvement in overall industry performance.

As the KPIs took shape following the KPI Working Group report, development occurred in two main directions, neither of which involved clients to the degree originally envisaged. Firstly, the number of areas covered by the KPIs was increased significantly; secondly the new indicators at sub-sector level were produced. In consequence, a Respect for People set of KPIs was developed through the work of a Task Group chaired by Alan Crane and a set of Environmental KPIs were produced in 2003 from a Sustainable Construction Task Group led by Sir Martin Laing. The so-called sector indicators took two forms. The first was an attempt to provide, at a more detailed level, the kind of information present in the All Construction KPIs. The second specifically focused on certain aspects of performance, with indicators tailored to the needs of the sector.

By 2002, KPI Consortium conceived of the objectives of the KPIs to be quite different from originally proposed, with three main aspects: a) to provide a method for organisations to benchmarking their own performance; b) to provide a means for assessing innovative projects, for example those carried out in the Rethinking Construction Demonstration projects against the rest of industry; c) a general barometer by which industry progress at a general level could be assessed against the Rethinking Construction targets.

Past and Present

Thus, the Key Performance Indicators as used in 2002 had lost any specific link to procurement. The objectives then stated were those adopted after the work of the KPI Task Group. Furthermore, surveys were dependent on information collected on a voluntary basis only and while those involved with the KPIs were independent of the firms that gave the data, the process lacked independent monitoring in the sense of active verification of data.

The current statement of the purpose of the KPIs which appeared in one of the most recent user manuals, (KPIzone User Manual, 2007) now emphasizes benchmarking for suppliers, and while the User Manual does include reference to the use of the KPIs to provide support for procurement decisions, there is no longer any notion of a systematic attempt to integrate benchmarking by suppliers with the needs of clients. It was therefore only within the context of the work done by the Housing Forum that customer satisfaction KPIs which scored performance of builders emerged; and moreover, these were developed separately from the general UK Construction KPIs and were only prepared for a limited period only.

Analysis and Discussion

The construction industry KPIs were originally developed to meet both client and supplier objectives and to do so with overlapping information collecting and analysis

processes. There was considerable political support for the development of an integrated process that united supplier and client benchmarking. The process appeared a *prima facie* means to achieve government policies of supporting innovation and development amongst construction suppliers and to reduce information asymmetries in the market place for construction services. The development began in propitious circumstances with relative political stability, significant policy time to devote to the project, and support from within the industry itself and from clients. There was strong political will for a benchmarking and information based solution to the industry's perceived problems of high cost/poor performance and client dissatisfaction.

As time passed, it became evident the two key processes could not easily be integrated. Eventually the KPIs began to address the needs of suppliers more explicitly, while a separate use of the information by clients met their needs in a restricted manner. It was initially assumed both by their representative bodies and by government that individual clients and suppliers would be happy to work together to share information. Given government financial support, it was assumed that a cooperative scheme could be developed. However, no industry wide integrated benchmarking system emerged.

Explanation of the development of the KPIs must, in our view, attend to the question of economic incentives, rather than merely the technicalities of different forms of benchmarking, or lack of political commitment. Although it is clear that the organisation of a large scale data collection and analysis process across industry would have been costly and complex, policy development never reached an official trial. Rather, suppliers and clients representatives gradually allowed the idea of the scheme to fall down the agenda, and ultimately to be abandoned.

It is interesting to see how this process proceeded. The initial plans and expectations were adumbrated without clear insight into how implementation would be achieved. One might ask whether at any point in the development of the policy the expectations of benefit were explicitly considered. The application of a game theoretic approach to explain the development by government of its policy in this construction context indicates such an explicit consideration probably never took place. However, if it had, there is doubt that such a policy would have left the drawing board.

Conclusions

The foregoing analysis has reviewed the development of the key performance indicators element of UK construction policy and in particular the Constructing Excellence KPIs. The analysis supports the view that the concept of mutual benchmarking involving extensive exchange of information between clients and suppliers and which was promoted in the Egan Report has proved not to be capable of implementation. The argument presented here on the basis of the case study is that such mutual benchmarking presents risks to the longer term interests of suppliers, leading suppliers to be reluctant participants and to avoid involvement if possible. Benchmarking may operate successfully in the context of certain industries, notably the car industry, with relatively small numbers of clients and suppliers. However, within the context of the construction industry, mutual exchange of information is perceived by the representatives of suppliers as likely to undermine their ability to compete on favourable terms.

Our explanation for the outcome of KPI policy endorses the important dichotomy outlined by Boxwell (1994) and Wolfram Cox et al (1997); however, while the different forms of benchmarking outlined by these writers are different forms of activity, being carried out in different ways and using different forms of information, and being largely incompatible activities, such a difference between benchmarking activities does not by itself explain why government policy in this area took the course observed. Rather, events unfolded sub-optimally from the point of view other schemes' aspirations, not only because of differences in style and purpose of benchmarking, but as we have argued above, because of the differences in the perceived benefits of the outcomes for suppliers.

Government support for benchmarking activities does however have strong policy justifications in certain contexts: in the context of organisational learning, government can legitimately support the activities of firms when positive externalities are likely and those engaged in innovation face difficulties appropriating the knowledge and know-how they produce; likewise, in the context of decision making in markets, governments can assist decision making by supporting procurers by improving the quality and increasing the quantity of information in existence about what suppliers might want. However, in the context of benchmarking between clients and suppliers, so-called mutual benchmarking, the rationale for large scale government supported schemes is weak. This is because

suppliers perceive such a scheme to be likely to remove their competitive advantage and in particular to lose them their control over prices and profitability.

An implication of the analysis is that government policies that simultaneously aim to deal with different forms of market failure at the same time may not be possible. How then can government operate in these sectors where there are market failures of both kinds? Can policies be identified that address these different market failures at the same time? It would appear that this is only possible at a very general level. However, at such a very general level such policies would be of very limited benefit.

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