Rationalising Public Procurement of Complex Construction Projects by the Price Component Selection

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Introduction

It has long been the custom in construction to select service providers, especially contractors, solely on the basis of the lowest bid. The practice has led to risk taking and adversarial relations and created problems in the sector, thereby, impeding its development. Pressures to renew the implementer selection come also from a broader cultural change: a value-added strategy is now being pursued also in construction and more collaborative, relational project practices are increasingly applied in various forms (see, e.g. Lahdenperä 2012b). A collaborative approach often also means early involvement of the key parties to the process since traditional, sequential involvement of the parties does not allow mutual exchange of information and collaboration for the benefit of the project. Therefore, early involvement of the construction team is increasingly utilised especially in demanding projects to incorporate versatile expertise in their planning. Early involvement has also become part of governments' strategies (Valkenburg et al. 2008; Edwards 2009; Alliancing Association of Australasia 2010; Procurement/Lean Client Task Group 2012; HM Treasury 2013).

At an early stage, the project is fraught with too much uncertainty which makes it impossible to estimate (all) costs reliably. Due to the resulting risk premiums, it is not sensible to fix the price in the early stages of project development. On the other hand, procurement methods involving competitors in early proposal design (for complete design and full price) forego the opportunity of collaboration with the client (owner) and stakeholders. Even if competitive ideas are presented, the owner's decision making can be conservative and ignore possible improvements since evaluation of alternative solution and ensuring the absence of gimmicks is often impossible in the middle of a hectic process where the public owner is required to treat all competitors equally and non-discriminatorily. If nothing else, those project

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constraints that require laborious administrative procedures to remove usually constitute an obstacle. Thus, collaboration is seldom genuine and profitable and much potential may be wasted in cases like this.

Thus, the current solution is to strive for an open process (incl. independent cost estimators, etc.) where the price (target cost) of the project is set later after a joint development phase by the owner and the selected team. However, it is not reasonable to ignore the cost and price elements totally even then and give the service provider disproportionate power to price the service/project subsequently which might happen as a result of the contractors' higher cost consciousness (or information asymmetry; e.g. Xiang et al. 2012). Actually, it is necessary especially for public owners to set constraints and/or a mechanism for price formulation in order to ensure price competitiveness also in the case of early involvement in order to comply with public sector accountability concerns. This leads to a complicated set-up and it is uncertain how such an approach works in practice. Accordingly, the essential goal of the study is to determine whether it is possible to find procurement procedures that integrate broad-based competition with good, creative collaboration. That is of critical importance especially since "public sector accountability concerns" have been considered the number one factor hindering the use of relational contracting in public construction (Ke et al. 2012).

More precisely, this chapter aims to increase the understanding of the possibilities and appropriateness of using partial price factors in case of early involvement in public procurement by delving into the practices and experiences of four different infrastructure projects. In those Australian and Finnish public projects team selection was based only on price tenders for some cost items or parts in addition to capability assessment. These items do not cover the total project price. The price components used in those four projects were, for instance, fee, project overhead, risk and opportunity provision, preliminaries and defect correction cost. In the case of assigned components tenders are binding. That which was not covered by the components was left to be priced during subsequent collaboration.

In other words, the proponents themselves do not seek/present a total price for a project: just an estimate of the unpriced part is prepared on the basis of the owner's own cost-estimate items and/or offered component prices to determine the comparative price. In the end, the selection criterion is the "most economically advantageous tender" which means that capability/quality is always taken into account in selection in addition to (comparative) price although it is not delved into here. The descriptions focus mainly on price components, and other aspects are described only to the extent that they are linked to the use and use criteria of components. Correspondingly, for the purposes of this study, the listed approaches are jointly called "price component selection" despite the term's possibly limited interpretation.

The chapter starts with a closer look at the need for targeted practice due to the on-going tendency towards relational contracting and better integration of the construction team. That is followed by an analysis of cost uncertainty and the ability to impact costs, which vary during the advancing process. The analysis produces two imprecise critical points to serve as a frame of reference for an examination of the practical examples thereafter. There, the focus is on the price components used as selection criteria in four different case projects which are also examined in relation to the said frame of reference for a better understanding of the wide range of possibilities in existence. Appropriateness of the different approaches is then discussed based on interviews of parties to the projects while some remarks are also made from the viewpoint of public procurement regulations. The European perspective is emphasised in the study; the different constraints possibly existing in other parts of the world are not examined.

Need for a Change

From Adversarialism to Collaboration

Fragmentation of the construction process and the resulting adversarial relationships between the involved parties have led to a lot of criticism towards prevailing procurement practices. The initial reason seems to be the separated design and construction, or disintegration of the construction project process in general (e.g. Latham 1994), where the low bid syndrome can be recognised as a major determinant behind the customary adversarial behaviour (Weston and Gibson 1993; Scott 2001; Stehbens et al. 1999; Nicholson 1991; Loraine 1994).

"Relational contracting" has been offered as a solution to these challenges. This is due to the fact that a contract based upon a relationship of trust between the parties, where responsibilities and benefits are apportioned fairly and transparently, is called "relational" as opposed to "transactional". This kind of duality can be traced back to "the relational theory of contract" (e.g. Macneil and Campbell 2001). In practice, relational and contractual mechanisms are complementary parts of the governance continuum of a project (Hartmann et al. 2010; Roehrich and Lewis 2010). While explicit contracts are needed to reduce uncertainty and minimise opportunism, they can only cover foreseeable contingencies—specifying everything would increase planning costs and prevent a flexible and quick response to unforeseen events. This is where the relational aspect, with its socially complex routines, comes into play in inter-organisational relationships.

