CONTRACT DESIGN TO PREVENT UNDERINVESTMENT IN PUBLIC-PRIVATE PARTNERSHIP

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Underinvestment happens when an investor abstain from investing in an asset, even if the investment is beneficial for the customer, because it does not perceive a profitable return on the specific investment. The risk for underinvestment is high in projects which rely on high asset specificity and towards the end of contract lifespan. This paper builds upon a qualitative analysis of documentation around a multimillion dollar construction project, where contractual mechanisms are investigated to determine if they could prevent underinvestment due to high asset specificity. The study shows that underinvestment in the project is prevented by unilateral options for the public authority to buy the property at different milestones during the contractual lifespan. In addition there are joint project groups to implement a concept of partnering to reduce asymmetric information during investment decisions. In conclusion, the contract gives the impression of dealing with underinvestment. Nevertheless, there are some draw backs due to the financial setup of the public authority and it exposes the private party to some contractual risks due to high asset specificity which could risk underinvestment.

Keywords: Procurement, Economic analysis of law, Contracting, Public-private partnership

INTRODUCTION

Public-private partnership, PPP, is a term as diversified as the number of articles written about it. Within the construction industry it can include a build, operate and transfer, BOT, setup but it can also include a design, build, finance and operate, DBFO delivery method (Leiringer 2003, for an overview). One divider between different PPP projects are joint ventures made by the public authorities in order to capitalize on a public asset such as land (Kwok-Chun and Walker 2000) and PPP projects aiming to provide a public service (Arrowsmith 2000). It could be construction of hospitals (Mckee, Edwards and Atun 2006), roads (De Palma and Lindsey 2000) or

railway infrastructure (Koppenjan 2005); the latter description has also been called institutionalised public-private partnerships, IPPP, (Tvarno 2009). For the purpose of this paper PPP will be defined as a project instigated to provide a public service and where a private party is responsible for the provision and operation of the project and also responsible for the initial financing of it. The cost and profit of the project is collected through the public authority (Arrowsmith 2000, Tvarno 2009). To further narrow the scope of this paper, aspects connected to construction projects only will be taken into account. Nevertheless, the reasoning in this paper would probably be applicable to other sectors.

In order to attract a private entity to commit to finance a PPP project, the private entity has to be, to a certain extent, sure of being able to get a return on its investments. At every degree of uncertainty it can be assumed that the private party will introduce different levels of risk premiums in order to compensate for uncertain outcome (Laryea and Hughes 2008). In spite of the use of risk premiums by the private party there still might be risk left not accounted for in those risk premiums. A private party could be forced to reduce their risk premium to a level which they are uncomfortable with because of high competitive pressure. It is also possible that risk is hard to estimate due to the lack of complete project definition or due to uncertainty about the future state of the world. As a project develops over time, the state of the world will become known to each party, and the expected outcome of the partnership will be more accurately estimated. If the private party, in those later stages of the contract, perceives a lack of return on its investment this might cause shading behaviour (Hart and Moore 2008). Shading behaviour may include a number of things, all which are a disadvantage for the public authority and typically includes either moral hazardous behaviour or underinvestment. Moral hazard is particular present in PPP situations where there is high asset specificity, for example where the investment goes into a project which cannot be used for any other propose than what it is provisioned for (Klein 2000). In those cases it might give one of the parties the opportunity to hold up the other party. There are two sides of this concept; either the public authority can hold up the private party by threatening to purchase the services elsewhere thus enforcing a lower than market price, or the private party can hold up the public authority by threatening to sell its service to a third party thus enforcing a higher than market price. Underinvestment (Hart 1995) is related to the investments the private party has to make in order to meet its obligations. If the private party, for some reason, do not perceive a possibility to recover its costs and profits it might resort to underinvest in the project and as a consequence lower quality. The focus of this paper is to identify contract mechanisms preventing

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underinvestment in a case study of a highly complex research facility which exhibits PPP characteristics.

