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# Technological innovation in PPPs: incentives, opportunities and actions

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**Abstract:** From a construction perspective, Public-Private Partnership projects (PPPs) are often credited as providing real incentives for the actors involved as well as a business environment that is conducive to innovation and improved practices. The validity of four common rhetorical arguments used to promote the PPP procurement route is explored: collaborative working, design freedom, long-term commitment and risk transfer. Particular interest is given to the extent to which espoused intentions correlate with experienced realities in allowing actors involved in the design and construction phases to be presented with, and able to exploit, opportunities for technological innovation. It is argued that there is reason to be cautious in fully accepting the purported benefits of the PPP framework and that the arguments often presented need to be revised. Alternative interpretations are provided.

**Keywords:** Public-private partnership, technological innovation, risk transfer, collaborative working, design freedom, long term commitment

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## **Introduction**

Public-Private Partnership (PPP) projects have received increasing attention over the last decade. Much is being claimed in academic circles, the press and the public debate alike, as to the inherent benefits. Whilst the possibility of initiating projects that might otherwise not be realized at the present time is clearly acknowledged and, indeed, is an integral part of the debate, several other issues are also brought forward. Examples of such claims of particular interest to those involved in construction include: lower project costs (cf. Haynes and Roden, 1999; HM Treasury, 2000a); shorter construction times (cf. Tiffin and Hall, 1998); competitive advantage (cf. Lemos et al., 2003); higher overall quality in the end product (cf. Regeringskansliet, 2000); and benefits accruing from letting the private sector be innovative in its solutions (cf. CIC, 1998). Indeed, PPP, at times, is portrayed as a vehicle of change and even as something of a panacea for the construction sector at large.

This paper explores some of these claims and the way that they are played out in practice. Of particular interest is the purported added potential for realizing innovations, in particular technological innovations, within the design and construction phases of PPP projects. Four issues are explored that in this respect have been given prominence in the PPP literature: collaborative working; design freedom; value for money through long-term commitments; and risk transfer. It is contended that the espoused correlations between each of these four issues and the provision of innovative solutions are not as straightforward as they at first might appear. Drawing upon construction and mainstream innovation theory and an extensive review of the PPP literature the paper sets out to put the PPP discourse into context.

Support for the presented arguments is drawn from a four-year study of PPPs carried out 1999–2003. The purpose of this paper is not to present the empirical findings in full (see Leiringer, 2003) but to extract the key elements of discussion that emerged. The overall intention is to contribute towards a broader understanding of the nature of innovative behaviour on PPP projects and the (dis)incentives provided.

## **The context of public-private partnerships**

Broadly defined, a PPP is an arrangement that brings public and private sectors together in long-term partnership for mutual benefit (HM Treasury, 2000b) – a definition that in its simplicity leaves much for interpretation. The term partnership is in this context ambiguous and the wording ‘mutual benefit’ is highly debatable. It could, for example, be argued that the public and private sector cannot have mutual goals as their planning horizons differ; thus, what could be considered beneficial for one party in the long-term may not be beneficial for the other (cf. Reijniers, 1994). On the other hand, proponents of these kinds of arrangement often predicate their arguments on the belief that both sectors have unique skills and characteristics providing them with advantages in undertaking certain tasks and that combining these skills would therefore be beneficial.

Following the wide definition given to partnerships, the multitude and diversity of project arrangements that are credited as PPPs are immense. In order for any kind of relevant

discussion to be carried out it is, therefore, clearly necessary to limit the scope, even though this means that only a limited selection of the arrangements that could be included in the term PPP will be dealt with. The paper targets arrangements in which the public sector contracts services, with defined outputs, from the private sector including the construction and maintenance of the required facilities. The following definition has been adopted and will be used hereafter:

A public-private partnership is an arrangement between public sector and private sector investors and businesses (the Private Sector) whereby the private sector on a non-recourse or limited recourse financial basis provides a service under a concession for a defined period that would otherwise be provided by the public sector.

The provision of such a service may involve the private sector in the tasks of planning, designing and constructing facilities in order to be in a position to provide the required service.

