

Performance-based contracting in the construction sector

A report for Transport for London compiled by Will Hughes and Shabnam Kabiri, School of Construction Management and Engineering, University of Reading, RG6 6AW, UK

Executive summary

Construction procurement is complex and there is a very wide range of options available to procurers. Inappropriate choices about how to procure may limit practical opportunities for innovation. In particular, traditional approaches to construction procurement set up many obstacles for technology suppliers to provide innovative solutions. This is because they are often employed as sub-contractors simply to provide and install equipment to specifications developed before the point at which they become involved in a project.

A research team at the University of Reading has developed a procurement framework that comprehensively defines the various options open to procurers in a more fine-grained way than has been known in the past. This enables informed decisions that can establish tailor-made procurement approaches that take into account the needs of specific clients. It enables risk and reward structures to be aligned so that contracts and payment mechanisms are aligned precisely with what a client seeks to achieve. This is not a “one-size-fits-all” approach. Rather, it is an approach that enables informed decisions about how to organize individual procurements that are appropriate to particular circumstances, acknowledging that they differ for each client and for each procurement exercise.

Within this context, performance-based contracting (PBC) is explored in terms of the different ways in which technology suppliers within constructed facilities might be encouraged and rewarded for the kinds of innovation sought by the ultimate clients. Examples from various industry sectors are presented, from public sector and from private sector, with a commentary about what they sought to achieve and the extent to which they were successful.

The lessons from these examples are presented in terms of feasibility in relation to financial issues, governance, economics, strategic issues, contractual issues and cash flow issues for clients and for contractors. Further background documents and more detailed readings are provided in an appendix for those who wish to find out more.

The conclusions from the study are:

- Clients must decide whether to seek innovation from the demand side or the supply side. If too much reliance is placed on public sector clients who may lack the in-house expertise to create innovative demand, this may result in excessive expenditure on consultants, as well as an ineffective risk transfer.
 - Performance-based contracts typically require suppliers to fund the development and installation work, foregoing payment until the operational stage (to varying extents, depending on strategic choices). Main contractors may lack the capital base on which to fund such contracts. If they rely on external funding, care is needed to ensure that contractual incentives and payment mechanisms do not follow traditional routes.
 - The transition from product installation to service provision provides huge challenges in terms of organizational change for both supply side and demand side.
 - Clarity of funding is essential. Where a contract for services includes the commissioning of new buildings or infrastructure, the duration of the service element need not be as long as has been the case in the past. Short to medium-term contracts may be more effective than long-term contracts.
 - In deciding on the duration of service contracts that require capital investment on the part of the supplier, clients should seek to keep the duration to a period that matches the amortization of the suppliers' financing requirements.
 - The question about whether performance requirements are structured around the required level of service or the definition of the work (i.e. output specification versus input specification) relates to risk. Where a public sector department has an inescapable obligation to provide a public service, it is difficult to justify attempts at transferring this to the private sector, unless there are extremely robust insurance-backed guarantees in place to ensure continuity of service. Contractual remedies may be inadequate in the event of contractor or supplier insolvency.
 - When contemplating PBC arrangements, cash flow on the demand side and the supply side should form part of the information for decision-making.
 - It would be worthwhile for the demand side to investigate the nature of the bonds, guarantees and warranties that would be required from both sides to provide the financial underpinning that make these arrangements plausible. There may be a need for more standardization of these financial instruments.
 - Care is needed to ensure that a move towards PBC does not simply result in the insertion of an extra layer into the supply chain as a result of the funding arrangements. It seems important that the demand side thinks carefully about how payment for performance incentivizes different behaviours from the supply chain. One important issue is the extent to which it influences 2nd and 3rd tier suppliers in the supply chain, or indeed whether such influence is necessary.
 - Demand-led innovation and supplier-led innovation involve significant risks on both sides of the transaction. Such procurements should not be seen as a panacea, but as innovative developments to procurement that need to be considered very carefully across a range of aspects.
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Introduction

The aim of this report is to explore the options available to a major public sector procurer in terms of demand-led and supplier-led innovation. The context for this is the consideration of performance-based contracting (PBC) in construction. The idea of PBC for sustainable construction procurement is linked with a series of practical procurement issues. There are many ways in which contracts and pricing mechanisms may be set up, and the purpose of this report is to enable TfL, as a client of the construction and engineering sectors, to make strategic decisions about the procurement of construction work that will enable them to take best advantage of innovative and sustainable solutions from the supply side. While some examples in this report are from the private sector, the overriding purpose is to develop an understanding of procurement within the context of EU procurement legislation and best practice guidance.

While there is a strong need to innovate, the procurement of complex and large-scale infrastructure is often organized in a way that creates obstacles to innovation. Contract clauses and payment regimes may have the unintended consequence of incentivizing and rewarding non-innovative behaviour, often because of very real concerns about risk and price, especially in the public sector. One key concern is the meeting of performance requirements. In discussions with public sector procurers and suppliers it is clear that the development of innovative solutions may come from the demand side or from the supply side, but contracts and payment mechanisms tend to dictate whether innovations will be encouraged or not.

Although PBC is widely used in other industry sectors, its application to the procurement of mainstream engineering and building construction work is innovative.

The Reading Procurement Framework

The Reading Procurement Framework is a fine-grained approach to the definition of procurement routes, as adopted in the new British Standard on Construction Procurement (BS8534:2011). This will form the “lens” for the detailed discussion of procurement that is presented in this report.

Traditionally, construction procurement methods are defined in an incomplete way. For example, the phrase “general contracting” indicates the separation of design from construction and the liabilities and the payment processes that would be associated with that idea. However, it indicates little about the way in which contractors are selected or how the project is funded. Partnering is a particular way of setting up long-term relationships, but implies nothing about funding or design responsibility. Private finance initiative (PFI) is a means of funding a project, but does not define selection methods or the extent of the integration of the supply chain, and so on. In other words, many of these procurement methods are not alternatives to each other; each differs from the others in a unique way. By considering all of the options for each dimension of the procurement decision, a framework has been developed that enables the description of procurement methods in a more fine-grained and specific way.

The framework is based on identifying six aspects of procurement, which may be combined in different ways:

1. **Source of funding:** e.g. owner-financed, public sector-financed, developer-financed, supplier-financed, private finance initiative, public-private partnerships.
2. **Selection method:** e.g. negotiation, partnering, frameworks, selective competition, open competition, competitive dialogue.
3. **Price basis:** e.g. cost-based labour and materials, single price for a whole building, lease of a managed facility, payment on performance, guaranteed maximum price.
4. **Responsibility for design:** e.g. architect, engineer, contractor, novation, client design teams.
5. **Responsibility for management:** e.g. client, lead designer, principal contractor, management contractor, joint venture.
6. **Supply chain integration:** e.g. integrated, fragmented, competitive, collaborative (a spectrum varying from systems integration to volume integration)

This framework helps to explain the complexity of procurement in terms that are more widely applicable than the usual, construction-specific terms like general contracting, design-build, PFI and so on. Interestingly, having six variables with five options under each generates more than 15,000 permutations! This not only helps to explain why the procurement decision is complex, it also helps to explain how a focus on service-based options leaves open a series of decisions to be taken about each individual procurement.

Performance-based contracting

There are growing trends in many industry sectors towards a service-based economy. This is variously known as servitization, performance-based contracting or supply chain contracting, among other terms. Although it is very topical in the construction and engineering sectors these days, it is not a particularly new idea nor is it unusual. Indeed,

in many sectors, it is the predominant business model, even in some sub-sectors of construction.

Early examples of performance-based contracting

Paying for services only when they are needed could be a future procurement model for many purchases that include a high level of service over time. The idea of paying for aircraft engines only when they are actually flying came about in the 1960s, when Bristol-Siddeley coined the term “power by the hour”. When the firm was purchased by Rolls Royce in 1966, the concept (and the trademark) came with it. Since then, Rolls Royce has continued to offer this service on a range of its engines. In defence and aerospace contracting, many customers and suppliers have recognized that purchasing world-class products is not enough; it is also necessary to provide superior, cost effective maintenance and support services after the product is sold. In those sectors the term is known as “performance-based logistics” and it has become, for example in the US, a standard contract provision for the support of such key sub-systems as aircraft engines and avionics systems. As well as aerospace, performance-based contracting is well-established in defence contracting and for complex items of equipment such as medical imaging devices.

More recently, the private finance initiative in UK public sector construction illustrates how the performance concept may be applied to public sector procurement of buildings and infrastructure. From the public sector client’s point of view, a unitary service charge that embraces funding, design, construction, maintenance and operation is preferable to using tax revenue for capital acquisitions. However, with PFI, the funding for development projects typically involved third party finance, from the banks. It was something of an irony that, even though the public sector can borrow far more cheaply than the private sector, PFI enjoyed a surge of popularity in the UK from 1992 until recently, when there was so little private finance available that public sector finance was issued to the financing banks, so that it could be used to fund these projects. Moreover, the development of the concept became much more about procuring finance rather than procuring service. Indeed, the financial arrangements produced a plethora of complex contracts around the finance, underneath which the usual design, construction, maintenance and operation contracts continued to be used. As such, this approach failed to change the incentives for the supply chain and did not lead to the kind of step change in contracts for the supply chain that was seen in the private sector with aircraft engines. Indeed, it seems as though the extra layer of a Special Purpose Vehicle or a Joint Venture between the client and the supply chain created more distance between those who provided infrastructure and those who used it. In many situations, the procurer needs to be closer to suppliers, rather than more remote from them.