Critical consideration of contract law also provides a basis for the theory of "transaction cost economics" when examined jointly with economics and organisation theory (see Williamson 1979). In reference to the theory, Sweeney (2009), for instance, writes that due to "bounded rationality", the actors in any contract have limited foresight and are unable to foretell the future, nor can they fully, precisely and unambiguously specify the known aspects due to the limitations of language and the cost of calculating and communicating plans and solutions (cf. Williamson 1985). While "asset specificity" (or "process specificity"; Chang and Ive 2007) ties the contracting parties together due to the losses caused by termination and changing service providers, "opportunism" in the form of pricing of extras may occur. Bearing this in mind, the initial tender may have been manipulated already considering the existing loopholes referred to above. Moreover, it is stressed that in traditional delivery methods an increase in reimbursable costs generates also costs that are not allocated to the project meaning that part of the cost effects often go unrecognised. For these reasons, traditional contracting would lead to an uneconomical result especially in complex projects from the viewpoint of the owner (see e.g. Sweeney 2009; Bajari and Tadelis 2001; Bajari et al. 2014), which explains the contents of "the low bid syndrome" referred to above.

Relational contracting is also called for by the change that has taken place within the modus operandi of the industry and its clients. The owners of built assets have increasingly regarded them as strategic means to improve the performance of their core operations (e.g. Krumm 2001). Correspondingly, they have in many cases started buying business solutions, not just construction capacity, which, moreover, requires employing relational contracting practices (Roehrich and Lewis 2010). In general, there are various forces driving towards further servitisation of construction (Leiringer and Bröchner 2010). Servitisation, which means integration of additional services, knowledge and support to the supplier's core product offerings, also puts the firm face-to-face with its customer (Vandermerwe and Rada 1988) increasing thereby the importance of the relational mechanisms that supplement the contract (Hartmann et al. 2010). Moreover, performance in demanding, risky projects could obviously be improved by joint risk management (Rahman and Kumaraswamy 2002; Pishdad and Beliveau 2010).

From Sequential Process to Joint Development

Studies aimed at fostering innovation in construction also stress the need for closer integration and improved collaboration (Blayse and Manley 2004; Holmen et al. 2005; Rutten et al. 2009). Systemic innovations, especially, require comprehensive or multidisciplinary expertise. It is also clear that co-operation that begins early enough with respect to design creates the best possibilities for utilising the partners' expertise in seeking better and more cost efficient solutions than the conventional ones. This is based on the fact that the ability to impact the cost weakens, and the cost of design changes increases, when the process proceeds as illustrated at the top of Fig. 1 imitating literature (e.g. Connaughton and Green 1996; American Institute of Architects 2007; Russell et al. 1992). Yet, conceptualisation of the project prior to the mobilisation of the entire team is needed to direct the work.

Although innovation-orientation may be considered the main driver for renewal, studies on the negative influence of project changes in the current practice provide some understanding of the existing potential. Hsieh et al. (2004), for instance, conclude that the fragmentation of the design and construction process increases the likelihood of change orders with conventional project procurement methods causing significant cost and time overruns. Most change orders arise from problems in planning and design (Hsieh et al. 2004; Arain and Pheng 2005; Cox et al. 1999; Hanna et al. 1999), which early team integration is believed to alleviate. Ibbs (2005), again, shows how late change is more disruptive of project productivity than early change as shown in the figure.