THEORIES ON THE BOUNDARIES OF THE FIRM

Underinvestment is a phenomenon, as mentioned above, where a seller invests less than necessary to achieve the quality desired by the buyer. Quality may, in this respect, be defined not only as the quality of a product, but also including the entire process covered by the contract in question. Many causes for the occurrence of underinvestment have been put forward in the literature, some of which will be considered below. There is, however, a unifying dimension in all causes of underinvestment: the presence of unobservable quality in the project. Unobservable quality can manifest itself ex ante; in an innovative process, when the needs of the buyer are unpredictable or when the scope of the project is too expensive to describe exhaustively. Quality can also be unobservable ex post due to immeasurability or owing to high transaction costs to actually establish or measure quality (Bajari and Tadelis 2001, 2006).

A situation where quality is unobservable ex ante but observable ex post started to attract tension in the early 20th century within the context of trying to define boundaries of the firm (Coase 1937). The theory recognized that creation of a firm took place when the new firm could manufacture a product to a lower price than the cost of a firm buying the product had when manufacturing the same product itself. The theory did however get more complicated when there was a need for specialised assets, high asset specificity, to produce products to satisfy a specific buyer. Coase argued (1988) that asset specificity can be dealt with through long-term contracting. This introduced an unobservable level of quality into the contract, because the states of the world throughout the contract was unknown, thus preventing the buyer to define the specification in the contract during the entire contract lifespan. This situation can be resolved through cost-plus contracting where the buyer pays for actual incurred costs with an addition of a profit margin. By signing a cost-plus long-term contract, the seller can secure return on necessary specific investments, while still being able to make adjustments due to changes in the state of the world, as a result securing quality for the buyer. The critique of this is based upon a situation where there is a need for a large reinvestment in order to keep quality up, occurring due to changes in the state of the world. In those cases there is a possibility for the seller to refuse to make investments which would increase quality, or decrease cost, and thereby price, thus holding up the buyer with the cost-plus agreement (Klein 1988). The solution is suggested to be that it would be more feasible to use vertical integration in those circumstances, in other words, it would be

beneficial for the buyer to integrate the production in its own organisation and assume total control (Klein 1988). If the production is undertaken in-house then the risk of moral hazard would decrease significantly. It has been argued that a vertical integration would be to take the solution too far, and it would be more beneficial to renegotiate, or prolong, the contract when needs for new investments arise (Coase 2000), thus keeping the boundaries specialised. The backside of Coase's solution is that it probably would increase costs, both for the seller and the buyer, in the form of increased transactions costs due to repeated contracting (Williamson 1988).

Another objection to the long-term cost-plus contract is based upon the property rights approach (Demsetz 1967). Property rights builds upon a theory of ownership. If a contract is complete, that would say if the contract specifies exact quantity, quality and the exact price, the ownership of the assets needed to produce the product is just a form of contractual relationship between the buyer and the seller (Hart 1988). Effectively the buyer leases the assets for the production of a specific number of units, or for a definite period of time. If the contract is incomplete the ownership of the asset plays another role. Since the contract is incomplete, it would not be possible to transfer all rights exhaustively, if it were, the contract would not have been incomplete. Those rights left behind and thus not included in the contract is the residual rights of control (Hart 1995). If A rent his bike to friend B, this would probably include the right for B to install a speedometer on the bike. But if B wants to mount a hybrid electric motor on the bike, B probably would have to ask permission from A first, if this were not included in the lease agreement. A has, as the owner, the residual rights of control, and accordingly has the right to approve any changes not included in the contract. The only way to fully transfer those rights is to change the ownership of the asset. According to this view, if the contract has unverifiable quality ex ante, and the state of the world changes during the contract lifespan, the seller has the residual rights to the assets needed for the production. The seller can, by using those rights, hold up the buyer, by threatening not to use the residual rights in benefit of the production. The seller can also refuse to develop those residual rights in a manner that would be beneficial to the buyer. The buyer can compensate for this, by limiting the residual rights of control left to the seller. However, at some point the buyer would have assumed enough control to be able to hold up the seller. The seller no longer has enough residual control to secure a return on its investments. This will provoke shading behaviour, often in the form of underinvestment in the quality of the project. Consequently, if the buyer relies on a specific asset, in order to get a return on its investments, the buyer should own the asset (Hart 1988). The main objection to this approach is that it seems to rely on physical assets. If the assets needed for production, at least partly, are formed out of human capital, assuming

ownership would not necessarily remove risk of moral hazard or a hold up. If certain groups of employees have certain skills or know-how those employees can hold up the buyer even after the buyer purchased the selling firm simply because the employees can threat to quit (Freeland 2000). Nonetheless it would seem that the buyer still is in a better position if it assumes ownership with regard to moral hazard (Hart and Moore 1990), due to transfer of a physical asset and because there is a probability that an employee might not gain on moral hazard in all situations.