This definition encompasses the most common contractual arrangements used on PPP projects such as Build, Operate and Transfer (BOT); Build, Own, Operate and Transfer (BOOT); Build, Transfer and Operate (BTO); Design, Build, Finance and Operate (DBOF) and; Design, Construct, Manage and Finance (DCMF).

### **Why public-private partnerships?**

It is self-evident that the driving forces for various governments to initiate PPPs are by no means the same. What is true for the particular political climate in one country at a given time is not, by default, true for any other. Furthermore, the reasons for initiating projects in a country might well differ between the various parts of the public sector (policy arenas). Even so, the social and political context in which the project becomes a part is key to the complexity that surrounds the initiation and execution of specific PPP projects. The context governs the underlying objectives of the parties involved and, hence, the actions taken. This is particularly pertinent for public sector actors.

At a macro level, there are several reasons why PPPs might be initiated, of which most are far beyond the scope of this paper. Examples of such issues are: public policy and governance (cf. Rosenau, 2000; HM Treasury, 2000b; DTF, 2001); effects on the public sector financial control framework and expenditure controls (cf. Broadbent and Laughlin, 2002; Spackman, 2002); and sustainable development in communities and regions (cf. Kerr, 1998).

Descriptions of arrangements that fit the adopted definition of PPPs can be traced back over two thousand years (cf. Polybius 1979). That there might be an increased possibility of implementing innovations has, however, come relatively late in the debate surrounding PPPs. It was only in the mid-1980s that the argument of increased efficiency was brought forward as a primary objective in an attempt to initiate a series of BOT (Build Operate and Transfer) projects in Turkey. Until this point it had primarily been about initiating

projects that would otherwise have been put on hold due to a lack of state funding. More recently these claims have been recognized in several governmental reports from around Europe. For example, the UK government (HM Treasury, 2000b, p.12) states that 'the search for new opportunities to develop profitable business provides the private sector with an incentive to be innovative and try out new ideas – this in turn can lead to better value services, delivered more flexibly and to a higher standard'.

In Sweden, similar lines of thought can be found in the report presented by the Swedish Agency of Administrative Development, on behalf of the Swedish government, where it is stated that: 'PPPs are based on the principle of 'value for money', as the outcome of increased incentives, innovations [and] utilization of the private sector's commercial skills in the planning, design and provision of public services etc.' (Statskontoret, 1998, p.105). The enthusiasm with which PPP has been reported amongst some governments is also reflected amongst practitioners (e.g. SEFI, 2001). However, despite the apparent acceptance and endorsement of such claims in industry, the theoretical basis to support them seems strangely underdeveloped.

So far, considerable attention has been given to PPPs within several academic fields such as accounting, micro and macroeconomics, political and social science (cf. Grout, 1997; Montanheiro and Linehan, 2000; Fischbacher and Beaumont, 2003). This has generated a noticeable amount of research activity dealing with issues such as: public policy and governance; effects on the public sector financial control framework and expenditure controls; sustainable development in communities and regions; and new forms of project finance. Yet, until fairly recently, comparatively little work has been conducted within the field of construction management research and has dealt primarily with risk (cf. Akintoye et al., 2001). In particular, it is difficult to find research that has been undertaken in order to investigate the claims of innovative behaviour and improved practices in construction. Even so, the prevailing view seems to be that these kinds of projects provide real incentives and create a business environment that encourages innovation and improved practices in the construction phase (e.g. Statskontoret, 1998). It is claimed that, since PPP generally involves replacing cheaper public finance with more expensive private finance, project participants will look for compensatory savings in other cost areas – essentially those of construction and operation (e.g. HM Treasury 2003). These arguments seem to be based on the assumption that engineering a certain kind of collaboration between operators, designers and contractors in conjunction with added incentives and longer-term thinking being adopted will lead to innovative solutions to the client's service requirements.

The above line of reasoning partly circumvents the research that has been conducted on procurement forms and strategies, as well as on general and construction specific innovation. Indeed, it is apparent that several of the publications that endorse PPP as arenas promoting innovation are based on anecdotal evidence and wishful thinking.