Sectors in which performance-based contracting is well-established

It is not necessarily the case that construction must be contracted on the basis of labour and materials; at least, not from the client’s point of view. Indeed, property developers have long stood between the client and the construction industry by procuring land,

erecting a structure on it and then finding a buyer/tenant. This is the standard model for UK private sector housing and for commercial property. Some developers may use a general contractor but, depending on the state of the economy, some may use construction management procurement (direct trades contracting) where there is no general contractor. This all depends on the risk profile of the developer and the job, and is not particularly dependent on the construction technology. Although there is no service element involved in buying a house, this transaction is a basic performance-based transaction because the price is based on the value of the property, not on the labour and material content. When entering into a lease for a car, an apartment or an office, various degrees of service may be part of the deal and there may be an option to purchase at the end. In PFI projects, the transfer of ownership may be automatic at the end of the contract period, having already been factored into the price.

Equipment maintenance

Performance-based contracting is becoming increasingly popular in the maintenance of equipment. Maintenance, repair and overhaul (MRO) contracts, on the face of it, seem to be similar. However, there is a big difference between PBC and MRO. In the latter, the supplier provides the customer with new equipment only when any of the equipment specified in the contract is faulty. In PBC, however, the supplier needs to ensure that equipment is good enough to deliver the specified outcome and if the specified service can be delivered more economically, the supplier stands to gain more. In this way, the supplier is incentivized to innovate to meet the promised performance targets.

Highway maintenance

The National Cooperative Highway Research Program (NCHRP) (2009), in the USA, produced a report about PBC in maintenance for highways. Based on that report, Performance-Based Maintenance Contracting (PBMC) was first introduced and implemented in British Columbia and then used in Australia, New Zealand, England and Finland. It has become more popular in the USA as well as other countries. Among 38 states in the USA (who responded to the NCHRP survey), 8 of them (including Florida, Maryland, Texas and Virginia) are applying PBMC. As for highway maintenance in other countries, South Africa uses PBMC for 100% of its national roads. In Estonia it is 63% and in Argentina 44% of the road network is being maintained using PBMC. Now, the question is whether the benefits of PBMC justify the cost to the client. One of the tools NCHRP used to answer this question is Value for Money (VfM). If VfM is defined as a ratio of Level of Services (LOS) to Cost Savings (CS), then any increase in LOS or decrease in CS would mean an increase in VfM. However, the challenge is to measure LOS and to provide a realistic estimation of CS.

- **Level of Services (LOS):** Measuring LOS needs performance criteria. In contracts that involve only a single activity, a small number of performance criteria would indicate any increase or decrease in the LOS. However, in contracts that involve numerous activities, measuring performance would consist of a large number of performance criteria. For example factors like the condition of the asset, the

response of maintenance services, mobility, safety and environmental issues all play a role in defining performance measurement and the LOS.

- **Cost Savings (CS):** As for cost savings, there is some evidence from the literature that PBC could lead to cost savings. NCHRP provides different examples of PBMC in different countries. Based on that report, PBMC has the potential for cost savings from 10% to 40%, but evidence/documents to support this claim are not convincing because, as NCHRP themselves acknowledge, it is not clear whether direct and indirect costs can be placed on a valid and comparable basis. Determining cost savings is not as straightforward as it sounds. There are different baselines for measuring cost in the public and private sectors. They may be measured in comparison to the cost of in-house staff performing the work before the PBC started, but that would not account for indirect costs. Another baseline would be against engineers' bid estimates.

Although value for money has the potential to be used as a tool to evaluate performance-based contracts, determining the level of services and cost saving has its own complications. Furthermore, as NCHRP mention, value for money cannot always be reduced to only LOS and CS. A guaranteed price, best use of resources as well as increasing administrative efficiencies are factors that cannot easily be reflected either in LOS or CS but are crucial in determining whether the implementation of PBC has a net positive value.

PBC in highways has various forms. There are two factors involved in determining what type of PBC for maintenance of highways is needed. The first factor is the scope of the work such as activities and assets and the second is the coverage which addresses the area and the amount of the highway work covered in the contract. For example, in the simplest case, PBC may concern only a single activity like sign replacement, a single asset like bridge maintenance or a set of activities like rest area maintenance. However, more commonly, PBC pertains to a corridor, which is a long section of limited access highway and the contract will involve everything in the provision of the right-of-way.

Other than the type of activities, PBCs differ in terms of payment method. The following list describes the most common methods in performance-based contracting for maintenance based on the NCHRP:

1. Fixed-price (lump-sum) plus disincentives (penalties like deductions and/or liquidated damages) and possibly financial incentives.
2. Cost plus with incentives fees or disincentives/liquidated damages.
3. Fixed-price or cost plus with an award payment.
4. Fixed-price or cost plus with an award term.

Although NCHRP provided this list, it mentions that the most common PBC in highway sector is lump-sum payments with penalties for not meeting the specified outputs, with at least one option to extend the contract period, which seems to be the only incentive that is not directly financial. While penalty clauses are not enforceable in many jurisdictions, there are acceptable contractual mechanisms, such as liquidated damages, that achieve a similar end.

Energy performance contracting

Another sector that increasingly uses PBC is the energy sector. In energy projects, the supplier/contractor provides the energy for the asset using new technologies and receives payments based on the savings made using the new technology. These projects are procured using the same idea as PBC but in this specific case it is known as Energy Performance Contracting (EPC). However, in some EPC projects it has been observed that up-front payments were also received by the supplier, creating a hybrid between more traditional contracting and EPC.

Alsatian High Schools project, France

A more specific example of EPC is the Alsatian High Schools project in France, which was presented as one of the SCI case studies¹. The project was for renovation work to 14 schools in the Alsace region. The renovation process was set up with the aim of making major energy-efficiency improvements and installing on-site renewable energy capacity. Financial mechanisms in this project included public private partnership (PPP) as well as EPC. The Competitive Dialogue procurement method was used so that different factors involved in such a complex project could be discussed with a group of suppliers. In order to produce a draft for tender specifications, a consultant was employed and all the candidates were invited on the 12 November 2008 to bid for the project. Different criteria, such as reduction in primary energy consumption, total cost of the offer, cost savings for the client and the strength of the financial and technical master plan, were used with different weights to evaluate the offers. The researchers at University of Reading were in contact with the client of this project, the Alsace Region Council, to discuss the business model of this project and received a copy of the contract from the Alsace Region Council. The following points were highlighted from the contract:

1. The Alsace Regional Authority pays a fee as rent to the contractor on a quarterly basis as a combination of five following fees:
 - Fee 1 - Financial: to refund the investment (principal and interest).
 - Fee 2 - Repairs or replacement: part of the fee corresponding to the contractor's obligations concerning value-added improvements that extends the useful life of the asset.
 - Fee 3 - Ordinary maintenance: part of the fee for the ordinary maintenance as one of the contractor's obligations.
 - Fee 4 - Provision of fuel: to represent the part of the fee corresponding to the provision of fuel for the biomass heating systems.
 - Fee 5 - Administration, insurance and management of the contract: part of the fee corresponding to the contractor's expenses related to the management and insurance of the contract.

¹ The SCI-Network, Sustainable Construction and Innovation through Procurement, was established by a network of European public authorities in September 2009. This Network aimed to identify European best practice to encourage innovation and sustainability in construction procurement (<http://www.sci-network.eu/>).

2. This method of contracting enabled authorities to undertake major renovation works without large up-front payments and is recommended for use in other major renovation works in any EU country.
3. There were two up-front payments after the installation of the equipment and before the school started to operate.

These arrangements are represented in Table 1 according to the Reading Procurement Framework.

UK Green Deal

It is interesting to consider whether construction contractors or suppliers would be in a position to provide services under PBC without up-front payments by the client or any third party. A good example of PBC without up-front payments is a new scheme in the energy sector in the UK called the “Green Deal”. The Department of Energy and Climate Change has launched a new financial mechanism to eliminate up-front payments by the client while receiving energy-saving solutions as well as equipment, underpinned by a subsidy to the suppliers. The Green Deal scheme uses different methods to improve the customer’s home; methods like loft insulation, installation of wind turbines and/or solar panels, double or triple-glazed replacement windows and many other techniques may be used to reduce the customer’s heating bill. Instead of direct payments, the supplier will take a share of the savings in energy bills over a period of time. The Green Deal Providers help individuals to calculate their repayments, including interest. If a customer whose home had been improved subsequently relocated, the scheme would remain on the property and the new occupier would take on the repayments and benefit from the improvements. The departing occupier would be required to provide the new occupier with a copy of the Energy Performance Certificate that shows the improvements, the repayment amounts that the electricity bill-payer needs to make, the length of the Green Deal and the name of the Green Deal Provider.

