COST SAVINGS FROM PERFORMANCE-BASED MAINTENANCE PARTNERING

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ABSTRACT

New procurement approaches combined with performance-based building approaches should reduce costs, but empirical qualitative and quantitative studies are lacking. We studied the cost savings on project level by adopting a performance-based maintenance partnering approach. In a performance-based maintenance partnering approach the contractor has incentives to improve his way of working. Innovative, cost-effective solutions that meet the performance criteria can be achieved, especially if the principle of whole-life costing is being adopted. Indirect cost savings are expected as well. It enables maintenance contractors to assume responsibility for certain activities which they are better equipped to perform than their clients. The findings show that performance-based partnering reduces both direct and indirect costs compared to a traditional procurement approach. The essential preconditions are long-term involvement and freedom in the maintenance design and process for the contractor, giving opportunities for product and maintenance process improvements.

KEYWORDS: maintenance, procurement, transaction costs, whole life costs

INTRODUCTION

The construction industry needs to adopt strategies for change and innovation and to change its orientation from cost of services to value and performance. It must take a longer-term view of value and adopt new procurement methods based on adding value for clients and a concept of performance (e.g. Courtney, 2005; Egan, 1998). In a performance-based maintenance relationship contractors no longer work as suppliers of capacity only, but become active participants in the overall maintenance process of a project for a specific agreed-on period. Performance criteria are explicitly stated by the client (Author, 2007). The professionalism of Dutch housing associations has led to paying more attention to maintenance processes and partnerships in the supply chain of maintenance, leading to performance-based maintenance agreements. European legislation for public tendering is not mandatory for Dutch housing associations. A breakthrough of performance-based maintenance partnering is obstructed by distrust, desired flexibility in decision-making and fear of disturbance of price competition. The existing adversarial relationship between clients and contractors make it difficult to introduce new procurement principles. The client organization's objectives are likely to change over time and external circumstances may change. Therefore any long-term cooperation must incorporate a degree of flexibility. Even more important is the fact that Dutch housing associations fear a disturbance of price competition using long-term performance-based agreements. Together with their desired flexibility in maintenance policy they restrict the contract period to maintenance work intervals. Contrary, they admit that a long-term partnership will enable them to derive the greatest possible advantage from the performance-based maintenance approach (Author, 2007). Those advantages are improves performance and service during a long maintenance period, adopting principles of life-cycle costing and whole-life costs. This will reduce the costs too.
This paper focuses on the cost savings of performance-based maintenance partnerships compared to traditional maintenance tendering based upon technical specifications. The research question is: To what extent does performance-based maintenance lead to project cost savings compared to the traditional way of conducting maintenance works? In the study costs have been calculated for two or more maintenance intervals (processes).

This paper expands on the current literature on the subject by evaluating expected cost savings from performance-based partnering. Next the research method is described, followed by the findings of the study. The paper finishes with conclusions and discussion.

EXPECTED COST SAVINGS BY PERFORMANCE-BASED PARTNERING

There is a general belief that new procurement approaches combined with performance-based building approaches will improve performance and service and reduce costs (e.g. Bresnen and Marshall, 2000; Egan, 1998; Saad et al., 2002; Trimmer and Kidston, 2003). Innovative, cost-effective solutions that meet performance criteria can be achieved, maintenance cycles can be extended, and change orders are reduced. Moreover efficient risk allocation will lead to cost savings.

Wood (2006) studied whether partnering is actually delivering win-win outcomes for both parties involved. He interviewed 10 major UK clients and 10 national contracting organizations. Lower costs for the client and guaranteed work for the contractor are the strongest and most consistent messages expressed by Wood’s respondents. Black et al. (2000) surveyed by postal questionnaire clients, consultants and contractors involved in construction projects. Most benefits attributable to partnering expected from the parties are better relationships rather than project-based benefits (such as improved design, quality improvement, reduced cost etc.). "It can be inferred that because a better relationship between the parties produces the project-related benefits, the project-based benefits have not been rated highly by the respondents” (Black et al., 2000). We believe that project-related benefits are becoming more obvious in maintenance relationships if the whole service life of a building is involved and contractors keep responsibilities for a long period.