### **Technological innovation**

Innovation, as a topic, is far too complex to be addressed in any detail within the scope of this paper. Views of where innovations come from and under what circumstances they appear are not shared (cf. Nelson and Winter 1977; Marquis 1988; Sundbo 1998; Van de Ven et al., 1999). Thus, the term is in many ways ambiguous and its wide applicability has resulted in a plethora of definitions used to describe phenomena in a variety of contexts. It is indeed difficult, if not impossible, to establish a common understanding of the degree of novelty, change and diffusion needed for the phenomenon to be an innovation. The discussion presented here, therefore, is solely concerned with technological innovations as defined by the OECD (1996, p. 31): 'Technological product and process (TPP) innovations comprise implemented technologically new products and processes and significant technological improvements in products and processes. A TPP innovation has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation)'.

### **Underpinning research**

The arguments presented in this paper are rooted in a four-year study of PPPs conducted between 1999 and 2003. The aim of the study was to examine the extent to which the PPP procurement route enables the actors involved in the design and construction phases to be innovative and novel practices and technology to be successfully implemented. A multi-method research design was adopted in order to capture the wide range of opinions, views and actions of practitioners involved in a variety of organizations and across various management levels. The paper, thus, draws from data collected from:

- (1) A reference group with 15 Sweden-based members all with experience of international projects. Together they represented a cross section of the major stakeholders in PPP projects including: architectural firms; banks; contractors (including both contracting divisions and specialist BOT/Private Finance divisions); law firms; politicians; public sector clients; regulatory bodies; service providers; and specialist investment funds.
- (2) Observational fieldwork within the specialist BOT unit of a large construction company; following the bidding for a major infrastructure project in Poland and the preparation of a business case for a large telecommunications project.
- (3) Site visits to five major international projects and numerous discussions and open interviews with senior representatives of organizations, public and private, involved in the PPP process in Australia, Finland, Germany, Poland, Spain, Sweden and the UK.
- (4) A theoretically grounded multiple-case study (cf. Eisenhardt 1989, 1991; Yin 1993, 1994) studying four projects, three with documented successful implementation of technological innovations and one project where this had not been case. The three 'exemplary' projects were: The Bromley Hospitals redevelopment project, Farnborough – one of the largest hospital schemes to be

carried out under the Private Finance Initiative (PFI) in the UK with a concession valued at £155 million; The HM Prison Parc in Bridgend, Wales – the first, major capital, non-lease-financing project to be put in place under the PFI, with construction work valued at £65 million and; King's College Hospital, Denmark Hill, south London – a £110 million DBFO project part of a long-term development plan at the hospital. The fourth project studied was The Arlanda Link (Sweden) with a project concession worth approximately 4.5 billion SEK, including the provision of the necessary facilities, such as rail track, underground stations and rolling stock, to provide a high speed shuttle train service between Stockholm Central Station and Arlanda international airport.

## **Four imperfect arguments**

### ***Design freedom***

The 1990s saw a change in regulatory policy at large and a strong emerging preference for performance based rather than prescriptive regulations (Gann et al., 1998). Nevertheless, public bodies that procure large capital assets using public funds typically have detailed manuals and standards that specify, for example, the designs, materials and components that should be used. Indeed, public sector clients use legislation, regulations, standards and norms to ensure that the construction complies with the criteria of the specific context. The regulatory systems for the construction sector vary between countries and each country has its own sets of these regulations, norms, standards and codes of practice, to which the actors on a project have to conform. The exact nature of the framework is influenced by historical approaches in the countries legal systems and through longstanding traditions within the local construction sector.

On PPP projects, the public sector client's requirements for the facilities and services are predominantly provided in the form of output specifications and service level agreements often in conjunction with minimal technical requirements. This is by no means unique to PPP projects, but it is fair to state that it is used to a higher degree than on traditionally procured projects. It is commonly claimed that the use of output specifications and service level agreements enables private sector actors to be innovative and use their skill and experience to create solutions that best serve the client's needs (e.g. Li and Akintoye, 2003). These claims follow the logic that the private actors are given greater freedom to interpret the tender documents without being impeded by past practices, rigid standards and norms. This phenomenon has been dubbed design freedom and is frequently brought forward as a positive aspect of the PPP arrangement. Yet, there is no consensus of what exactly constitutes design freedom or how exactly the term is to be understood.