The UK government encourages any tradespeople, manufacturers and small and medium-sized enterprises (SMEs) to participate in this scheme as energy providers. Different business models for manufacturers, assessors, installers and providers are available. Among the different ways of becoming involved, businesses may join the new market by subcontracting as an assessor and/or installer to large providers such as energy suppliers, retailers or local authorities, or as a manufacturer who sells energy-saving products. Thus, this technique places a third party into the supply chain between the end user and the technology providers.

Table 1: Definition of procurement route for Alsatian High Schools

Source of funding	Contractor-financed
Selection method	EU competitive dialogue procedure
Price basis	Hybrid of up-front payment and performance-based service charge over 20 years
Responsibility for design	Supplier-designed
Responsibility for management	Supplier-coordinated
Supply chain integration	Open option for supplier

Customers can get quotes from different providers and have the right to choose any of them. Furthermore, they are allowed to choose their improvements from different recommendations made by the providers. Providers are not allowed to charge the customer more for repayments than the amount a typical household is permitted to save on energy bills. Should a Green Deal Provider not meet the expected quality, the customer can contact the Green Deal Ombudsman (penalties are not clear at the time of writing). If customers fail to make the repayments as specified in their Green Deal Plan, the electricity company will use its normal debt collection process. The question at this stage is that what happens if the customer's energy consumption behaviour does not allow the expected savings to be achieved? Or what if a new occupier has very different usage behaviour in terms of energy? In other words, what will happen if the customer does not cooperate to receive the expected outcome?

Ultimately, by placing a third party provider between the end user and the supply chain, this form of contracting is a novel means of funding construction, but the contractual relations between the provider and its supply chain may remain unaffected. In this sense, it is similar in effect to PFI, which did little to change contractual patterns below the level of the Special Purpose Vehicles set up to deliver services.

Hordaland public transport authorities

In Norway, PBC was implemented by the public transport authorities first in Hordaland¹ in 1999 under the name of "quality contracts". (In some management and business literature, the phrase, quality contracts is used to distinguish performance-based contracts from those for labour, such as consultants, whose contracts would typically be characterized as "time contracts".) In 1999, the operators of public transport services had the best knowledge of the market. The contract started from the premise that the design of this system should be left to the operators because of their knowledge of the system. Although implementing PBC in Hordaland happened as the result of a political decision and not as the outcome of a detailed decision-making process, it is considered to be one of the most successful PBCs in the world (Carlquist *et al.* 1999, Hensher and Stanley 2002). It started first in 1999 by adopting Oslo's trial model for PBC into a full-scale performance contract for Hordaland.

Before implementing PBC in Hordaland, the transport authority was involved in the strategic level as well as the tactical level of responsibilities for running the bus system. At the strategic level, the political council was responsible for the transport as well as social politics and the transport department was responsible for the mobility and the accessibility standards. At the tactical level, the transport department was responsible for fares, routes, timetables as well as the vehicle type. At the operational level, however, the transport authorities had no responsibility and it was mainly the operators' duty to deliver the outcome. Those duties include sales, information and management of persons and vehicles. This was delivered for all different companies including

¹ Hordaland is one of the Counties in Western Norway. It includes a township called Bergen, and has a total population of about 450,000.

Table 2: Definition of procurement route for Hordaland public transportation

Source of funding	Supplier-financed
Selection method	Competitive tendering
Price basis	Revenue-generated concession
Responsibility for design	Supplier-designed
Responsibility for management	Supplier-coordinated
Supply chain integration	Open option for supplier

publicly owned bus companies, private urban bus companies as well as private regional bus companies.

After implementing PBC, responsibilities changed at the tactical level. It became the operator's duty to set fares, routes, timetables and vehicle types. It remained for the authorities to define the framework comprising overall quality requirements relating to price, service and accessibility. One of the key principles in the Hordaland system is that the operator is given financial incentives for product development. However, if the operator fails to meet the requirements, the contract will be put out to tender. Another principle is to have joint cooperation between the authorities and the contractors, so that PBC can be implemented as successfully as possible. In this regard, authorities are obliged to enforce measures to improve the effectiveness of the public transport system.

The first key principle is incentives. The PBC contract in this project is a net contract. This means that the operator retains all ticket revenues and carries the revenue risk. There is a strong link between passenger demand and operations; a model that works very well in Bergen, where 92% of the total revenues are generated in the market. In addition, public transport requires extra incentives to make sure that the level of production will not be lower than what is economically effective.

The second key element is the quality framework regarding fares and accessibility that was set by the authorities. Authorities only define certain minimum criteria and, for major decisions, operators have plenty of room; they can change the mileage and fares to meet their planning and product development requirements as long as the specified boundary levels are met. By running a customer satisfaction survey, however, authorities will make sure that the level of customer satisfaction is over 90% of the target level. If this is not the case the contract may be cancelled by the Hordaland County Council.

The third key principle is the cooperation between authorities and operators. A public transport committee was established with members from Hordaland County, municipalities, operators, police as well as Hordaland road administration. The main responsibility of this committee is to improve bus priority measures, information provision and bus stops/terminals. Should the Hordaland County achieve any savings through cost reductions in bus companies, the savings will be used to improve public transport services. Table 2 summarizes the procurement variables for this arrangement.

Specific examples of performance-based contracts

In considering two further specific examples of performance-based contracting, there are several insights that emerge regarding a distinction that may be drawn between supplier-led innovation and demand-led innovation. The first example is the provision of utilities to an apartment block in Queensland, Australia. The second is the contract for equipment replacement and a maintenance programme for the traffic lights in Manchester. The key difference between these two examples is that the first is organized around supplier-led innovation and the second around demand-led innovation.

SBS utilities contract with apartment tenants

The Queensland apartment block is a small project consisting of ten apartments. The supplier, SBS, describes itself thus:

SBS conducts the business of providing metering-related products and services. SBS is a supplier of utility meters, automatic meter reading systems and associated communications, IT and software products, a provider of maintenance and repair services for automatic meter reading systems, a supplier of serviced heat-pump hot water heating systems and a provider of remote meter reading and billing services.

This particular contract was for the supply, installation, commissioning, maintenance and operation of hot water, cold water and electricity. The design and supply of the necessary equipment would normally be the responsibility of the developer (or their designers and construction contractors). However, in this case, SBS contracted with the tenants to provide the utilities. The design and installation of the equipment is simply a part of the supply of the utilities, the cost of which is subsumed into the service charge, which is related to the metered units of each of the services used by the tenant.

In this case, the design and selection of equipment, and the methods of installation, were matters for the discretion of the supplier, whose payment is based solely on performance. The supplier is only paid when the consumer uses the service. Therefore, the supplier carries all of the performance risk and is incentivized to find innovative technologies that will provide the service as efficiently and effectively as possible, in order to maximize their returns.

Table 3 shows how, under the Reading Procurement Framework, this approach is supplier-financed, performance-based payment, supplier-designed, supplier-coordinated leaving supply-chain integration as an open options for the supplier. The supplier was selected as a result of a negotiation process on scope and pricing mechanism.

Table 3: Definition of procurement route for SBS utilities contract

Source of funding	Supplier-financed
Selection method	Negotiation on scope and price
Price basis	Performance-based
Responsibility for design	Supplier-designed
Responsibility for management	Supplier-coordinated
Supply chain integration	Open option for supplier

In terms of the success of this route, the procurement met with a mixed reaction. The client (the developer) was happy with avoiding the need for capital outlay. He initially thought that he would also secure a small income stream from this. However, the usual setup in Australia is that the occupiers of an apartment block have an “Owner’s Corporation”: it was they who took control of the finances and services. The surplus revenue went into the operating fund. The owners of the apartments are happy with only paying for what they use, as long as the rate is reasonable. The on-site operators of the building were happy with the billing (which is done remotely via the internet) but had issues about breakdowns and service, which could have been improved. On the days when hot water was unavailable, the on-site operators were precluded from attempting to repair the installation because the owners of the equipment insisted that repairs were only carried out by their own technicians.

There are several useful lessons from this scheme. First, the developer did not have a well-articulated design for the heating. Their original design was dropped as the supply contractor wanted to install its own proprietary equipment. The project manager would have kept to the original design if he could have. Second, the developer sought legal advice at every step, as there was no precedent for this kind of agreement in the region. Third, if the developer had retained ownership of the block, then the financial outcome would have been different, but his bank pressured him to sell the apartments and by doing so he had to forego the control of the finances, which then went to the Owners’ Corporation.

Siemens and the Association of Greater Manchester Authorities

In an example of procurement around the idea of demand-led innovation, Siemens entered into a contract was based around the multiple needs of the Association of Greater Manchester Authorities (AGMA). The aim was to reduce expenditure and improve performance of traffic lights. Through a competitive dialogue process, complex specifications and contracts were developed. The client had a very clear idea about what technology was to be used. The main difficulties in such a contract were in identifying the database of assets that were to be maintained and developing a very tight specification with complex pricing equations that ensured that the public sector client was only paying for the labour and materials that were being provided. While there was an indication of a requirement for the supplier to innovate, clearly the client was making the decisions about technology and methods. This is an excellent example of demand-led innovation, where the expertise of the client (or the client’s consultants) is brought to bear in identifying the means and methods for providing the service. Because it is predominantly a maintenance contract that incorporates an equipment replacement programme, the supplier had an obligation to ensure adequate performance of the equipment with minimal down-time.