Game theoretic modelling has shown that this view of property rights can be too simplistic. A joint-ownership contract is a contract where both parties own the property rights to the asset, and where the parties cannot use the property without the permission of the other party. If a bilateral exit clause is entered into such a contract, with addition of a tax, it would make some of the disadvantages of a joint contract to disappear. This is because of the power of a bargaining game (Nash 1950a) joined with an extra tax, or extra cost to use the exit (Maskin and Triole 1999). The tax is presumed to be collected by the community, thus not beneficial to any party within the contract. The contract would reduce both parties profit of unilaterally using the exit strategy. It would be hard to make a theoretic judgment on which of the single- and joint-ownership contracts is most advantageous (Maskin and Triole 1999). This inference would allow for a joint-ownership in spite of Harts conclusions.

METHOD

Even though the theories about the boundaries of the firm, initially was based on a series of case studies (Coase 1937, 2000) the main body of work has been done through theoretical approaches (Demsetz 1968, Hart and Moore 1988, Klein 1996, Williamson 1988). This approach has, together with theories intrinsic nature of generalisation and simplification, led to an ideal discussion on the theory of contracts. In order to apply the theories transparently there was a need to study an extreme case: where the contract was very incomplete, had a high number of unobservable quality variables, relied on high asset specificity and stretched over a long period of time[1]. Under such circumstances the choice of boundaries within the project would be particularly distinguishable. Building upon this the choice was made to study the procurement of a highly complex research facility[2]. The facility is a synchrotron light facility which is used to x-ray objects in a non-destructive

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[1] The project also had to be procured by a public authority for reasons not discussed in this paper.
[2] A more complete account of the case is being prepared for publication elsewhere, thus this account is limited to the aspects needed for the purpose of this paper.

manner. It can be medical compounds in order to view the molecule shape, or archaeological artefacts trying to determine how phosphate travels through different layers in the artefact. The facility will consist of a storage ring approximately 500 meter in circumference, attached to it is a 250 m linear electron accelerator. The facility will also contain office space and areas to house research equipment. The facility will be built on land consisting of 17 m of soil of varying density before hitting the bed rock. The significant detail, making it a highly complex construction project, is that the accelerator and the storage ring are only allowed to vibrate in the magnitude of 20-30 nanometres. Those specifications were however not included into the tender notice nor into the contract, since they were not finalised. The only references to the magnitude of vibration specifications were from the media and from a conceptual report, and it was concluded that given current technology it were possible to achieve a 40-50 nm stability. The construction of the facility is expected to last for five years and the level of investment in the construction will reach over 100 million euros, with another 200 million in equipment.

In order to understand the contractual relationship between the contracting authority and the contractor all documentation and contracts included in the procurement process were collected, together with the formal communication between the authority and the tenderers during the procurement. Interviews were conducted with the responsible procurement officer. The contract signed after contract award was gathered, but later signed documentation has not yet been collected. Thus, there can be later signed documentation affecting the relationship between the parties.

All documentation were initially put through a systematic document analysis similar to what has been suggested by Corbin and Strauss (1990). The coding process will not be described exhaustively in this paper, but a rough description will be given. The first step contained a review of all shift in ownership, control and liability for a certain result were coded into concepts and the direction of the shift were also taken into account. Out of those concepts categories were created out of the effect of the specific concepts. For example, categories were created out of codes that, in some sense, left control with the contracting authority, or if a decision were to be made unilaterally as opposed to jointly. From this, three broad themes arose; issues regarding unobservable results or quality, topics concerning high asset specificity and there were areas with relationship to long contract lifespan.

The analysis of the coding results were quite extensive, and were built upon analysing relationships between categories and themes, the nature of linkages and of course entailed a broader view of external factors. One of the aspects arising out of the analysis was processes and linkages which were coupled

with the control, in a broad sense, of the facility. It is suggested that this battle of control could beneficially be analysed out of a property rights approach.