In construction, three broad areas of regulatory policy are likely to affect innovation: labour market regulations that govern the construction process; planning and environmental regulations that principally affect the construction; and technical regulations that affect products and processes. Several other legal provisions relating to different aspects of the construction work also exist. Furthermore, codes of practice and standards that are commonly applied do not necessarily have to be regulatory. Voluntary

frameworks have been developed to ascertain that developed products and the means of producing them are compatible with existing products and practices. Even though the client might not specifically request that they should be used they often are as they regulate the interfaces between the actors as well as between the final construct and its environment.

It was evident on the case study projects that there was considerable confusion over what exactly was meant by design freedom and that this at times severely complicated procedures. This was especially apparent in one of the projects where wasteful working and time delays accrued from the misconception of the term, which had been explicitly written into the contract. The private actors were led to believe that they could design away from norms and standards to a greater extent than the public sector client and the regulating bodies would allow.

The key issue, which cannot be circumvented, is that the constructed facilities have still to be approved by the various regulating bodies and, furthermore, they have to be convergent with the rest of the public sector client's infrastructure and operations. There is, in practice, little more chance to design away from the traditional standards and norms than there would be on any other type of project. Hence, there is little room for design freedom, in the true extent of the word, except in the very early conceptual phases of the project – though exceptions arguably do exist that to some extent contradicts this line of reasoning. The prison in the multiple-case study is an example of one such project. It distinguishes itself through that the private actors were the sole operators of the prison and did, therefore, not have to take account of the need to incorporate the end product or the services with those already in existence. Few other types of PPP promise to present similar conditions.

Thus, in practice, even if the opportunity existed to design away from past practices and rigid norms the increased uncertainty that it attracts would act as a powerful deterrent to the Project Company as well as the organization taking on the construction contract. This greater uncertainty could range from not getting to the preferred bidder stage to not getting the built product approved at final inspection.

Instead, the argument could be realigned to focus on the opportunities provided to the private actors, through the output specifications, to perform the specific tasks in a fashion that best suits their expertise. This could involve using new or improved techniques, but it could just as well be a matter of using old and tested techniques found suitable for the task in hand. Previous research into innovations on PPP projects, however, has failed to establish a correlation between the form of the output specifications and innovative behaviour (e.g. CIC, 2000). Similarly, the output specifications provided on the four projects in the multiple-case study varied in extent, style and detail and no apparent link was found between their disposition and the implementation of innovations. This suggests that the exact nature of the output specifications is of secondary importance and that it is instead the communication between the public sector client, the Project Company and the contractors during the development of the design that is key. The very limited degree of change allowed in the main contracts adds to the complexity of this



exercise. Hence, both sides from the outset need to be certain of what the private actors can and cannot do and under what circumstances or conditions. This is equally important in the relationship between the public sector client and regulating bodies and private actors as between the Project Company and the construction and operational organizations. Ultimately, there is not likely to be any design freedom unless both the public sector and the private sector are comfortable with the meaning of the term and create an environment that encourages it.

### ***Collaborative working***

Claims that the participants in PPP projects will look for compensatory savings in cost areas such as construction and operation is as previously mentioned based on the assumption that the PPP environment facilitates the engineering of collaborative efforts between operators, designers and contractors. Reference is implicitly made to various forms of relational contracting that are predicated on mutual benefits and, so called, win-win situations being achieved through the establishment of more co-operative relationships between the parties. However, this is not necessarily a valid comparison. The project agreement in a PPP project is foremost a business deal that happens to include a construction undertaking. Regardless of the constitution of the Project Company – commonly the Project Company takes the form of a Special Purpose Vehicle (SPV) established either in the form of a consortium or joint venture – the adherent construction contract is merely one of many in a complex array of subordinated contracts. The degree to which the various contracts incorporated in the project agreement inter-lock varies and whether or not the contract arrangements will force the actors involved to collaborate is highly arguable. In comparison, relational contracting is normally based on the application of less stringent contracts where the parties themselves, to a large extent, govern the transactions within mutually accepted social guidelines.