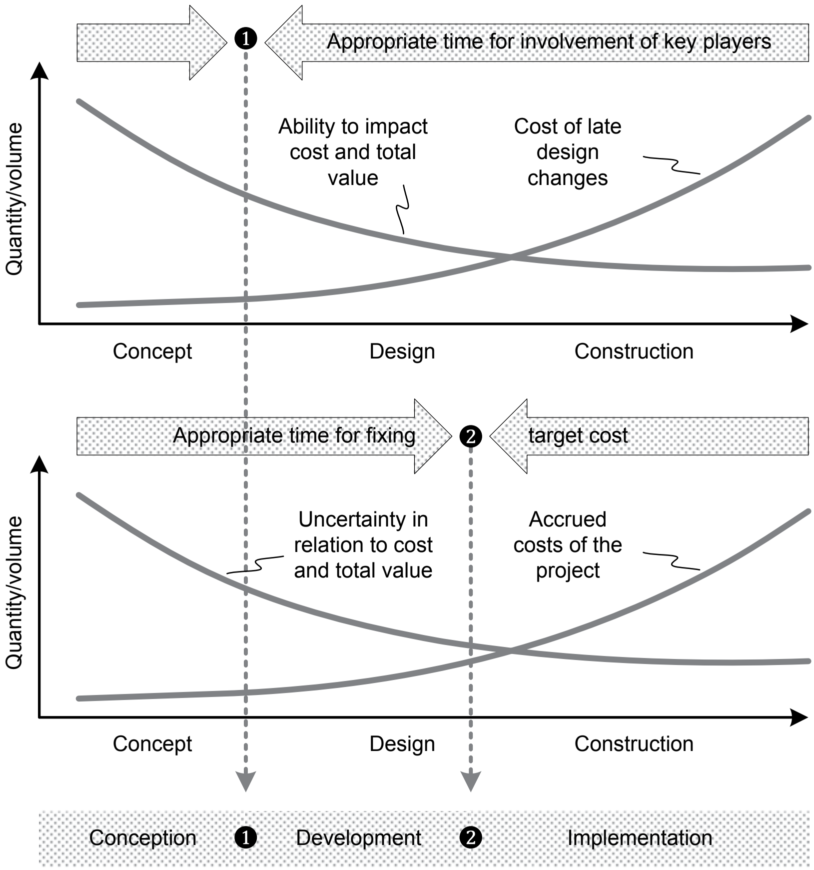

Fig. 1 Illustrations of the two conceptual fulcrums of the involvement process

On the other hand, as illustrated for instance by Bredehoeft (2012) and Lundman (2011), a project budget evolves towards an increasing level of accuracy: the spread of uncertainty becomes narrower, as would be expected due to the intensive work undertaken by the team to develop the plans. Since risk premiums alternate in parallel with risks (e.g. de Neufville and King 1991), the owner should aim to fix the pricing of the project relatively late in the process as outlined in the middle of Fig. 1. In other words, early pricing with inadequate planning lead contractors to add arbitrary premiums to their quoted prices potentially resulting in money being wasted by the client (Mosey 2009). Yet, the pricing should normally be agreed prior to launching the costly construction phase to avoid the situation where the owner carries all the risks.

Practical application of both of the above viewpoints means early involvement of the construction team (Step 1 in Fig. 1) combined with late fixing of the price level (Step 2). In other words, early involvement of the construction team, which leads to the signing of a final contract (although conditional) is of primary importance for the project's success providing that an arrangement ensuring a reasonable price later in the process can be developed. Such arrangements, for the most part, are examined later in the chapter, and the two-node process reintroduced at the bottom of Fig. 1 forms a tentative frame of reference for that.

The importance and potential of this "development stage" (between Steps 1 and 2) is obvious also on the basis of earlier research. The reported experiences from early involvement are mostly positive (National Audit Office 2005; Valkenburg et al. 2008; Ballard 2008; Song et al. 2009; Edwards 2009; Mosey 2009) especially when the team is involved with the intention of implementing the project to completion—consultative involvement is not likely to work as efficiently due to the inadequateness of incentives or, more precisely, the existence of disincentives (Lahdenperä 2010). All in all, it is clear that the trustful relationship of "relational contracting" should not be understood only as a collaborative component of a contract after all its price-inclusive conditions have been fixed.

Case Examples

Common Project Characteristics

This chapter presents four projects adhering to the practice of "price component selection" to introduce the change of the previous section (partially) to traditional practice while yet remaining cost conscious and observing public sector accountability requirements—not putting the owner at the service providers' mercy.

More precisely, these projects are alliancing projects for major infrastructure procured by public bodies. Project alliance is a project delivery method based on a joint contract between the key actors to a project (owner, designer, and constructor) whereby the parties assume joint responsibility for the design and construction of the project to be implemented through a joint organisation, and where the actors share both positive and negative risks related to the project and observe the principles of transparency of information in pursuing collaboration (Lahdenperä 2009; Department of Infrastructure and Transport 2011). The alliancing practice also typically leans on the early involvement of the team for joint development. Thus, it truly is a form of relational contracting.

The project alliance system evolved from the need to improve the implementation of demanding and risky investment projects—due to, for instance, new technology and project conditions or interfaces—and it has broken through especially in Australia (Department of Treasury and Finance 2006, 2009).

Overall Selection Process

The overall selection method naturally varies per project but is generally based on both qualitative and price components. Typically the competition entrants, who have been selected as tenderers, receive a request for proposals. After the first round proposals have been submitted, the number of tenderers is reduced based on an assessment including interviews. Thereafter, two competing teams usually continue to the stage involving workshop tasks that are evaluated as a part of qualitative criteria. Then, the competitors give their quotes for the requested price components. Sometimes pricing is openly discussed already during the preceding workshops (e.g. in case of a risk analysis which is of no real value if cost consequences are not dealt with), but most often they are finally tendered in a sealed envelope that is opened only after other evaluation measures have been completed. As a rule, the tendered price components have been binding. Selection is then made based on joint assessment of the team's capability and a comparative price constructed from the quotes.

Overall, that was the process primarily followed in the presented cases with a few exceptions. In Case 4, the final evaluation of capability was done already in an earlier stage and the three competitors continuing to the last stage focused just on project design and pricing. Case 4 was also different from the others in that cost escalation provision was not needed due to later index-linking whereas in the other cases the tenders also had to cover cost escalation. In Case 3, again, some of the presented price components were not binding.

Subsequently, selected service providers develop the project and its design in co-operation with the owner before the actual target cost (or target outturn cost, TOC) is set and the parties are ready to finally commit to the implementation of the project in question. Thus, TOC is agreed prior to launching construction and termination is possible if the parties are not able to agree on, for instance, the TOC. The TOC is to be based on quoted price components and, the remaining part, on project/risk- and market-adjusted (or tested), audited direct costs of earlier projects. After the completion of the project, the owner and service providers share the difference between the target and outturn costs.

One characteristic of the selection process needs to be emphasised in particular since the following presentations skip examination of the quality/capability assessment: evaluation of capability—with its manifold meanings—is a very in-depth, stage-wise process especially if the price components are rare (cf. Department of Treasury and Finance 2006; Lahdenperä 2012a). It includes interviews and collaborative development workshops often with a psychologist involved in the evaluation—in addition to the more usual criteria of past performance, know-how and experience of section managers, and project specific narratives on strategies, approaches and management plans.