THE CASE

The contracting authority decided to procure the construction project as a PPP project with contract design based upon a design-build-operate delivery method. There were several reasons for this, for example, the contracting authority is prevented, by government regulation, to own property. To submit a request for exemption would probably delay the time schedule. The lease agreement was set for 25 years, which is the longest allowed lease period in Sweden. Further, the contractor should finance the project and the contracting authority would pay annuity interest calculated on actual incurred cost during construction, the interest should also cover all running costs except for facility management (which is paid per square meter). This setup allows for the contracting authority to budget running costs, and it did not need to raise funding for a large initial investment. The interest is indexed by a specific published index every month, making the price stable over time from external financial factors. After the design is set, the contractor is obliged to, in competition, request quotes from subcontractor. The contracting authority and the contractor then set a reference price based on those quotes. The reference price is subsequently used as calculation of an incentive clause. The clause allows for an increase of the contractors profit margin if actual costs runs below the reference price and it decreases profit margins if costs rise above the reference price.

Starting at year 5, the contracting authority has the option to assume facility management them self and to procure it from another supplier. If the contracting authority does take responsibility for the facility management, the authority has to follow the maintenance guidelines from the contractor. At year 15, 20 and 25 there is an exit clause for the contracting authority, giving it the right to purchase the facility. The price is set as the current residual value with the addition of a 'fair' profit margin. It is not defined what constitutes a 'fair' profit, but it is clear from the documentation it is not equal to the difference between the residual value and the current market value. The contractor can exit the contract by selling the facility to another firm, though this transfer has to be approved by the contracting authority.

During the design and construction stages of the project, it is mandated that the project will run under a partnering regiment (Eriksson 2010). The scope of the partnering collaboration is only set on a strategic level, no provisions on its implementation exists. The contracting authority also has the right to reject other tenants, extensions and developments extending the use of the

facility if it affects the operation of the facility. However, there is a stipulation that the parties should, during the operation, in collaboration develop the use of the facility in the interest of the parties.

ANALYSIS

The contract do not exhaustively transfer control from the contractor to the contracting authority. The contracting authority does not have a right to make major changes to the facility. This would prevent the contracting authority to construct extensions and it probably also preclude the contracting authority from undertaking major renovation work. Further the authority has not the right to sublet parts of the facilities without the consent of the contractor. Accordingly, other tenants would at least have to be accepted by the contractor, and quite possibly have to negotiate a lease directly with the contractor. This could be a matter of concern if the contracting authority, for instance, would like to collaborate with another organization. On the other hand the contracting authority has the right to stop the contractor to lease parts of the facility to other tenants if the lease would affect the operations of the contracting authority. Even though the right to make major alterations or extending the facility is put on contractor, the authority still has the right to reject the plans if it would disrupt the day-to-day operations. The facility management can be transferred to the contracting authority, thus allocate some control to the authority, although, even under such conditions, the overall maintenance of the structure would still be left to the contractor. In consequence, there seem to be a considerable degree of residual rights left to the contractor. But most rights are partly dependent upon the contracting authority accepting the usage of those rights. The arrangement could open up for the contractor to benefit of moral hazard, or underinvestment, towards the contracting authority, and it does not seem to restrict the contracting authority's behaviour.

Counteracting the possibility for moral hazard is the exit points unilaterally allocated to the contracting authority. If the contracting authority would perceive a moral hazardous behaviour on the part of the contractor, it could simply assume all property rights from the other party by using those clauses. The cost for using this clause is not exhaustively defined, but it has some components worth considering. First, because 'fair' profit is not clearly defined, this cost will not include the actual established 'fair' profit only, but also cover the negotiation costs while establishing the level of the profit. Second, since the contracting authority would have to pay the current residual value, the cost of securing the funds needed would also have to be taken into account. Third, the raising of funds for the purchase of the facility will be done within a political process, which's intrinsic nature of uncertainty would

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incur costs in the form of increased risk. It is clear that the cost for the contracting authority using an exit clause would be higher than simply calculate the residual value and a reasonable profit. In accordance with the theories of Maskin & Triole (1999) and Nash (1950b, 1951) cited above, the cost of using the exit clause will serve as equilibrium in the choice of using the clause. This construct should be accentuated. If the 'fair' profit is defined as the profit the contractor would make if everything held status quo until year 25, then there will be a possibility for the contractor to underinvest without any risk for retribution since the cost of using the exit clause would be higher than accepting the underinvestment. If the 'fair' profit would be detached from the projected profit, and instead be a 'fair' profit on a single transaction, then the contractor would be enticed to not underinvest. But if the profit would be below the total cost of employing the exit clause, then the contracting authority would actually gain by using the exit clause. As a result it seems to be important, for the contract in hand, that 'fair' profit is defined somewhere around a 'fair' profit on a single transaction, in order to prevent shading from the contracting authority or underinvestment from the contractor.