Under the Reading Procurement Framework, this procurement can be described as client-funded, selection through competitive dialogue, cost-based pricing on labour and materials, client in-house design and specification, supplier-coordinated work, leaving decisions about supply-chain integration as open options for the supplier. This is summarized in Table 4.

Table 4: Definition of procurement route for Siemens/AGMA contract

Source of funding	Client-financed
Selection method	Competitive dialogue
Price basis	Labour and materials-based
Responsibility for design	Designed by client in-house team
Responsibility for management	Supplier-coordinated
Supply chain integration	Open option for supplier

One potential weakness of the Manchester contract is that savings are not shared between the parties. It is quite common in PBC and/or EPC for savings to be shared, but in this case the work is funded from the energy savings. Therefore, if the energy savings are greater than predicted, then it seems that the client will keep all of the savings. In one respect, it seems that this does not incentivize the contractor to seek more economical solutions. However, the contractor had no choice in the materials and components to be used and the contract is simply a contract to mobilize the labour and materials. Therefore, it is not expected by either party that the contractor will be seeking to change the specification in order to make greater savings.

Reasons for doing PBC

The Transportation Research Board¹ (2009) provided a list of motivations for an agency to decide to do PBC, based on results from a survey. Some of those reasons are:

- Potential to increase level of service (LOS)
- Potential to reduce agency costs
- Change in performance criteria from a focus on inputs and outputs to customer-oriented outcomes
- Pressures on the operating expenditures budget (for maintenance contracts)
- Shifting risks to or sharing risks with contractors
- Fostering more innovation by allowing the contractor the freedom to use any method to meet performance specifications rather than have to adhere to method specifications.

It could be expected that all but the last one of these would also apply to demand-led innovation.

Impediments to performing PBC

There are numerous reasons for not doing PBC. Based on the research carried out by the Transportation Research Board (2009) some of them are:

¹ Transportation Research Board (TRB) is one of six major divisions of the National Research Council - a private, non-profit institution in the USA that is the principal operating agency of the National Academies in providing services to the government, the public, and the scientific and engineering communities. Since 1962, TRB has been administering the National Cooperative Highway Research Program (NCHRP), as requested by the American Association of State Highway and Transportation. TRB's mission is to promote innovation by bringing the findings of research directly to those who are in a position to use them, in an objective and interdisciplinary setting.

- Lack of government support
- A significant change in culture required by the contracting agency and contractors not familiar with this approach
- Inadequate experience with PBMC or a negative experience on the first try
- Lack of training
- Lack of legal authority
- Challenges in estimating in-house and contractor costs
- The need to secure substantial funds through the budgetary process for large, multi-year contracts
- Inability to achieve sufficient competition
- Fear that privatization will result in large numbers of staff having to leave government
- Insufficient contractor capacity
- Potential bonding or warranty requirements, including those established by law
- Incomplete or inaccurate asset inventory and condition data

When considering demand-led innovation, many of these impediments do not apply because so much of the risk remains with the client. However, the last five key impediments in the list may apply, depending on the circumstances that prevail and the extent to which work once carried out by direct works departments is being contracted out.

Risk allocation

There are risks associated with PBC on both sides of the contract. For example, the risk regarding government ability to continue to pay led to a higher price being offered by contractors in one (unidentified) PBC projects in Brazil, to the extent that all bids were in excess of available funds (Zietlow 2005). The following is a brief list of risks that both the contractor and the client need to deal with (Transportation Research Board 2009):

Risks of PBC for the contractor:

- Unexpectedly severe weather condition
- Unanticipated environmental problems
- Unanticipated legislative changes
- Unexpected traffic growth (for road network projects)
- Poor quality of construction
- Client's liability to pay

Risks of PBC for the client:

- Contractor's failure to meet the required expectations in terms of quality
- Contractor's insolvency while the project is running

The risks for the client may be unacceptable. For example, public sector departments may have an inescapable obligation to provide public services. They cannot simply pass on the risk of non-performance. Therefore, inadequate contractor performance will remain a risk for the client, regardless of how much risk is built into pricing, unless very secure insurance-backed guarantees are put in place. However, the price of such insurances may make it more economical for the client to simply absorb performance risks and contract on labour and materials in a more traditional way.

In a survey carried out by Gruneberg *et al.* (2007) the top 50 UK construction companies, ranked by turnover, were contacted to study their attitudes towards risk management in relation to PBC. The survey was carried out as a semi-structured telephone survey. In all, 22 companies replied and the respondents occupied such roles as marketing directors, commercial directors, managing directors and risk managers.

It was expected that senior managers in big companies who were involved with PFI would understand what PBC is. However, only 5 of the respondents claimed to be aware of PBC. After explanation of the concept, respondents collectively suggested 27 risks associated with PBC. These were categorized in seven groups. Some of the most frequently-mentioned risks were:

1. Fitness For Purpose (FFP) and associated insurance issues
2. Costs rising above budget
3. Measurements
4. Briefing/specification
5. Contractual issues

The biggest concern of respondents regarding PBC was insurance as FFP is usually excluded from professional indemnity (PI) policies. Another issue is the duration over which a contractor faces the risk of a building/project being unfit for purpose. This could extend 10, 20 or even 30+ years. Maintaining the building once in use increases the risk associated with any unanticipated cost and may lead to the project being above budget. Another issue is measuring the performance of a completed building while the contractor does not have any control on the day-to-day usage of the building. Maintaining a building is a service that contractors may not have much experience with. Moreover, it has been the subcontractor in the project who would install components supplied by manufacturers, while in PBC the contractor needs tighter arrangements with suppliers to avoid additional costs imposed by the client; a case that might not always protect the contractor. In addition, PBC may require the contractor to provide a service for which they do not have the resources. Many contractors employ labour on a project-by-project basis while PBC may need a longer and therefore, a different system of employment. This may lead to some serious organizational changes that a contractor may not be ready to go for. In this way, contractors may judge the burdens to outweigh the benefits.

As for risk management and allocation, respondents provided two interesting points. Being able to manage risks associated with current projects provides contractors with some good risk management skills; skills that may need to be adapted to new strategies to deal with the risks associated with PBC. One of the strategies mentioned by the respondents is to use products that have already been proven, inspected and tested. Although this approach may seem safe, it does not encourage innovation. This is ironic, considering that one of the aims of PBC is to incentivize contractors. The second interesting point is about risk allocation: 63% of the respondents did not know who should take the risk of PBC!

Finally, in answering a question about conditions under which contractors would be prepared to use PBC, 66% felt that they would not accept a PBC contract, although under a PFI arrangement it might be acceptable. The reason for their unwillingness was given as fitness for purpose liability and their resistance to take any long-term obligations beyond the completion of the building. Despite these results, it is somewhat inevitable that, if contractors need to secure work in a shrinking market, they will have to reduce their profit margins or take on more risk.

Discussion, analysis, synthesis

One key issue that arises when comparing public sector to private sector service provision is the extent to which non-performance or down-time may be tolerated. In the private sector, while it is decidedly inconvenient to suffer from outages of utility supply, the consumer may withhold payment and develop coping strategies. In the public sector, service outages may put lives at risk and the public sector department's obligation to provide services may be seriously compromised, which is politically inexpedient, to say the least. The purpose of this section is to examine the feasibility of PBC approaches in complex, public sector procurement.

Financial feasibility

Financial arrangements define the basic idea of PBC. If there is a funding organization between the client and the contractor, even if it is a wholly-owned subsidiary of the supplier, perhaps the procurement method may not even be considered as PBC. This is the case if the supply chain is paid by the funding organization in the traditional way. Ideally, a move towards PBC should not bring an extra layer into the supply chain. Thus, the ability of supply-chain companies to forego payment for capital work in return for a revenue stream is dependent on their financial structure.

Although PBC looks to be very appealing to the client, it poses a real challenge for the supplier because it may demand a new business model. A number of challenges that suppliers/contractors need to deal with to establish a new business model are issues like dealing with cultural change, taking on responsibilities for performance where performance might be impacted by circumstances other than their own work, achieving coordination of their own suppliers/subcontractors and an extended supply chain delivering the specified outcome.