Of significant importance in this context is the stringent fashion in which the contracts, especially the construction contract, are written in PPPs. The manner in which they are formulated make it very difficult for the contractor to make changes as the project develops. These inhibitors for change that are imbedded in the contract cannot be disregarded and must be taken into consideration in any argument for or against implementing innovations on these projects. It is not as likely that benefits will accrue from incentives derived from the fashion that the contracts are formulated in PPPs as in, say, partnering agreements. To the contrary the involved parties have to go out of their way to establish routines that effectively counter the restrictions in collaborative working forced upon them by the stringent contracts. Whilst this is possible, it is by no means a trivial task.

Most types of innovation that are introduced into a project context, perhaps with the exception of the incremental kind, have to be agreed upon by one or several of the associated actors. Hence, the establishment of effective communication between the actors on the project ought to facilitate innovative behaviour. This line of reasoning resonates with findings from previous studies on innovation. For example, Tatum (1984) presents the early involvement of representatives with the authority to commit resources

to all parts influenced by the innovation; and the establishment of effective information flow within the project team as conditions that occurred repeatedly on major construction projects that claimed successful innovation. Christensen (1997) presents similar arguments and states that organizations have a greater chance of successfully implementing an innovation if sufficient resources and knowledge are applied.

The findings from the multiple-case study suggest that there is a need for public sector and private sector actors to create a mutual understanding of the needs and ambitions of the other parties involved. In three of the studied projects, the actors, to a greater or lesser extent, succeeded in striking a balance between the overall goals of the project and their own organization's agenda. This, in turn, facilitated a smoother development of the output specifications into a workable design. It is suggested, therefore, that the project outcomes benefit from a certain level of agreement having been reached before the contracts are signed; or put somewhat differently, the little scope provided for changes makes it crucial that early input is provided from those involved in the operational phase. Furthermore, both sides need to understand the drivers and motivators of the other. Policy decisions will influence the public sector client in procuring the project as well as the actions of other public actors throughout the project. Ultimately, the attitude has to be one of convergence and openness in the negotiations and mutual understanding of the other organizations' views and motivators. Thus, being able to minimize the degree of opportunistic behaviour from the private actors as well as the public sector.

### ***Risk transfer***

It is unavoidable that an infrastructure project will contain risks for the parties involved. Exactly how these are identified, allocated and managed is dependent on the type of project, the procurement route chosen and the contractual arrangements that are put in place. The very nature of PPP projects makes risk a key factor in the procurement and delivery of the project.

Proponents of PPP projects, and indeed most government guidelines on PPP procurement from around the world, tend to use the maxim that the risk should be allocated to the party that is best able to control and manage it (cf. UNIDO, 1996; HM Treasury, 2003). However, this is not a trivial task and there is no one-way to do it. For example, should the risk be allocated to the party that has the greater ability to influence the probability of occurrence or the party that is best suited to deal with the consequences of the risk occurring? Having the best access to suitable mitigation techniques might not always be a sufficient criterion, as a number of other considerations have to be taken into account. In some cases, it is fairly evident which party should take the risk, whilst in other cases this is by no means clear. One obvious reason is that the implications of a risk materializing might have slightly different meaning to the actors in the project, both positively and negatively.

That a greater degree of risk transfer from the public to the private actors could lead to achieving value for money for the client on the project due to greater cost certainty has been dealt with in several publications; see for example HM Treasury (1999) and CIC

(2000). Yet, it continues to be a source of political and ideological debate. That a greater degree of risk transfer will lead to value for money through forcing the private actors to come up with innovative solutions is even less certain and is an area that has been less researched than the former.

It is, indeed, by no means self-evident that greater risk sharing or risk transfer will lead to innovative behaviour on the project. On one hand, the organization's ability to make rational calculations about any one innovation is highly variable and commonly thought to be dependent on factors such as reliable information, sufficient time, degree of inclination etc. (cf. Freeman and Soete, 1997). On the other hand, innovation and risk go hand-in-hand and it is commonly stated in innovation literature that innovation involves uncertainty in an essential way (cf. Nelson and Winter, 1977). Ultimately, innovation cannot be taken lightly. Examples of failure that have had disastrous effects for the involved organizations abound (Christensen, 1997).