The contractor is locked into the contract until year 25 with the exception of it selling its rights of the property to another firm; this possibility is on the other hand depending on approval from the contracting authority. This situation limits the usability of the contractor's options. Nonetheless, the applicability of the authority's veto right may be less than it is prima facie. If the contracting authority would refuse an exit by transferring the rights to another firm, it might actually provoke underinvestment by the contractor. The underinvestment would be limited to the exit equilibrium because the transfer of rights could be done at a market price exceeding 'fair' profit of the exit clause. Even so, underinvestment could still be significant to the contracting authority and thus limit the applicability of the veto. In spite of this, there is still a, rather small, degree of opportunity for the contractor to escape the contract. This situation would, according to the theories of property rights, open up for underinvestment because the contractor cannot secure return on its investments given the lack of control[3]. In order to counteract this tendency the contracting authority would need to be rather liberal with allowing for development of the property and in such way allow for the contractor to get return on its investments.

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[3] One aspect is lacking from this reasoning and is not included in the analysis of this paper. If the contractor ex ante, perceive this risk of lack of control, and the risk coming out of the unilateral exit clauses, it can add risk premiums to its bids. Such practice would allow for compensation of risk by transfer the cost to the contracting authority, ex ante.

The equilibrium also deserves some consideration. If the point is reasonably high for the contracting authority, thus leaving a non-trivial opening for underinvestment on the part of the contracting authority, the contract can reach an interesting state. If the contractor underinvests too much, the contracting authority would use the exit clause. If the contracting authority is too restrictive with allowing for the development of the facility, it would force the contractor to underinvest, assuming that the information of each party's strategy is unknown to the other. Those assumptions would therefore presume a non-cooperative relationship between the parties. It is also argued that the structure of the equilibrium in this case, serves as Maskin and Trioles (1999) tax addition when using the exit clause. The cost of the political process and the cost of selling a property with extreme asset specificity would not benefit either party. In such circumstances it is possible that the equilibrium would reach a state where the parties would not gain on a non-cooperative relationship (Nash 1950a, b, 1951). Thus, this state would serve as an incentive on using a cooperative relationship, where the parties in a collaborative manner can find an optimal strategy. The contract facilitates partnering as a tool to run the project, while the forms of the process is not defined it could serve as a medium to facilitate a cooperate relationship between the parties. It would certainly allow for communication, and for transfer of information on the contracting authority's strategies and the contractors strategies. Provided this is done successfully in an optimal fashion, the contract could eliminate underinvestment completely.

CONCLUSIONS

The contract situation in the case study seems to exhibit an environment which could provoke underinvestment. The facility in the case study has a high degree of asset specificity, further it will require large investments in the initial stages. Due to the long construction stage, the facility's quality will not be observable until a dominant part of the investments has already been made. This explains the contracting authority choice of a long-term contract on a cost-plus-like basis. However since the states of the world during the contract life over 25 year is unknown, the contracting authority has put in some provisions into the contract. In something that can be seen as an effort to counteract underinvestment, there are exit clauses in the contract allowing for the contracting authority to purchase the facility. Nevertheless, it has been shown that this practice can actually provoke underinvestment in some circumstances by reducing the contractor's possibility to earn return on its investments. It is suggested, that this situation can be counteracted by a non-trivial cost for the procuring authority of using those exit points together with a loss of profit for the contractor when the exit is used. This would cause a state between the parties where they would actually gain on cooperating

instead of maximising their own gain, without consideration of the other party. This is a thin line and since the contract is heavily weighted in control towards the contracting authority, it is probable that shifts in the state of the world outside this analysis would result in underinvestment.