As identified by Gruneberg and Hughes (2011), PBC begins with identifying the performance that is required by the client from a constructed facility. The contractor's reward is then tied to the extent to which this performance is achieved. Building contractors negotiate directly on their ability to meet performance targets. The focus of the negotiation thus moves from a traditional supplier-led focus to a discussion of customer and user requirements. As well as a series of successful implementations in the USA, a number of modern procurement methods in the UK, e.g. Procure 21 and Prime Contracting, involve these principles to varying degrees. Moreover, some European states routinely procure buildings on a functional basis, rather than the cost of

the builders' work and materials. Different implementations of PBC result in specific business models for the supply side. For example, a lease arrangement for the provision of a service over a specified time will result in the supplier retaining ownership of the hardware or facility and receiving money only when it is successfully used. This requires the supplier to maintain and operate the facility. A second method would be to incorporate the transfer of capital assets within the deal, as in PFI projects at one extreme and as in the Siemens/AGMA contract mentioned above at the other. A third approach may require a consortium to be formed from various members of the supply chain, when no single firm has all the diverse technical competence and resources to fulfil the requirements. This adds an extra layer of complexity and, potentially, distance between buyer and supplier (Gruneberg and Hughes 2006). The involvement of third party finance frequently results in such consortia being an indispensable part of the performance-based contract, unless the head contractor has the resources to fund the work. In all cases, PBC moves from a position where the client funds the construction work in progress, to one where the client only pays out if, and when, the service is operational. The timing of income to the contractor may be earlier than this, if the deal involves contractors being financed by third parties. Thus, third party financing does not necessarily result in the contractor being placed under a PBC.

Financial security is an important criterion for contractors as well as clients. On the one hand, if a contractor carries out work for a client, with a view to being paid some time later, he/she needs to ensure that the money will be available at the agreed time. Factors like client insolvency, policy changes, budgetary restrictions and so on should be discussed in advance and the risks associated with them clarified and apportioned explicitly. In traditional contracting work, where contractors are paid monthly for work in progress, the risk of non-payment is very different from PBC-type work, where payment takes place sometime after the work is done, and is dependent on the quality of service. Contractor's insolvency and other similar problems are, on the other hand, risks that client should deal with. There are clearly already many financial instruments available that can be developed for these purposes, such as bonds, warranties and parent company guarantees (Hughes, Hillebrandt and Murdoch 1998).

Governance feasibility

There are two extremes of contracting out for the public sector client. First, is buying resources in relation to time, which is an input-based procurement such as employment or consultancy contracts. Second is buying resources in terms of performance, which is an output-based procurement such as PBC. The nature of the governance in the former is trivial compared to the latter, which requires significant investment and skill from the public sector client in specifying and monitoring performance through a higher level of contract scrutiny, as described by Levin and Tadelis (2004). There may be a need in multi-party contracts to develop very sophisticated contracts that ensure the various parties are clearly identified along with their rights and liabilities. At the level of the public sector client, concerning client approval and decision-making processes, these new forms of procurement satisfy EU procurement legislation requirements because they are simply service contracts. Therefore, they are no more or less equitable than any

other contracts for service. Where things may get more complex is in the supply chain where, ultimately, someone is providing labour and materials. How the obligation to provide the service is underpinned with monitoring and control is something that has to be carefully thought through in terms of the whole supply chain. The danger in terms of governance is that a financial intermediary simply steps in as the service provider, and then sub-contracts all of the work in the traditional way. This fails to allocate risk and reward to those technology providers who could otherwise be motivated to innovate sustainably.

Economic feasibility

For the suppliers, the arguments for a move from product installation to service provision seem very persuasive, as summarized by Olivia and Kallenberg (2003): substantial revenues are available from an installed basis of components or products with a long life cycle; services generally produce a higher profit margin than products; and they provide a more stable stream of revenue compared to the highly variable demand for capital items. Given that there are such advantages, the relative scarcity of such moves means that there are major hurdles to overcome for firms wishing to make the transition from providers of equipment to providers of services. As Olivia and Kallenberg comment:

Transitioning from product manufacturer into service provider constitutes a major managerial challenge. Services require organizational principles, structures and processes new to the product manufacturer. Not only are new capabilities, metrics and incentives needed, but also the emphasis of the business model changes from transaction- to relationship-based. Developing this new set of capabilities will necessarily divert financial and managerial resources from manufacturing and new product development, the traditional sources of competitive advantage for the organization (p. 161).

One of the most important reasons that may make PBC attractive to clients is the opportunity to encourage innovation or, more importantly, the prospect of rewarding innovators in return for the risks they take. It is interesting to study the extent to which payment for performance incentivizes different behaviours from the supply chain as well as its 2nd and 3rd tier suppliers. Although this question is too complex to cover in detail here, there are clearly important issues in figuring out where in the supply chain the transition ceases. At some point, a sub-contractor will be purchasing only products or raw materials with no service element being passed on. For now, it remains an open question as to whether this is significant.

Strategic feasibility

Clearly, a move to a wholly different procurement regime will require strategic change in client and supply-chain organizations who take part. Corporate change is required in order for this to work. A key issue of strategic feasibility is the extent to which in-house functions are effectively contracted out, leading to shrinkage of the public sector department that is doing the procuring. Moving to a service-based contract in order to empower the supply chain to innovate would typically mean handing over decisions

about specification of materials and components to the supply chain. This may cause strategic reorganization of procuring departments, as their design responsibilities shrink, along with their supervision responsibilities which become supervision of service delivery, rather than supervision of construction. On the other hand, moving to a demand-led innovation model, such as the Siemens/AGMA contract, requires sophisticated in-house design teams with a profound understanding of the service that their organization is providing to its clients. Typically, this would be a valid option for a client whose task is more complex and/or risky than would be acceptable for the supply chain.

Contractual feasibility

There are no recognized and familiar forms of contract available for this kind of transaction. Bonds, insurance-backed guarantees and warranties of diverse kinds will be needed to underpin the rights and liabilities associated with PBC.

As payment is directly linked to performance, especially in supplier-led approaches, specifying output requirements and incorporating them into contracts are some of the most important challenges in this type of procurement. There is a need to investigate the effects of PBC-type contracts on the arrangements with the downstream sub-contractors and suppliers. However, in the case of demand-led innovation, the risks, and therefore the liabilities associated with design, lie with the client. Thus, the supply contracts in demand-led innovation may be similar to the more familiar contracts for supply of labour and/or components.

Another issue is the realistic and desirable duration of the agreement in the client's as well as contractor's perception. PFI/PPP contracts last for 20 to 30 years and some PBC agreements also last for 15 to 20 years. However, whether this long duration is appropriate for all types of project is questionable. It is clear from the UK experience of PFI, and the secondary market for operational PFI projects, that there are sufficient returns to be made in a much shorter timescale. It is also clear from the lessons of PFI that development risk should be clearly distinguished from operational risk.

Cash flow models

In considering the various mechanisms for procuring construction and engineering work, the business case for supplier and customer is crucial. The following graphs are intended to provide abstract models of cash flows to help develop a better understanding of why specific routes may or may not be appropriate.

Figure 1 shows the contractor's cash flow in general contracting, a widely used method for procuring engineering and construction infrastructure. In this method, the contractor provides a tender based on designs and specifications provided by the client. (All too often, such designs are incomplete for all sorts of reasons, and this can be very problematic.) The contractor's obligation is to provide labour and materials as specified, and assemble them. The obligation for performance of the completed facility lies with the design team, not with the contractor. Contractors are paid monthly for work in

progress, usually within two weeks of a certificate being issued. The shape of the income line in Figure 1 represents the cumulative income earned by the contractor. Contractors sub-contract a large proportion of the work, if not all of it, and their suppliers may be paid on invoices on 60 or 90 day terms. This means that the contractor's expenditure (shown by the dotted line) occurs after they receive income. In this way, the contractor can maintain a positive cash balance throughout the project, and this is often used by the contractor as working capital to run their business.