Case 1: Road Tunnel with Junctions

The project involves relocating an arterial road that is a major entry road to a city as well as a through road for long distance traffic. The aim is to bury part of the road, that currently divides the city and becomes regularly congested, in two 2.3 km tunnels with three lanes in each direction, to widen the rest of it (along 3 km), and to connect it to the surrounding traffic network by graded interchanges. Besides the city infrastructure, the tunnels will also pass under the rapids traversing the city at 20 m below the river bed. The price components used in the selection were the following (Finnish Transport Agency 2012):

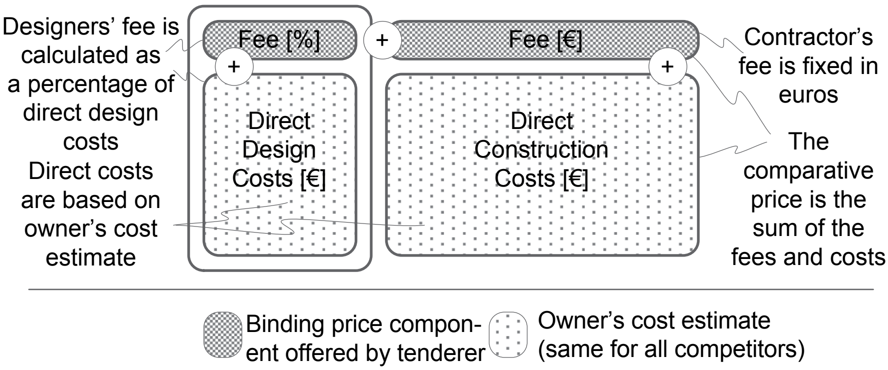

Fig. 2 Formation of comparative price in the road tunnel project

- Fee percentage of design companies which consists of company-level overheads and expected profit when the fees of designers to the main contract are combined according to their work shares.
- Fixed-fee of contractors which consists of company-level overheads and expected profit when the fees of contractors to the main contract are combined according to their work shares.

The owner used the same—his own—direct cost estimate in comparing competitors, which thus became the basis of the assumed size of the direct costs of both last stage proponents. Based on data from earlier projects, the owner divided the total cost estimate into likely design and construction costs for the calculation of a comparative cost. Designers' fee was calculated from the design share (based on the percentages) after which all items were added up to arrive at a total comparative cost (Fig. 2). Selection was then made based on joint assessment of the team's capability and the comparative price where the former carries greater weight than the latter. Due to the small number and limited coverage of concrete price components, the cost viewpoint is reflected in the selection primarily as a component of capability through the proposed method for control of the economy, presented budget critique and suggested development possibilities. Thus, it is not question of track records and formal qualification, but a solution-oriented view is required.

Case 2: Water Treatment Plant

The project involves renovation of a water treatment plant that processes the sewage of about 1.5 million people. Before the renovation, the treatment system consisted of two main stages that

were not modified. Instead, the renovation added a third stage to the process, which improved the treatment result considerably. The project was a new type of combination of technologies, which means that the implementation also involved technologically demanding development. Besides, the intermediary storage of water between the second and third stages and its reorganisation/location posed a big challenge to the project. The price components used in the selection were as follows (Melbourne Water Company 2010):

- Preliminaries costs that cover costs related to the erection of temporary structures for launching the site (such as fences, site roads, warehouses and site offices).
- Project overheads, which here cover the project-level management costs (e.g. safety officers, supervisors, accountants and financial systems) of the entire project until completion.
- Risk and opportunity contingency based on the risk analysis made by proponents, that is, the pricing and summary of risks and opportunities constituting a risk allowance to be included in the TOC.
- Fee percentage which consists of company-level overheads and expected profit when the fees of designers and contractors are combined according to their work shares.

The owner used the same—his own—direct material and labour cost estimate in comparing competitors, which thus became the basis of the assumed size of the direct costs of both proponents. The cost items priced by the proponents were added to the cost level of the owner's estimate: management costs, site establishment costs and risk contingency (Fig. 3). This total cost was then increased by the share of the fee derived from this sum based on the fee percentage submitted by the competitors. The result of this calculation provided a comparative price for the competitors. Selection was then made based on joint assessment of the team's capability and the comparative price.

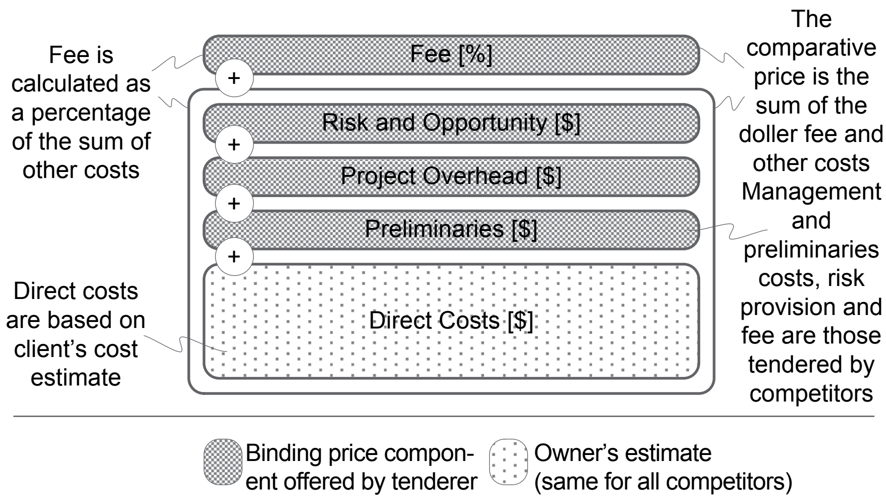

Fig. 3 Formation of comparative price in the water treatment plant project

Case 3: Road Bridge and Surroundings

The project involves replacing an existing road bridge across a river with a new one next to a rural community. The new approx. 150 m long two-lane bridge with a separate lane for light traffic will be built in the immediate vicinity of the old bridge that is to be dismantled later. The work includes the implementation of walls subjected to loading from earth and erosion reinforcements as well as road connections and nearby access and intersection arrangements. The special challenges of the project derive from the fact that the bridge is connected to the adjacent square of special cultural-historical importance.