REFERENCES

Arrowsmith, S (2000) Public private partnerships and the european procurement rules: Eu policies in conflict? Common Market Law Review, 37(3), 709-37.

Bajari, P and Tadelis, S (2001) Incentives versus transaction costs: A theory of procurement contracts. RAND Journal of Economics, 32(3), 387-407.

Bajari, P and Tadelis, S (2006) Incentives and award procedures: Competitive tendering vs. Negotiations in procurement. In: Dimitri, N, Piga, G and Spagnolo, G (Eds.), Handbook of procurement, pp. 121-39. Cambridge: Cambridge university press.

Coase, R H (1937) The nature of the firm. Economica, 4(16), 386-405.

Coase, R H (1988) The nature of the firm: Origin, meaning, influence. Journal of law, economics, & organization, 4(1), 3-47.

Coase, R H (2000) The acquisition of fisher body by general motors. Journal of Law and Economics, 43(1), 15-31.

Corbin, J and Strauss, A (1990) Grounded theory research: Procedures, canons, and evaluative criteria. Qualitative Sociology, 13(1), 3.

de Palma, A and Lindsey, R (2000) Private toll roads: Competition under various ownership regimes. The Annals of Regional Science, 34(1), 13-35.

Demsetz, H (1967) Toward a theory of property rights. The American Economic Review, 57(2), 347-59.

Demsetz, H (1968) Why regulate utilities? Journal of Law and Economics, 11(1), 55-65.

Eriksson, P E (2010) Partnering: What is it, when should it be used, and how should it be implemented? Construction management and economics, 28(9), 905-17.

Freeland, R F (2000) Creating holdup through vertical integration: Fisher body revisited. Journal of Law and Economics, 43(1), 33-66.

Hart, O D (1988) Incomplete contracts and the theory of the firm. Journal of Law, Economics, and Organization, 4(1), 119-39.

Hart, O D (1995) Firms, contracts, and financial structure. Oxford: Clarendon Press.

Hart, O D and Moore, J (1988) Incomplete contracts and renegotiation. Econometrica, 56(4), 755-85.

Hart, O D and Moore, J (1990) Property rights and the nature of the firm. The Journal of Political Economy, 98(6), 1119-58.

Hart, O D and Moore, J (2008) Contracts as reference points. Quarterly Journal of Economics, 123(1), 1-48.

Klein, B (1988) Vertical integration as organizational ownership: The fisher body-general motors relationship revisited. Journal of Law, Economics, and Organization, 4(1), 199-213.

Klein, B (1996) Why hold-ups occur: The self-enforcing range of contractual relationships. Economic Inquiry, 34(3), 444-63.

Klein, B (2000) Fisher-general motors and the nature of the firm. Journal of Law and Economics, 43(1), 105-41.

Koppenjan, J F M (2005) The formation of public-private partnerships: Lessons from nine transport infrastructure projects in the netherlands. Public Administration, 83(1), 135-57.

Kwok-Chun, W and Walker, A (2000) Property rights implications of public-private joint ventures. Construction management and economics, 18(2), 131-8.

Laryea, S and Hughes, W (2008) How contractors price risk in bids: Theory and practice. Construction management and economics, 26(9), 911-24.

Leiringer, R (2003) Technological innovations in the context of public-private partnership projects. Trita-ieo, 1100-7982 ; 2003:9, Stockholm: KTH Industrial Economics and Management.

Maskin, E and Triole, J (1999) Two remarks on the property-rights literature. The Review of Economic Studies, 66(1), 139-49.

McKee, M, Edwards, N and Atun, R (2006) Public-private partnerships for hospitals. Bulletin of the World Health Organization, 84, 890-6.

Nash, J F (1950a) The bargaining problem. Econometrica: Journal of the Econometric Society, 18(2), 155-62.

Nash, J F (1950b) Equilibrium points in n-person games. Proceedings of the National Academy of Sciences of the United States of America, 36(1), 48-9.

Nash, J F (1951) Non-cooperative games. Annals of Mathematics, 54(2), 286-95.

Tvarno, C D (2009) A critique of the commission's interpretative communication on institutionalised public-private partnerships. Public Procurement Law Review, 1, 11-23.

Williamson, O E (1988) The logic of economic organization. Journal of Law, Economics, and Organization, 4(1), 65-93.