Transport Policy 47 (2016) 119–126

Contents lists available at ScienceDirect

Transport Policy

journal homepage: www.elsevier.com/locate/tranpol

Degrees of freedom and innovations in construction contracts ☆

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ARTICLE INFO

Article history:
Received 15 January 2015
Received in revised form
7 January 2016
Accepted 10 January 2016
Available online 27 January 2016

Keywords:
Contracting
Innovation
Design and build
Design
Bid and build

ABSTRACT

DB (Design and build) and DBB (Design-bid-build) represent two different contracting forms in construction. The first provides the contractor degrees of freedom in design, which enables innovation. DBB is the safe and traditional contracting form, where the client is responsible for the design and the contractor builds accordingly. Using a case study approach of five Swedish road construction projects, the present paper compares these contracting forms in terms of innovation. In this, the client's labelling of a contract being DB or DBB is taken at face value. It is established that the actual degrees of freedom for the contractors are highly restricted and that no important difference can be seen between the contracting forms regarding innovation. This implies that it is no reason to expect more innovation simply by labelling contracts as DB. Rational explanations for the usage of DB-contracts with bounds on the degrees of freedom are also suggested. Policy implications for promoting innovation in infrastructure contracting finalise the study.

1. Introduction

The make or buy issue is today a core topic of microeconomic research (Coase, 1937; Williamsso, 1985). In the construction industry, the workhorse type of “buy” contract is referred to as a Design-Bid-Build (DBB) or Unit Price Contract. This means that the principal (the client) establishes the design of a project and specifies precisely which activities and quantities a contractor is supposed to implement to have the project built. After a bidding contest, the contractor submitting the lowest (or more generally the economically most advantageous) bid wins the contract and implements these activities.

There are, however, several alternatives to DBB. A vital change in responsibilities and risk between the two parties is introduced by using Design-Build (DB) contracts. While the client still establishes which type of product that is supposed to be built, the contractor is now in charge of the design. A further step on this ladder is to allocate not only construction but also maintenance responsibility to the contractor, often referred to as a performance contract.

The extreme form for decentralising responsibility from client to agent is the much-touted use of Public Private Partnerships (PPP). While there are several ways to implement PPP projects, one of its core feature is that – except for being based on a performance contract – the contractor wholly or partly provides upfront funding of the initial investment. The public sector representative is still responsible for considering whether the ultimate delivery – a new piece of infrastructure – can be expected to become available at lower cost to society in this alternative than in any other construct for buying the service. Hart et al. (1997) demonstrates the pros and cons of this type of contract in a more general setting, using an example of prison services provided by either a public or a private party as an illustration.

The Swedish Transport Administration (subsequently referred to with its Swedish name, Trafikverket) has in recent years formulated a comprehensive policy for increasing innovation and productivity (see e.g. Trafikanalys, 2015). One central part of this is a switch from DBB to DB procurement contracts. The belief is that DB contracting has a better potential than DBB to promote innovation. Degrees of freedom in the design of the project enables the contractor to undertake the construction in new ways and should thereby increase innovation.

Trafikverket is not alone in pushing for DB contracting in order to promote innovation. The US Federal Highway Administration has established a quantitative target for using DB when tendering construction projects (Mendez, 2010). Moreover, the Finnish Transport Agency and Dutch ProRail use DB contracting regarding rail investments (Nilsson and Nyström, 2014).

This paper has one narrow and one broader purpose. The narrow purpose is to look closer at the details of five recent

☆Joint funding from SBUF (Grant no: SBUF 12800), the construction industry's organization for research and development, and from the Swedish Transport Administration (Grant no: TRV 2013/70073) is gratefully acknowledged.

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http://dx.doi.org/10.1016/j.tranpol.2016.01.004
0967-070X/

Swedish DBB and DB contracts and consider whether they differ with respect to degrees of freedom in implementation. Can DB contracts provide a reasonable proxy for degrees of freedom in the execution of infrastructure projects? If there is no difference in degrees of freedom, there is no reason to expect a change in the rate of innovation. The broader purpose is to combine this and other empirical studies with basic microeconomic theory to provide suggestions how procurement contracts can be designed in order to stimulate socially valuable innovations. This is necessary since some innovations may be means for increasing the contractors profit at the expense of the client's costs for future maintenance Borg (2011).

The relevance of our analysis goes beyond DB and DBB contract types. A necessary while not sufficient rationale for motivating DB projects is that the client is able to abandon the detailed structuring of the input for having a project built provided by the benchmark DBB construct. Contracting the agent to prepare design means that the client loses control. Discharging control may be the single most provocative part for the client organisation of any alternative to the familiar and safe DBB contracting.