In the competition, most of the components needed to determine the full price were tendered for. Only some relatively insignificant parts, such as the relocations of utilities/services networks, were not priced. Yet, some price components were indicative only while others were binding. The price components to be tendered for at binding prices were (Roads and Maritime Services 2012):

- Bridge TOC, which is the total of the labour and material costs needed to build the bridge (without a specific risk provision).
- Risk contingency for bridge, a risk premium produced by risk analysis of bridge building to be included in total TOC.
- Project overheads TOC, which cover the overheads of both the bridge and the so-called balance of works of the project.
- Risk contingency for project overheads, a risk premium produced by risk analysis of overheads to be included in total TOC.
- Fee percentage consisting of company-level overheads and profit margin. A corresponding share of the sum of all other cost items is included in the tender/TOC.
- In addition to the above binding components, the following price components were offered as tentative prices:
- Budget TOC for the balance of works, that is, a preliminary estimate of the total cost of inputs other than those required for building the bridge.
- Risk contingency for balance of works, a preliminary risk premium produced by risk analysis of a so-called balance of works to be included in total TOC.

At the same time, the model with its indicative scope and unit price data determined the way of calculating how later changes in components tendered for at tentative prices affect the overall price.

The owner calculated the total prices of the alternatives on the basis of the price components submitted by the proponents as illustrated in Fig. 4, i.e. including the contribution and influence of the owner's estimator. The final selection of the contractor was based on both capability and price. In principle, the intention was to assign equal weights to quality and price.

Case 4: Arterial Road with Junctions

The project involves a massive road investment for improving a main road network and increasing its capacity. The works centre around an about 10 km section of a

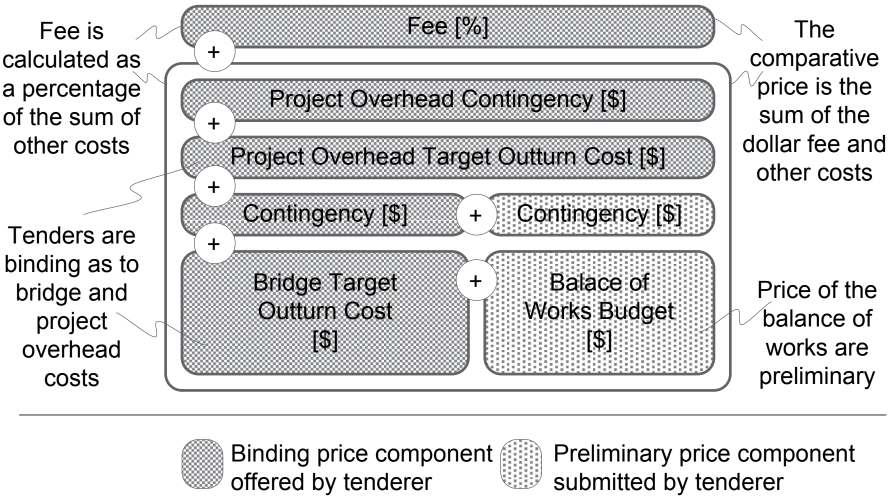

Fig. 4 Formation of comparative price in the road bridge project

highway bypassing a major airport. Additional lanes are being built for this section and many junctions are being rebuilt, a few are being expanded into complete interchanges. The project also includes the improvement of many kilometres of roads intersecting the main road and some other roads in the area. The works are mainly restricted by existing urban structure and the airport area.

The selection model can be considered a partial price competition model due to the extensive scope of the project, although the pricing concerned a considerable part of the road network practically in its entirety, covering all costs at binding prices. The price data to be specified in the tender consisted of the following parts (Main Roads Western Australia 2012):

- Total price of construction works covering the specified part of the project (road network; utilities/services networks, etc. excluded) based on a unit cost calculation to be submitted as part of the tender.
- Defect correction percentage, which is a cost item reserved for warranty works, calculated from and added on top of actual construction costs.
- Project overheads (site overheads and other staff costs) which are supplemented in the case of design and supervision with the related staffing plan and corresponding breakdown of costs.
- Risk provision percentage that describes the risk provision to be added on top of direct costs and calculated on their basis, which in the light of the risk analysis is sufficient to cover expected variation in costs.
- Fee percentage that consists of company-level overheads and expected profit when the fees of designers and contractors are combined according to their work shares.