Whole-life costing

If principles of whole-life costing are adopted, reducing of the production costs can be realized by:

- planning the maintenance activities according to the existing level of quality, the desired quality and the desired service life of a building;
- ensuring better coordination between work to the substrates and to the finishing (e.g. undercoats and final painting).
- conducting maintenance activities ‘just-in-time’ based upon performance measurements.

The performance-based relationship offers the contractor greater opportunities to plan the maintenance activities to the requirements of the client during the duration of the maintenance period, and to coordinate maintenance activities with each other. This is the result of the contractor’s long-term involvement in, and responsibility – including financial responsibility – for the maintenance project under the performance-based partnering
agreement. The fact that the same contractor takes responsibilities for both the paintwork and maintenance work to the substrates is also important. In the initial process, a thorough analysis of the causes of defects will be conducted. The contractor will select the solution offering the lowest costs over the entire service life. Performance-based partnering offers a better guarantee of actually achieving the advantages of condition-based maintenance than the traditional approach, since it is the contractor who conducts the performance measurements and who also bears the risks relating to the timely performance of maintenance activities. The deterioration can be predicted more accurately and maintenance cycles may be extended, for example from six to seven years. Accordingly, in a maintenance scenario of thirty years, there would be only four maintenance intervals and rather than the current ‘traditional’ five. This view is based on experiences with performance-based partnering and the results of performance measurements.

**Transaction costs**

Client and contractor both make transaction costs. Reducing of the transaction costs can be realized by performing process activities by the client or contractor that is best equipped to perform the activity and by a better management of the entire maintenance process.

In the traditional maintenance approach, many activities are duplicated, i.e. conducted by both client and contractor, because information is lost following the once-only tendering process. In the performance-based approach, clear agreements are made with regard to which party is responsible for which activity during the co-operation period. Site supervision by the client is not needed if performances are specified. We expect that process improvements and indirect cost reductions will become particularly apparent after the initial process. The costs of collecting project information, consultation, condition assessments and the design of alternative maintenance scenarios will decrease dramatically due to the continuity of the performance-based partnering agreement.

**RESEARCH METHOD**

**Direct and indirect project costs**

In this research distinguish is made between direct project costs and indirect project costs. The direct project costs represent the production costs for a certain maintenance period. For the client actual payments to the contractor represent the production costs (the bid price). The indirect project costs are the transaction costs in connection with the procurement process. See Table 1.

<table>
<thead>
<tr>
<th>Table 1 Direct and indirect costs</th>
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<tbody>
<tr>
<td>Direct costs</td>
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<tr>
<td><strong>Project costs</strong></td>
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<tr>
<td><strong>Non-project specific costs</strong></td>
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The production costs can be influenced if principles of life-cycle costing and whole-life costing are adopted. The transaction costs can be influenced by the kind of relationship between the client and the contractor. The kind of specifications may influence both. The overall project costs for the client include the bid price and his own transaction costs.

Waara and Bröchner (2006) argue that transactions costs for the contractor could easily be measured, being the bidding costs. We think it takes a lot of effort to make the bidding costs of the contractor transparent is working in a performance-based manner. The indirect project costs (transaction costs) depend on the process activities that must be conducted by the client and the contractor respectively throughout the maintenance period of the complex. The contractor is working as a maintenance engineer. The costs for providing advice about maintenance solutions and for conducting performance measurement are being part of the bid price or priced separately.

Projects

An initial study included ten projects (Author, 2005). In order to make a thorough comparison, 12 more projects were selected. Each project involves exterior maintenance of housing estates owned and managed by a housing association. 13 housing associations and 9 maintenance contractors are involved. The number of projects of one housing association is between 1 and 4; the number of cases of one contractor is between 1 and 6. The cost comparison assumed a performance-based approach, with the applicable basic premises in terms of performance level and maintenance period. The contractors had produced a maintenance scenario, including a price, for this period. The maintenance scenario influences both the direct and the indirect costs. The notional direct and indirect costs of the traditional procurement approach could be closely estimated, based on the quality level and maintenance period. The maintenance history of the building played a significant part here. It was assumed that the direct costs of painting – including preventative maintenance work – are cyclically recurrent.