2. Method

The more narrow purpose of the paper is to assess whether DBB contracts give more degrees on freedom than DB contracts. Because of difficulties to collect appropriate data about a large number of projects, the comparison is based on a case study approach, describing five projects in more detail. The absence of a comprehensive dataset for making comparisons makes it impossible to draw general conclusions. Therefore this paper indicates the way in which clients in many countries seem to handle their assignment regarding innovation. The activities are driven by an engineering sentiment with little regard for the need to establish ex post consequences of alternative tendering or contract designs. One contribution of the paper is therefore to highlights the need for further quantitative analysis and the necessity to identify ex ante the type of information that is necessary to compile in order to facilitate this analysis. This would also provide a stepping-stone for a more formal theoretical modelling, which would not provide insights that could be tested against data.

Focus is on the scope for innovation at the ex ante, tendering stage trying to determine if DB is a good proxy for degrees of freedom. In order to find out how much of the technical design that is determined by the client and how much is left open to the contactor, we study the contracting documents from the ex ante tendering stage. This material consists of hundreds of pages for each contract. The documents also refers to underlying handbooks and reference texts. Analysing the ex ante situation is suitable since this is the information available for the contractors when deciding on bid strategy and how to later carry through the project with or without innovations.

Ex post information about whether innovative solutions actually have been implemented would also be relevant. Again, lack of data makes it impossible to measure. We report about ex post costs of the projects, but they are not analysed more in detail as that is outside the scope of this paper.

The five contracts are a convenience sample. This provides a risk that the client has provided us with projects that are believed to be “good” in some way. In order to reduce this risk, the officials at Trafikverket were not informed about the purpose of the study. In the assessment, the client's labelling of a contract to be DBB or DB is taken at face value irrespective of the actual design of the respective contracts complies with a formal definition of the two concepts.

The second purpose of the paper relating to the general evaluation makes use of material from two domestic studies evaluating Trafikverket's general procurement strategy (Tra®-kanalys, 2015 och EY, 2015). In the evaluation basic theories about incentives and risk are used, and as mentioned above the empirical material on consequences of different strategies are lacking so the evaluation has to be made using implications from different theories. As an example it can be mentioned that from a theoretical perspective giving more freedom to the contractor entails the risk of moral hazard. There are a number of methods to reduce the risk of moral hazard (see Eriksson and Lind (2014) for an overview). The proposals at the end are partly based on such methods.

A reference group with staff from Trafikverket and three contractors followed the project. Meetings with the group gave valuable guidance, even if many observations from a scientific perspective can be classified as “anecdotal evidence”. Some information of this type was an inspiration for the proposals presented at the end of the paper.

3. Central concepts

The raison d'être of DB contracting is rather straightforward in the literature (see e.g. Mandell et al., 2013). Degrees of freedom for the contractor in the design allows the contractor to develop the construction of a project in accordance to their own knowledge, facilitating and promoting innovation, which will ideally create value for money for all stakeholders.

The chances for a bid to win the procurement contest increases in the number of innovative solutions. Innovations are here seen as being a new idea, a more effective device or process. In the construction sector both product and process innovation are of great importance (de Valence, 2010). In the short run and on project level, innovations will create value for money by creating improved quality for the same client cost or by cutting client cost but delivering the same quality. One could also think of a situation with both improved quality and lower cost. In this sense, delivering improved value for money means delivering a more Pareto efficient project i.e. both contractor and client are better off. In the long term, value for money in the sector is tantamount to improving sector productivity.

We do not seek to establish a more precise definition of the innovation concept. For the present purpose, it suffices to know whether a contract provides scope for the agent for freely implementing activities. This would provide scope for solutions that differ from what other contractors or indeed the client would have done. Consequently, we have little to say about whether the respective projects in a substantial way were innovative or not.

3.1. DBB and DB contracts

The design-bid-build (DBB) framework is the most common way of contracting in the construction industry. It makes the principal/client responsible for the design and the contractor for the construction. If e.g. a bridge breaks down due to an underdimensioned pillar in the design, it is the principal's responsibility, while a breakdown due to careless implementation such as forgotten rebars is the responsibility of the contractor. While this principle is clear, the allocation of responsibility may be less so in actual practice where the causes of a problem might be difficult to identify.

DBB contracts are also used in procurement auctions outside the infrastructure industry (see e.g. Ewerhart and Fieseler, 2003; Gupta et al., 2012). Irrespective of application, a generic feature of the tendering documents is to include a detailed Bill of Quantities (BoQ). This Bill identifies the activities to undertake for constructing a new project and also quantifies the activities. The BoQ