The owner used the unit costs submitted by the proponents in determining the comparative cost while calculating the estimated magnitudes of the costs of actual construction works for parts of the project to be designed later. These parts were not

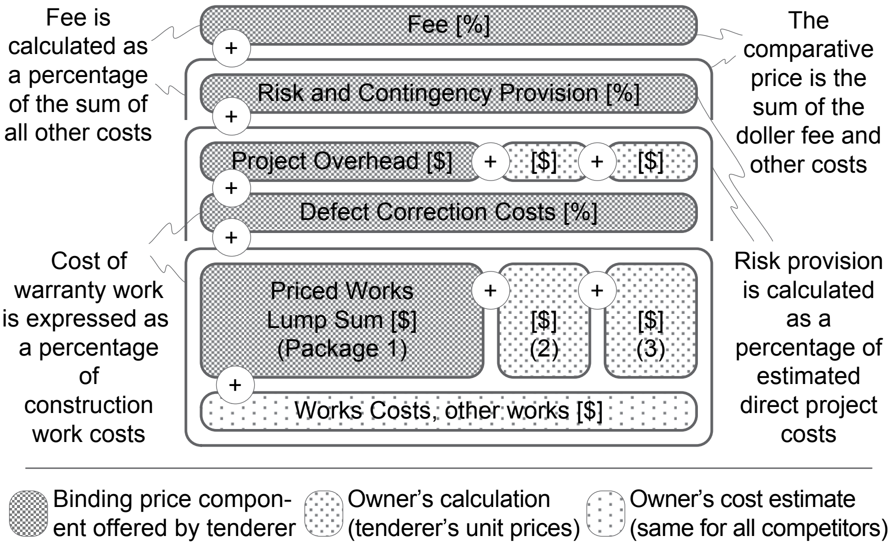

Fig. 5 Formulation of comparative price in the arterial road project

subject to design in the competition, although they were also meant to be included in the works under the very same contract together with the road section priced in the tender. Thus, we are dealing with areas 2 and 3 of Fig. 5 illustrating the calculation of the comparative price (whereas only part 1 was included in proposal planning and pricing). Besides, the owner used his own cost estimate for some works excluded from tender pricing, which was the same for all competitors.

The total comparative price was arrived at by adding to the construction costs determined phase by phase first the cost of warranty works calculated as a percentage of them, and then the sum of project overheads also compiled phase by phase, as well as the risk provision and fee of the service providers to be calculated later on the basis of the percentages submitted by the proponents. The risk provision was calculated from the mentioned item covering direct costs and project overheads, and it was added to the cost estimate before calculating the fee from the resulting sum of costs that included the risk provision. However, the setting of the comparative price was not just mechanical calculation, but the evaluation team also had to do a lot of work in making the tenders comparable. The selection, yet again, was made on the basis of both capability and comparative price while the latter carried more weight this time due to the relatively complete design of a critical section of the project.

Discussion and Conclusions

General Assessment

The case projects shed interesting light on both the possible applications of price component selection and the reasons behind its use. Both the reasons and applications were different in all mapped cases:

- In Case 1 the model was used in the most minimalist way where the fee was the only price component quoted by the proponents. It was considered that the most important determinant of efficient project solution was early integration of the team and genuine, collaborative joint development due to the uniqueness and uncertainty related to the project. Competitive tendering on sub-contracts and price transparency were also of importance, in addition to the fact that the owner's budget had already initially been considered stringent.
- In Case 2 the model was used mainly to determine project and company overheads and joint costs. Direct costs were determined largely on the basis of later competitive tendering on sub-contracts, so there was no need to price them during the selection of the alliance team. Thus, the use of indirect costs as competition components locked in the price determination criteria reliably enough, and use of the owner's own cost estimate for direct costs made it possible to calculate a reliable comparative price.
- In Case 3 the model was used due the genuine uncertainty related to implementation. The whole was clearly composed of different types of largely independent sections: the main part of the project could be priced and there was significant uncertainty only about the other part of the project, which justified the use of this model. The former project part was priced in the competition, while an estimate was adequate for the latter part of the comparative price, as project overheads were included in the tenders comprehensively.
- In Case 4 the challenge was the extensive scope of the project, which is why a large portion of the project had not yet been defined by the competition phase. A key part of the project was developed and priced during the competition. On that basis the owner could calculate a comparative price for each proponent using the tender prices submitted and the default project size and contents. Thus, the unit prices specified in the tender also acted as guidelines for the price level of the project part that had not yet been designed.

A summary of price components used in the case projects is presented in Table 1. A characteristic feature of most components is that they are contingency provisions or joint costs and overheads added on top of direct costs. Direct material and labour costs are also priced partially sometimes in search of innovative project solutions. Their use can also be the solution when the owner considers it inadequate to base the selection on contingency provisions and overheads only (in addition to capability, etc.). In the case of a large project it may be reasonable, for instance, to request proposals for a certain part of the project area-wise while selection is based on the

Table 1 Bases for definition of price components of case projects

	Case 1: Road tunnel with junctions	Case 2: Water treatment plant	Case 3: Road bridge and surroundings	Case 4: Arterial road with junctions
Fee	✓	✓	✓	✓
Cost escalation		✓[a]	✓[b]	
Risk contingency		✓	✓	✓
Project overhead		✓	✓	✓
Preliminaries costs		✓		
Direct costs, structure-specific[c]			✓	✓
Direct costs, section-specific[d]				✓
Defect correction				✓

[a] Part of risk contingency
[b] Part of direct costs
[c] Tendered in the case of certain structures of a diverse project
[d] Tendered in the case of a certain section/area of a wider project

comparative cost of the entire project (cf. Case 4). In determining the comparative cost, the owner can use the unit costs submitted by the proponents as a part of their proposals to calculate the estimated magnitudes of the costs of actual construction works for parts of the project to be designed later in the joint development phase. An alternative is to break down the project structure-wise so that the proposals cover only critical structures throughout the project (Case 3) or within a section (Case 4). (More information on Cases 2–4 is available in Lahdenperä, 2014, and on Case 1 in Alliance Executive Team, 2013; Alliance Leadership Team, 2014).