Presumably the size and scope of the project will influence the proportion between direct and indirect project costs per procurement approach. Here a distinction has been made between ‘simple’ projects, ‘complex’ projects and ‘total facade’ projects, depending on the scope and type of maintenance work involved, and the lead-time of the (initial) process. Ten projects could be classified as ‘simple’, 7 cases as ‘complex’ and 5 as ‘total façade maintenance’. The cases studied vary in terms of the characteristics of each housing estate, size, maintenance history and original quality, and working methods. Accordingly, they are not directly comparable one against the other. However, each case enables a comparison to be made between the long-term performance-based approach and the traditional approach in terms of direct and indirect project costs. The distribution of size and construction years is large. The number of dwellings is between 27 and 360. One housing estate was built before the Second World War. The housing estates involve single- en multi-family dwellings. Generally, the traditional approach as well as the performance-based approach of both the clients and contractors shows a great variety. There are differences in process steering by the housing association closely connected with the given freedom in maintenance solutions by contractors and the monitoring of performance by contractors and/or third parties commissioned by the client. Experience may affect the production costs as well as the transaction costs. Two of the 13 involved housing associations were not experienced in performance-based maintenance partnering. That means that the projects in this research were the first projects procured performance-based. The number of performance-based maintenance contracts of experienced
housing associations differs strongly. Just a few clients see performance-based partnering as the only procurement method.

**Calculation model**

A calculation model was developed that calculates the net present value of the direct and indirect project costs at project level. The initial process and the subsequent processes consist of all activities conducted during a maintenance interval. Following the initial process, one or more subsequent processes will take place. It is assumed that these subsequent processes will be equal in scope and cost, although the actual maintenance activities undertaken in each can vary.

The model distinguishes 25 process activities. The activities are based upon the traditional maintenance process and the performance-based maintenance process (see Author, 2007). The process activities in the initial and subsequent processes can be clustered into five phases: specification, selection, contracting, work and supervision, and after-care. Table 2 shows the process activities of the phase contracting.

The costs are based on a differentiation in hourly charges per activity, with the level of charges depending on the various wage scale groups applied by both client and contractor. The model assumes that each party will have three such groups. Third parties, such as consultants or inspection agencies, may perform some activities; the costs involved being charged to the client and/or contractor.

**Table 2 Process activities phase contracting**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Traditional Client</th>
<th>Contractor</th>
<th>Performance-based Client</th>
<th>Performance-based Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collecting or adjusting project information</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Consultation about functional specifications and</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>performance criteria</td>
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<tr>
<td>Inventory</td>
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<tr>
<td>Condition assessment</td>
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<tr>
<td>Collecting external advice</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Inviting tenders and assessment subcontractors</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Designing or adjusting maintenance scenario’s</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Formulating or adjusting offer</td>
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<tr>
<td>Assessment offers</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Consultation about offers</td>
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<td></td>
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<tr>
<td>Working out and consultation about activity plans</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Commissioning and confirmation work</td>
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</tbody>
</table>

**FINDINGS**

From the results the overall project costs appear to be lower for performance-based partnering than for traditional maintenance tendering. This concerns all kind of projects. The average overall project costs difference is 20%. In all cases, the direct costs (bid price minus
the indirect costs of the contractor) of performance-based partnering are lower, or at worst the same, as in the traditional approach. The share of the indirect costs of the client in the overall project costs is small, in traditional working method as well as in performance-based partnering. The cost savings on bid prices by performance-based partnering are the biggest for ‘total façade’ projects, followed by simple projects. See Figure 1.

![Figure 1 Average overall costs client, initial process and subsequent processes,](image)

The indirect costs of the client are lower in case of performance-based partnering in the initial process as well as in subsequent processes. On average for all projects the indirect costs of the client are 51% lower in case of performance-based partnering. See Figure 2.