It is suggested here that it is not the risk transfer per se that is of importance, rather it is the greater clarity of the where the risks have been allocated that might prove beneficial for innovative efforts. However, it is also evident that even though an innovation might be more likely to be successfully implemented if the implementing organization is clear over the risk allocation and, hence, is able to make rational decisions based on it; the allocation also has to be appropriate and manageable. Although the risks are regarded to be quite clear on a project it does not necessarily mean that they are considered as appropriately or fairly allocated. For example, in the multiple-case study all projects contained examples of where the private actors thought that they had been forced to take risks that they could not handle and, furthermore, all interviewees agreed that there were examples of organizations on the project that clearly had not understood the magnitude of their commitments or the attendant risks. In other words, identifying the risks is one thing, assessing them and understanding their implications and future impact is something completely different. Furthermore, in dealing with the risks that are closely coupled to innovations, there is a need for all actors involved to understand that there are upsides as well as downsides to risks.

### ***Long-term commitment***

A distinctive feature often pointed out by advocates of the PPP approach is the prolonged contractual obligation of the contractor. A longer-term commitment places capital at risk and is believed to force private actors to produce something that is durable and functional whilst keeping whole life costs to a minimum (HM Treasury, 2003). In order to do so, both the client and the contractor are forced to consider the interaction of design solutions and construction methods with long-term performance. Most public sector clients would claim trying to accomplish this on all their projects, but the means for doing so is many times considered to be greater within the commercial environment of a PPP contract than through public sector exhortation (Spackman, 2002). Thus, it is believed that PPP encourages solutions that provide value for money throughout the project life cycle.

However, little, if any, empirical research has been conducted that supports this line of reasoning. Instead, increasing evidence suggests that, whilst in principle contracts prevent the contractors from opting out, it is in practice difficult to design and enforce clauses, extending over any longer period, that stops this from taking place. The number of projects where construction companies sell their shares in the Project Company long before the contract is due to terminate is steadily increasing (as exemplified by two of the case study projects: The Arlanda Link and HM Prison Parc). Indeed, changes in the equity ownerships/ratios throughout the project lifetime is to be expected as various forms of restructuring and refinancing are undertaken; regardless of whether the projects are performing or not.

Thus, however trivial a statement, arguments common in the rhetoric supporting PPPs that centre on whole life cost appraisals and operational benefits accruing from the long-term commitment of the contractors, i.e. life cycle cost savings, are valid only if action is taken along those lines. Instead of increased long-term commitment leading to technological innovations being implemented, it could be argued that the characteristics of the main construction contract forces the actors concerned to look at tried and tested solutions, i.e. existing methods and technology, in order to limit the risk exposure.

However, as argued above, the private actors are, through the output specifications, given increased opportunity to better utilize their expertise as they choose the method of production. In this light, the PPP procurement route is more likely to provide solutions that adhere to best practice and available knowledge and expertise rather than something new or unique. This, however, does not exclude the achievement of technological innovations. Yet, it might serve to explain the kind of innovations that are implemented. For example, in the multiple-case study, the main innovations could all be considered as successful technology transfer or the development of existing technology. In each of the three exemplary projects there was evidence from elsewhere that they could be successfully implemented, which provided a certain degree of security for the solution, thereby leading to less risk exposure for all involved. Previous research, e.g. CIC (2000), present similar findings.

Thus, the value for money argument could be revised to instead focus on the role of the operator/service provider. It is not a new argument that the users should be involved earlier in construction projects in order for them to provide input into the design and construction phases. Even so, the multiple-case study showed that a systematic involvement of the service provider and those that are going to be involved in the day-to-day operations encourages innovative behaviour on the projects. However, due to the nature of the construction contract this input needs to be acquired very early on in the project's life.

## **Conclusions**

This paper has dealt with some of the main arguments that are commonly advanced in favour of PPPs. It has been argued that there is reason to be cautious in fully accepting these claims in proclaiming the pre-eminence of the PPP procurement route and its

alleged provision of added incentives for the private sector to be innovative. Indeed, it would be rash to claim that PPP is the panacea for change within the construction industry. Yet, this is not the same as stating that there is no room for innovation on PPPs but there are, as in any other kinds of projects, several potential inhibitors in the process that are likely to limit the amount of innovation achieved. The arguments often presented, especially those concerning benefits accruing from design freedom, collaborative working, risk transfer and long-term commitment need to be revised. Several of these issues have been pointed out together with explanations of alternative interpretations.

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