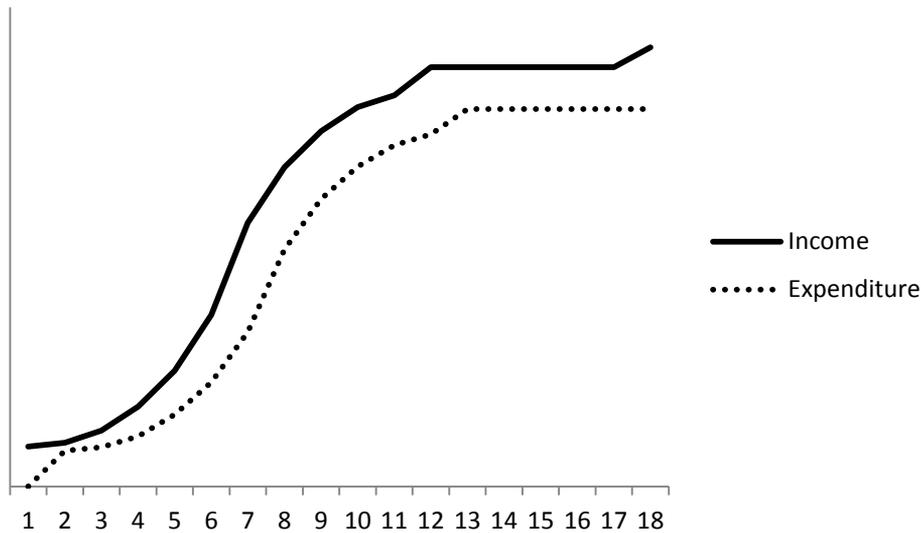


Figure 1: Contractor's cash flow in general contracting

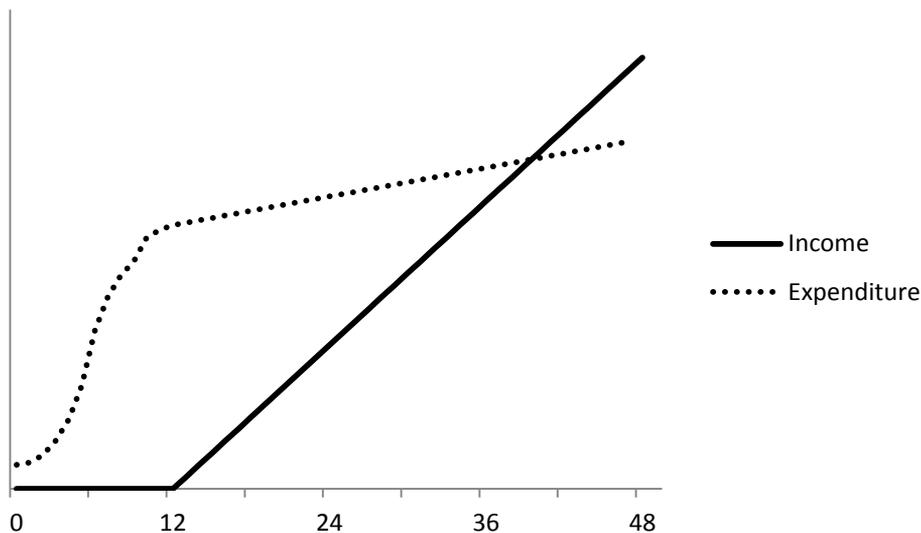


Figure 2: Client's cash flow in general contracting

Due to the high levels of sub-contracting, there is little need for such a contractor to maintain premises or plant. Thus, this positive cash flow, combined with their bank overdraft, may be the sole source of their working capital. In this model, their incentive is to provide the labour and materials as cheaply as possible and pay their suppliers as late as possible, which many people characterize as the reasons for adversarial relations in the construction sector as well as a lack of innovation. Contractors are not in a

position to invest in R&D if this is how their businesses are funded. Because clients are paying contractors for work in progress, they are generally paying for the building before it is completed and, therefore, before it generates revenue. Figure 2 shows a private sector client's cash flow in a general contracting construction project, but over a more extended period than Figure 1. The Client's expenditure (dotted line) is exactly the same as the contractor's income in Figure 1, but continues to accumulate after the completion of the building because of maintenance and operation costs. The most marked thing about this graph is that the client's income (or other benefit) does not commence until completion of the building and therefore there is a need for major funding from the client. Partly, it is this need to fund the development that has caused public sector clients to seek other solutions to the problem of procuring expensive infrastructure from dwindling capital budgets.

In thinking about the public sector client, expenditure on construction will typically come from a capital budget and expenditure on maintenance/operation from a revenue budget. Since it is extremely difficult to move money from capital to revenue budgets, different procurement models are of great interest because of the different mix of capital and revenue.

In PBC, the contractor/supplier is expected to finance the development of the project until the facility begins to generate revenue. Clearly, there are many ways of organizing payment. Figure 3 illustrates a pattern that might be observed if the client partially pays for the facility on completion, with the contractor receiving part of the payment for the capital element of the contract on handover, and then a revenue stream for maintenance and the remainder of the capital outlay. The interesting thing about Figure 3 is the extent to which a proportion of the capital requirement might be transferred into a 4-7 year operational maintenance contract. This would incentivize the contractor to perform in the construction period, because otherwise there may be losses in the maintenance period. It also shows that the service element of such a contract can be much shorter than the 15-25 year periods often used in the past for such arrangements.

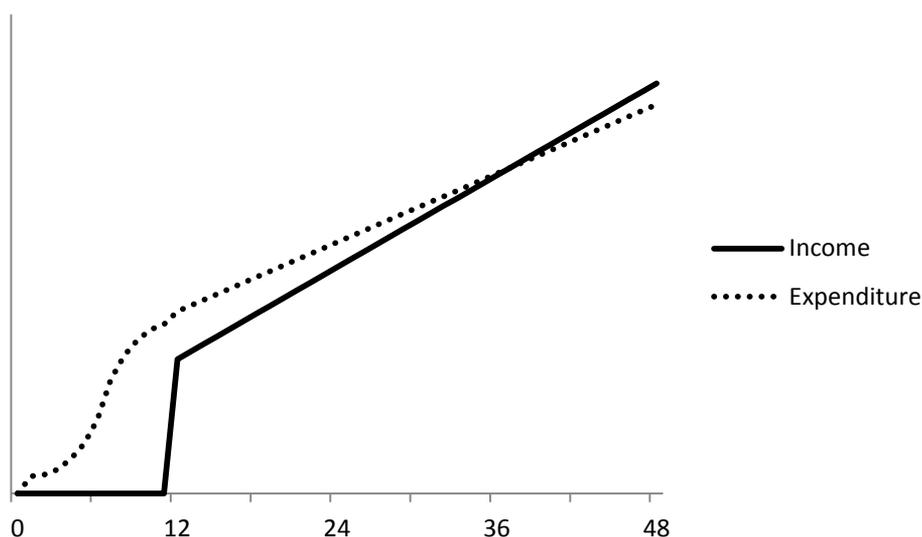


Figure 3: Contractor's cash flow in performance-based contracting

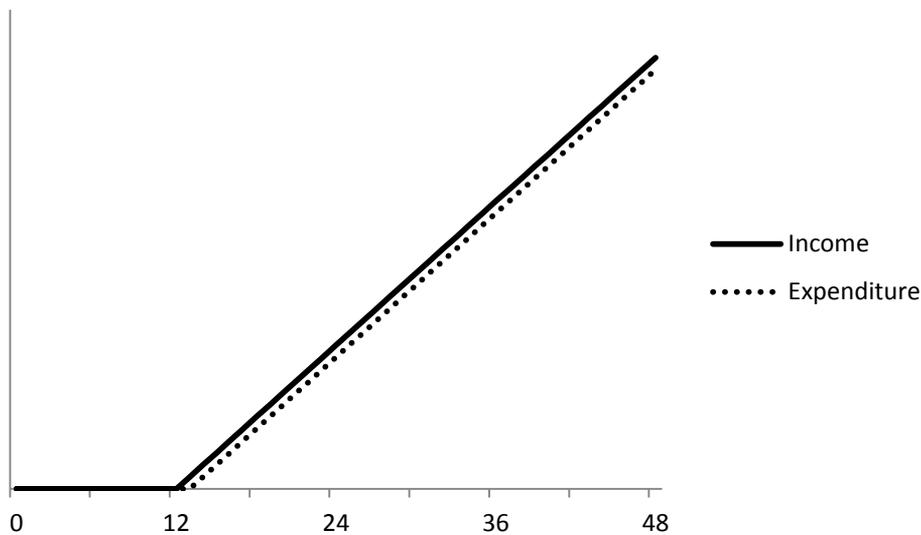


Figure 4: Client's cash flow in PBC

Figure 4 illustrates a stylized example of what many public sector clients may consider to be an ideal solution. In this example, the client pays nothing until the facility is ready for use, and then only pays for it when it is being used successfully (like the power-by-the-hour model of Rolls-Royce). Essentially, there is no reason why this should not be used in construction and engineering. The public sector client may find this enticing. Annual budgets are allocated by government or municipalities and departments have to plan for a mix of long-term capital expenditure and revenue. The appeal of PBC is that it avoids the need for capital planning and enables a situation where the level of services provided to the public are in direct proportion to the in-year budget, which may lead to a model more like that shown in Figure 5.

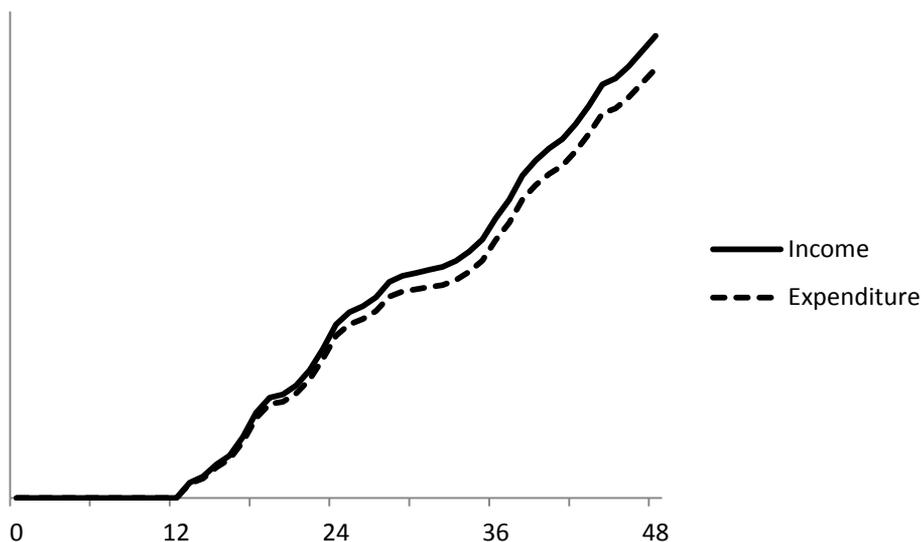


Figure 5: Client's cash flow in variable PBC

These cash flow graphs help to illustrate the principles of various contract structures. Clearly, each incentivizes the supply chain in a different way. Moreover, it may be

helpful to develop more specific graphs for each new project as part of the decision-making related to a particular procurement.