As to Case 4, the owner had already used a very similar price component selection procedure to select the team for an earlier road project. Its components corresponded to those used in this project with the exception that in terms of direct costs only part of the pavement had to be priced, although the contract covered the design and construction of the entire road structure so that the total costs were many times larger than the priced part. Both the owner and the service provider seemed to be highly satisfied with this previously used lighter model, but the huge size of the current project together with public accountability concerns forced extending the set of components to cover a bigger share of the project. To illustrate other possibilities deviating from Case 1 (where the owner used the same direct cost estimate for both proponents), only a fee quote can be requested while a proponent-specific estimate is prepared by the owner's estimator for the comparison adhering to a model used in another Finnish project where a proposal included a partial concept design for the project (University of Helsinki, 2011; the comparison was structured differently in the actual case, however). And other possibilities not captured by the study surely exist.

All in all, there are numerous ways of applying price component selection as shown just by the case examples. The used price components were different, and

Table 2 Relative efforts needed for the two stages of the development phase in case projects (indicative only)

	Case 1: Road tunnel with junctions	Case 2: Water treatment plant	Case 3: Road bridge and surroundings	Case 4: Arterial road with junctions
Competition	✓	✓✓	✓✓✓✓	✓✓✓
Joint development	✓✓✓✓	✓✓✓	✓	✓✓

the organisation of the selection processes also differs, for example, in the timing of the workshops. The amount and nature of proposal planning also vary. Perhaps the most important factor is the weights the owner assigns to competitive pressure and genuine joint development for the benefit of the project, i.e. how the "development phase" of Fig. 1 breaks down into the "competition" and "joint development" stages of Table 2. Some procedures are not very far from traditional auction while some really are. Accordingly, the more design is needed for a proposal, the more weight is assigned generally to comparative price in the selection. In fact, the extreme models apply very different strategies to the development of the project and its value for money which allows drawing only general conclusions.

Experiences

Experiences from the use of price component selection in the presented cases vary correspondingly with the fact that the mode used in the four case projects differ from each other in many ways. In the case of partial price selection models that aim at a relatively unambiguous and comprehensive comparative price, the same doubts often arise that have been found problematic in pure price competition. Besides, the use of price components may make procurement more challenging, unless the contents of the components have been clearly defined. At worst, the proponents get frustrated interpreting the contents. The formation of the costs of projects is a complex equation including many interdependencies and even overlaps where the interpretation of the content of an individual component may depend on the performer of the calculation. On the other hand, there is the risk that the design solution is manipulated to lower the comparative price without really improving the efficiency of the project.

This also makes the comparison of tenders more challenging. Practice has shown that the owner often has to work to make the tenders commensurate before deriving genuinely comparable reference prices from the tenders (Cases; Chipman and Woodman 2010). For these reasons, the price components of the partial price selection model should naturally be as independent cost items as possible. This is also required by the fact that the low prices of components included in the competition cannot be compensated for later by other cost items priced only at the development phase. Moreover, price components should be defined so that they play a central role in the formation of the overall costs and that they allow the competitors to stand out from each other.

To make comparisons easier in the case of an alliance project with a joint organisation, proponents should also assume at the competition phase that all tasks are performed solely by the staff of the service providers. Risk contingency is a more conceptual factor that also poses a challenge. It is worthwhile incorporating the risk view of all proponents in the owner's register at first, and later to let them price the revised version. Risk contingency may not, however, be a reasonable factor in price component selection unless the related uncertainties can be expected to be largely minimised during the joint development stage before fixing the TOC. Fees and even project overheads, again, are appropriate in most cases due to their insensitivity to variations in direct costs. The breakdown of costs into direct and indirect ones must, however, always be clarified, since companies seem to have different practices in that respect. Direct costs, on the other hand, can be eliminated from the competition the more likely, the larger the share of the project purchased from the market or based on standardised solutions is.

Thus, in some cases, the use of the price component method may be even more demanding than full-price selection. Experiences from the projects have, however, been for the most part very encouraging and support the validity of price component selection due to the reasons given in the "need for a change" section above although possible caveats were listed as an advisory for future applicants. Especially in the case of more demanding projects it is evident that the other advantages gained by early involvement and collaborative project development weigh more than the challenges of competitive tendering. This was also underlined by the participants of the studied projects. In the case of the simplified applications of the studied projects, no express criticism was levelled at the selection method either.

It must be emphasised that the presented view is based on interviews of the owner's and service provider's representatives in all presented cases. At the time of the interviews, some of the projects (Cases 3 and 4) had just completed the selection phase and, naturally, there is no certainty about what the definitive experiences will be. Yet, the overall assessment was highly positive and optimistic. The projects that had progressed to implementation/construction (Case 1) or completion (Case 2) were even more so: the parties were absolutely satisfied with the cost efficiency and believed that better results could not have been achieved by any other methods.