![Figure 2 Average indirect costs client, initial process and subsequent processes,](image)

In all phases with the exception of ‘after-care’, the costs of performance-based partnering are lower. Cost savings are relatively the biggest for the phases of ‘specification’ and ‘selection’. Because of the fact that the client will continue the relationship with the contractor after the initial process, time and costs being spent for selection are in subsequent intervals very low. See Figure 3. Cost savings in contracting and work and supervision are very clear in the subsequent processes. Not surprising is that the client spends more time and money for after-care if applying a performance-based partnership.
The indirect costs of the contractors are a part of the bid price. This research project made these costs transparent. Contractors are not involved in the phases of ‘specification’ and ‘selection’. Contractors will spend hours in the phase of ‘after-care’ only if working performance-based. Those ‘extra’ hours are amply compensated by saving hours in the process phases contracting and work and supervision, especially during subsequent maintenance processes.

On average the indirect costs of the contractor are 21% lower in the case of performance-based partnering. See figure 4. During the initial process contractors spend on average more hours. The expectation was that ‘simple’ projects are an exception, but this is not true. Contractors spend also more hours in most of the simple projects during the initial process if working performance-based compared to traditional maintenance. Clients give contractors free reins.
product and maintenance process improvements. The findings show that average overall project costs are 20% lower. The phases ‘specification’, ‘selection’, ‘contracting’ and ‘work and supervision’ become markedly less expensive in case of performance-based partnering. The ‘after-care’ phase is markedly more expensive in every case when the performance-based approach is adopted, because of conducting periodic performance measurements. For the contractor the initial process is more expensive within the performance-based approach. That this method is nevertheless less expensive overall for the contractor is due to the cost reductions in the subsequent processes. Indirect cost reductions become particularly apparent following the initial process, once both parties have gained experience with the project. The direct costs can be reduced not only in terms of savings on manpower and materials, but also – and especially – in terms of incidental costs such as the hire of scaffolding and site costs. Scaffolding hire represents a growing proportion of the total direct project costs. Longer maintenance cycles enable this type of expenditure to be reduced significantly.

The client’s initial selection of contractors is likely to cost more time in the performance-based approach than in the traditional method. The selection will not be for each individual project, but the client will divide all his projects among a number of pre-selected contractors. Prior to the initial phase of the first project (or projects) the client and contractors will be required to devote considerable time to seeking out the most appropriate partnership form(s), agreeing unit prices and decisive performance indicators, and drawing up the relevant framework contracts. However, these activities are also part of the traditional working method, albeit under different names. Like selection, the evaluation of contractors and the assessment of customer satisfaction will also take place outside the confines of individual projects, although project-related aspects will also be taken into account in the evaluation.

Because maintenance activities are assigned to the contractor for a long period, covering a number of subsequent processes and maintenance intervals, it is no longer necessary to re-bid for each period. This continuity will result in lower indirect project costs throughout the subsequent processes for the contractor. It is questionable whether this cost benefits should be calculated in unit prices beforehand. The findings show that on average the indirect costs of the contractor are 21% lower in the case of performance-based partnering. This means that new activities by contractors, especially advice about maintenance solutions and performance measurement, do not raise contractors’ transaction costs, at least on the project level. The execution of these activities demands additional capabilities from the contractor (Author and Van Mossel, 2007); relation specific costs and overhead costs may increase. Moreover maintenance contractors must be able to achieve a sufficient level of turnover under performance-based partnering agreement in order to be able to perform these ‘advisory tasks’ in satisfactory manner. Due to the continuity of the performance-based partnering agreement maintenance contractors can improve their internal business processes, with more efficient logistical deployment of manpower and equipment, and more efficient purchasing of materials. This will reduce the overhead costs.

ACKNOWLEDGEMENTS

The author gratefully acknowledges Henk-Jan van Mossel for his contribution to the research and to this paper, all housing associations and maintenance contractors who took part in the cases, and the support of the Dutch Building Research Foundation (SBR) and the branch organisation of maintenance contractors WVB in funding this research.
REFERENCES