Conclusions

This report has considered emerging options for procuring infrastructure and buildings in novel ways that may encourage innovative and sustainable solutions.

Clients must decide whether the expertise for innovation lies on the demand side or the supply side. If too much reliance is placed on public sector clients who may lack the in-house expertise to create innovative demand, this may result in excessive expenditure on consultants, as well as an ineffective risk transfer.

Main contractors may lack the capital base on which to fund performance-based contracts. If external funding is to be used, it should be used in such a way as to ensure that contractual incentives and payment mechanisms do not follow traditional routes.

The transition from product installation to service provision provides huge challenges in terms of organizational change for both the supply side and the demand side.

Clarity of funding is essential. Where a contract for services includes the commissioning of new buildings or infrastructure, the duration of the service element need not be as long as has been the case in the past.

The question about whether performance requirements should be structured around the required level of service, or the definition of the work (output specification or input specification) relates to risk. Where a public sector department has an inescapable obligation to provide a public service, it is difficult to justify attempts at transferring this to the private sector, unless there are extremely robust insurance-backed guarantees in place to ensure continuity of service. Contractual remedies may be inadequate in the event of insolvency.

In deciding on the duration of service contracts that require capital investment on the part of the supplier, clients should seek to keep the duration to a period that matches the amortization of the suppliers' financing requirements.

When contemplating PBC-type arrangements, cash flow on the demand side and the supply side should form part of the information for decision-making.

It would be worthwhile for the demand side to investigate the nature of the bonds, guarantees and warranties that may be required from both sides to provide the financial underpinning that make these arrangements plausible. There may be a need for more standardization of these financial instruments.

Care is needed to ensure that a move towards PBC does not simply result in the insertion of an extra layer into the supply chain, because of the funding. It seems important that the demand side thinks carefully about how payment for performance incentivizes different behaviours from the supply chain. One important issue is the extent to which it influences 2nd and 3rd tier suppliers in the supply chain, or indeed whether such influence is necessary.

Demand-led innovation and supplier-led innovation involve significant risks on both sides of the transaction. Such procurements should not be seen as a panacea, but as innovative developments to procurement that need to be considered very carefully across a range of aspects.

Acknowledgements

We are very grateful to the following people who helped with advice and information during the compilation of this report. The responsibility for any errors of fact or judgement remains with the authors.

Ian Steenson (Siemens) for information on the AGMA contract.

Arnaud Clemens (Construction Director of Région Alsace) for the information on the Alsace Case Study.

Carole Boudeau (HaCIRIC researcher) for help in translation of the Alsace case study documents.

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Background documents and further reading

Brady, T., Davies, A. and Gann, D. (2005) Can integrated solutions business models work in construction? *Building Research & Information*, **33**(6), 571–579.

<http://dx.doi.org/10.1080/09613210500285064>

It has recently been suggested that the future of the construction industry lies in adopting a new business model based on the concept of integrated solutions. Integrated solutions are combinations of products and services that address a customer's unique requirements throughout the life cycle, from development and design to systems integration, operations and decommissioning. Research on integrated solutions in other capital goods sectors has shown suppliers have had to create new business models, including developing new approaches to adding value, and building up new capabilities especially in systems integration. The paper presents some preliminary empirical findings about construction industry perceptions of value, systems integration and integrated solutions that suggest the concept of built environment solutions provision is still at an early stage in its development and that the best opportunity for its introduction is in the context of private finance initiatives in the public sector or large clients who require repeatable

British Standards Institution (2011) *BS 8543:2011 Construction procurement policies, strategies and procedures: Code of practice*, pp. 60. London: British Standards Institution.

BS 8534:2011 gives recommendations and guidance on the development within a public or private sector organization of policies, strategies and procedures for the procurement of construction in the built environment. Contents for BS 8534:2011 includes: Scope, Normative references, Terms and definitions, Policy, Initiation, Procurement strategy, Procurement tactics, Managing performance and delivery, Information about this document.

In May 2006 a strategic workshop was held to establish what drives value in the construction industry. It and a subsequent series of specialist workshops were sponsored by the then Department of Trade and Industry and its successor, the Department for Innovation, Universities and Skills, under the heading “Rethinking Standards in Construction” and organized by BSI and Constructing Excellence in the Built Environment. The main conclusion was that there was definite potential for a new standard on procurement, provided it used the Office of Government Commerce process as a baseline.

British Standards Institution (2010) *BS ISO 10845-1:2010, Construction procurement, Part 1: Processes, methods and procedures*. London: British Standards Institution.

The objective of the ISO 10845 series is to provide a generic and standard set of processes, procedures and methods for a procurement system that is fair, equitable, transparent, competitive and cost effective. The standards apply to public or private sector client organizations in the development of their procurement systems and their principles are intended to apply down the supply chain. The main objective is the creation of a framework for the development of procurement systems that facilitate fair competition, reduce the possibilities of abuse, improve predictability of outcome and allow the demonstration of best value. In particular, ISO 10845: Establishes basic requirements for the conduct of an organization's procurement, including integrity and the avoidance of conflicts of interest; Creates a framework for the development of an organization's procurement policy; Describes generic methods and procedures for procurement, including a detailed consideration of the

alternatives available, including negotiation, competitive selection, competitive negotiation and electronic auction.

In procurement systems such as those used by the World Bank, the United Nations Commission on International Trade Law (UNCITRAL) and the European Union, each category of procurement is dealt with separately with the provision of its own implementation guidelines or regulations. ISO took the view that this compartmentalized approach caused confusion and made procurement unnecessarily complex. Therefore, ISO 10845 (all parts) introduced an alternative approach of first developing a generic procurement system and then identifying the methods and procedures best suited to particular categories.

Bröchner, J., Ang, G.K.I. and Fredriksson, G. (1999) Sustainability and the performance concept: encouraging innovative environmental technology in construction. *Building Research & Information*, **27**(6), 367–378.

Encouragement of innovation is a major reason for using the performance concept in construction regulations and specifications, mostly in the context of design-build contracts. Performance criteria aiming at sustainability emphasize long-term behaviour of built facilities, which complicates the measurement of compliance. Strategies for identifying areas with strong promises of innovative technologies should be developed, so as to concentrate the efforts in developing performance requirements. The development of standardized consensus methods and procedures should be accelerated. Finally, it is suggested that good examples of how performance requirements can be expressed and monitored should be made globally available.

Cohen, M.A., Agrawal, N. and Agrawal, V. (2006) Winning in the aftermarket. *Harvard Business Review*, **84**(5), 129–138.

Ever since businesses started offering solutions instead of products, they have acknowledged that selling spare parts and after-sales services could be a lucrative source of profits. So why do so many companies still treat aftermarket services as an afterthought? One reason is that after-sales support is so hard to manage. Original equipment manufacturers (OEMs) often subject their customers to unnecessary delays when problems arise, and many OEMs outsource customer service. As a result, customers are dissatisfied with the level of service they receive, and companies don't benefit from the aftermarket's potential. Only businesses that provide services efficiently can truly benefit. Focusing on after-sales services can pay off in a number of ways. For example, it's cheaper for businesses to increase sales of parts and service-related products than to find new customers. And when companies provide aftermarket support, they gain unique insight into their customers' businesses that's difficult for rivals to acquire. The authors, who have studied after-sales service networks for more than 20 years, have developed a six-step approach to help companies improve after-sales service quality levels, reduce investments in service assets, and cut operating costs. To be successful, firms must identify the products they want to support, design a portfolio of service products, use multiple business models, determine after-sales organizational structures, create an after-sales supply chain, and monitor performance. Companies that ignore these steps, say the authors, are doomed to mediocrity.

Faith, J., Panzarella, C., Spencer, R. C., Williams, C., Brewer, J. and Covone, M. (2010) Use of performance-based contracting to improve effective use of resources for publicly funded residential services. *The Journal of Behavioral Health Services Research*, 37(3), 400–408. <http://www.ncbi.nlm.nih.gov/pubmed/18654859>

This article details the process that was undertaken to convert the financing mechanism for publicly funded mental health residential programs in a large urban setting from non-incentivized agreements to performance-based contracts. The initial target for change was improving occupancy rates for residential services targeted to persons with serious and persistent mental illness. Improving occupancy rates enhanced efficiency such that 25 additional cents for every dollar spent on mental health residential services went to direct care. Challenges met in the process of effecting the contracting conversion of this expansive system are addressed. The importance of centralized gatekeeping, stakeholder involvement, and setting modest expectations are emphasized as keys to success. Although the system still has less capacity than client demand warrants, existing beds are no longer underutilized. Recent efforts to expand contracting targets beyond efficiency goals to include improved quality and effectiveness are also discussed.