Public Procurement View

Although all the presented cases represent public construction projects, Case 1 is obviously the most interesting one from the public procurement perspective for two reasons. First, it is a procurement that was carried out in Europe, in Finland, while Cases 2–4 describe Australian activities. (Based on anecdotal evidence, a model similar to that of Case 1 has also been occasionally used in Australia although it is not dealt with in this study.) The author's view is based on the fact that in Europe public procurements are controlled by basically clear regulations (whereas in Australia there are no similar, universally applicable regulations, and the decisions on procurement practices are mostly made by public servants and politicians under the guidance of various policies). Second, in Case 1, the price components were the least comprehensive leaving most of the pricing to take place only after the selection which may be presumed to provide the most potential for violating the regulations. This view is based on the fact that although the European directive on public procurement allows the application of "the most economically advantageous tender" criterion, it implicitly also includes the price viewpoint.

Yet, a project that applies the price component method in selection can rely on numerous means for managing its costs. Naturally, the actual method depends on the project and used price components. In general, however, at least the following means were used in the studied projects:

- The owner reserves the right to subject final stage competitors to financial audits where the level of costs of realised projects can be assessed to serve as a benchmark in evaluation.
- Besides the specified price components, the proponents are expected to include their pricing bases in their tenders for additional auditing and to serve as benchmarks for the parts to be estimated later on.
- Major purchases of the project are to be jointly subjected to competitive bidding later and, at the minimum, the prices are to be market-tested (the contractor may do the work if competitive enough).
- An independent third-party estimator is involved to assess the appropriateness of the TOC and the cost items it consists of (evaluation of costs and justification material).
- A financial auditor is involved to verify costs incurred and financial management in general (auditions of financial systems, breakdown/limitation of direct and indirect costs, audition of reporting and invoicing).
- The owner's budget guiding the joint development and pricing of the project is based on two expert estimates completed independently and is made strict compared to the general cost level in the market.
- The owner has the right to terminate the project for convenience, without default, for instance, but the owner has to pay a fair compensation for all work and services carried out by then.

These features of the practice led the owners of the presented case projects to regard it the most appropriate method to provide good value for money in the targeted projects considering their properties, constraints and objectives. The requirements of owners included flexibility in scope definition and fast completion as well as the ability to introduce novel technologies for improved performance. Another reoccurring challenge was created by the fact that the work disturbed on-going operations and that numerous stakeholder issues had to be solved in the course of the project. The uncertainty due the project constraints and conditions was part of the challenge as were the multi-dimensional value systems of projects. That is to say, that although the study speaks for the use of price component selection it is not suggested as an all-round solution for all projects.

On the above basis, also the owner of Case 1, the Finnish Transport Agency, made a decision to use the described selection model. Due to the cost management measures itemised above, it was considered that the price view was incorporated into the decision making process to a reasonable degree except for part of company overheads and profit. Therefore, it was seen necessary in the completion phase to request a fee which was also seen as the minimum condition for procurement to meet the requirements of the regulations on public procurements (i.e. Directive 2004/18/EC; Act on Public Contracts 348/2007). In terms of the current public procurement legislation, the described procurement practice is based on the stage-wise "negotiated procedure" where "the most economically advantageous tender" is the selection criterion (Finnish Transport Agency 2012). According to the directive, this procedure could be used "in exceptional cases, when the nature of the works, supplies, or services or the risks attaching thereto do not permit prior overall pricing". Yet, 13 % of all public construction by value is procured by the negotiated procedure in Europe (Strand et al. 2011). All of the above suggest that there is room for the presented models despite the restriction.

What is more important, however, is that the directive has recently been updated (Directive 2014/24/EU), and within 2 years it (the relevant parts) should be guiding the practice after having been transposed into national laws within the European Union (EU). Although the author refrains from legal interpretations, it is clear that the new directive broadens the possibilities for negotiation. Thus, it provides a long awaited opportunity to consider new approaches and, consequently, use of price component selection also in the procurement of major, largely public, infrastructure projects. Yet, it should be noted that when EU directives are implemented through national laws, they may set stricter terms for various alternatives. Therefore, it is not necessarily certain that the practice is applicable as such to all countries within the EU.

Closing Remarks

Along with the change in procurement and project delivery practices, and the corresponding increase in the use of relational contracting, project alliance has proved its applicability as a project delivery method of demanding projects. At the same time, it has established itself in the realisation of complex infrastructure projects in Australasia and is also spreading to other continents. Early involvement of implementers in collaborative design is a central part of the solution, and it cannot be combined effectively with full-price competition. This has caused price components to be used in parallel with qualitative criteria since that is often considered necessary to maintain competitive pressure and gain acceptance in the eyes of politicians, auditing authorities and the general public. In selection based on price components, the tender covers only part of the items that finally make up the total price of the project.

The study has examined experiences gained from projects applying various forms of competition that include price components as selection criteria. In their totality, the experiences from case projects have been highly positive and definitely also encourage considering the possibilities of using the partial price selection model also in challenging future projects of the public sector. Especially, since the performance of full-price selection is often questionable in projects requiring innovative approaches and flexibility and ones that involve many constraints and uncertainty. Yet, the practice should be combined with the principles of transparency of information (incl. external auditors and estimators) and emphasis given to the creation of collaborative, trustful relationships among the team members.

It must, however, be remembered that different projects call for different selection methods derived from project properties and boundary conditions of implementation. Price component selection is not expected to be the answer to all situations and projects: more straightforward and standard projects may still be best procured by more conventional methods than the one discussed in this chapter. Yet, since projects are becoming more complex and more constraints and requirements are set by society and stakeholders, the number of projects that would most likely benefit from price component selection is growing. It seems to be a model, which at best, efficiently integrates competitive pressure and genuine joint development for the benefit of the project.

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