Gruneberg, S.L. and Hughes, W.P. (2011) A review of performance-based contracting. *RICS Research Papers*. London: Royal institution of Chartered Surveyors.

Performance-based contracting (PBC) is a method of contracting, which is based on the post-construction performance of a building or structure rather than the cost of materials and labour that produced it. Payments by the client are therefore spread throughout the contract period (beginning on completion) and not as interim payments during construction. PBC represents a simplification of the Private Finance Initiative as it separates the physical structure from the financial structures. This separation means that negotiations between clients and contractors are less time consuming, expensive and complex. Because the contract is not directly concerned with the details of the building, less paperwork and monitoring of the construction work may be required compared to traditional contracting and procurement methods. A number of conclusions are drawn from our research and findings. These include:

- performance-based contracts often involve engaging a consortium of firms
 - the roles and relationships within consortia are structured around risk. The members of consortia share commercial and reputational risks but otherwise adopt traditional roles within consortia-type arrangements
 - the main source of risk and conflict is the reliance on other members of a consortium to deliver
 - long term borrowing in construction tends to be lower than the automotive manufacturing and repairs sector, implying relatively less fixed capital investment and longer term commitments. This is reinforced by the ratio of fixed assets to capital employed and fixed assets as a percentage of turnover
 - there are many firms in the construction industry whose ratios may well equip them to take on PBC contracts
 - the perceived risks of PBC deter most contractors from considering PBC as an option. However, in a survey, carried out as part of this research, 5% of respondents agreed that PBC might be used for minor projects only, where the project represented only a small percentage of total output of the firm and was therefore not a threat to its survival
 - PBC represents a service innovation if viewed as an extension of the provision of a product. Alternatively it may be viewed as the introduction of a new service.
- To provide some context and a relative perspective, we compared the construction sector to a manufacturing sector. What this revealed was that:

- firms in the construction industry tend to have relatively lower capital to output ratios than firms in the automotive industry. This implies that firms in construction have little spare financial capacity for working capital, long term commitments and contingencies. This is reinforced by the net current assets to turnover ratio
- the argument frequently given that firms in construction experience relatively low profit margins is not supported by the comparison with the automotive industry.

Guajardo, J.A., Cohen, M.A., Kim, S.-H. and Netessine, S. (2012) Impact of performance-based contracting on product reliability: an empirical analysis. *Management Science*, **58**(5), 961–979. <http://dx.doi.org/10.1287/mnsc.1110.1465>

Using a proprietary data set provided by a major manufacturer of aircraft engines, we empirically investigate how product reliability is impacted by the use of two different types of after-sales maintenance support contracts: time and material contracts (T&MC) and performance-based contracts (PBC). We offer a number of competing arguments based on the theory of incentives that establish why product reliability may increase or decrease under PBC. We build a two-stage econometric model that explicitly accounts for the endogeneity of contract choices, and find evidence of a positive and significant effect of PBC on product reliability. The estimation of our model indicates that product reliability is higher by 25%–40% under PBC compared to under T&MC, once the endogeneity of contract choice is taken into account. Our results are consistent with two mechanisms for reliability improvement under PBC: more frequent scheduled maintenance and better care performed in each maintenance event.

Hillig, J-B. and Hughes, W.P. (2008) Ownership rights in performance-based contracting: a case study of English law. In: Brown, S. (ed.) *Procs 2008 COBRA Conference*, Dublin, Ireland, September 4-5.

Clients and contractors need to be aware of the project's legal environment because the viability of a procurement strategy can be vitiated by legal rules. This is particularly true regarding Performance-Based Contracting (PBC) whose viability may be threatened by rules of property law: while the PBC concept does not require that the contractor transfers the ownership in the building materials used to the client, the rules of property law often lead to an automatic transfer of ownership. But does the legal environment really render PBC unfeasible? In particular, is PBC unfeasible because contractors lose their materials as assets? These questions need to be answered with respect to the applicable property law. As a case study, English property law has been chosen. Under English law, the rule which governs the automatic transfer of ownership is called *quicquid plantatur solo, solo credit* (whatever is fixed to the soil belongs to the soil). An analysis of this rule reveals that not all materials which are affixed to land become part of the land. This fate only occurs in relation to materials which have been affixed with the intention of permanently improving the land. Five fictitious PBC cases have been considered in terms of the legal status of the materials involved, and several subsequent legal questions have been addressed. The results suggest that English law does actually threaten the feasibility of PBC in some cases. However, it is also shown that the law provides means to circumvent the unwanted results which flow from the rules of property law. In particular, contractors who are interested in keeping their materials as assets can insist on agreeing a property right in the client's land, i.e. a contractor's lien. Therefore, the outcome is that English property law does not render the implementation of the PBC concept unfeasible. At a broader level, the results contribute to the theoretical framework of PBC as an increasingly used procurement strategy.

Hughes, W.P., Hillebrandt, P., Greenwood, D.G. and Kwawu, W.E.K. (2006) *Procurement in the construction industry: the impact and cost of alternative market and supply processes*. London: Taylor & Francis.

The UK construction industry has recently witnessed a move to innovative working practices that involve greater collaboration and partnership than has been the case in the past. While the benefits of such collaborative ways of working are widely discussed, little is known about their relative cost. Indeed, there is scant evidence of the procurement costs of even the more traditional, competitive practices. The purpose of this major piece of research was to examine whether different procurement approaches are associated with differences in procurement costs.

In seeking answers to this question, we examined the most significant procurement methods, both traditional and innovative, to identify, and where possible, quantify the commercial costs that are involved in each. The costs arise under four headings: marketing, agreeing terms, monitoring of work, and resolving disputes. Recent literature reveals that expectations vary about the impact of procurement method on procurement costs, but such expectations are largely untested. Most researchers agree that competition in construction procurement is organized wastefully, but estimates of the cost of tendering alone have varied from 0.5 to as much as 15% of construction prices. Commentators tend to suggest that the use of collaborative working would reduce tendering costs, although there has been little to substantiate this, so far. It was against this background that the research project was set up to identify and describe the procurement practices in use, and to explore, identify and measure their cost. The research benefited from the generous participation of a very active research steering group in which industry practitioners were strongly represented. Consequently, some guidance was expected on the most advantageous approaches to be adopted in the future, with particular interest being shown in the relative procurement costs of collaborative working.

For the purposes of this report collaborative working is defined as an approach to procurement where:

- competitive bidding is not the only criterion upon which contractors, consultants and suppliers are selected;
- some reliance is placed on the deliberate development of long-term working relationships;
- there is a limited number of interdependent participants or 'partners'.

The nature of the research has necessitated the adoption of a radical, but far more rigorous approach to the classification of procurement methods than is customary. In practice, these have usually been defined in very general terms, and a rather casual and arbitrary basis has been used to distinguish one from the other. In fact, in order to account comprehensively for the differences between procurement methods, six variables should be defined for each project. These are: the source of funding, contractor selection method, price basis, responsibility for design, responsibility for management, and extent of sub-contracting. The uncomfortable fact then emerges that, assuming at least five options under each one of the variables, there are thousands of permutations.

A wide range of research methods was applied. A comprehensive literature search was undertaken; three questionnaires relating directly to costs were administered, though only two were found to be practicable; extensive interviews were conducted with participants from all stages of the procurement process; group discussions were held with selected experienced contractors, specialists, consultants and clients; and participants at several international conferences were presented with and debated the research as it progressed. The strategy for the gathering of data was ambitious, but has resulted in the most comprehensive and exhaustive study on this topic to date.

Discussion interviews showed that companies throughout the construction supply chain are seriously engaging with collaborative working practices. There are, however, many barriers to their widespread implementation. Partnering is good for getting contractors involved at an early stage but involves serious commitment and costly negotiations to set it up. Moreover, frameworks and partnerships do not guarantee that work will actually flow from partnered clients, and the flow can be turned off at any point. This kind of risk means that few contractors and suppliers can afford to have too high a proportion of their turnover in partnering arrangements.

Some negative aspects of collaboration have been given very little attention. The development of collaborative working practices in which a limited number of contractors are required to communicate their growing body of experience and expertise to each other needs careful management to avoid the development of collusive practices. While large continuing clients have a lot of power over the markets in which they procure, there are dangers of distorting the market by enabling limited numbers of suppliers and contractors to develop monopolistic positions, if the experience of particular types of project cannot be accumulated by anyone else.

One of the major conclusions of the research, based on a survey of bidding costs, is that there is no evidence that simply the presence or absence of collaboration affects tendering costs. There is tremendous variation in tendering costs according to the extent of the work involved (for example whether it includes or excludes design), according to the participant in the process, or according to the success ratio of bids. A main contractor typically spends about 2½% of its turnover in selling its services, specialist and trade contractors about double that, and suppliers of bespoke components nearly 9% of turnover. These figures, because they are related to turnover, take into account the costs of tendering for work not obtained.

Hughes, W.P., Yohannes, I. and Hillig, J.B. (2007) Incentives in construction contracts: should we pay for performance? In: Haupt, T. and Milford, R. (Eds) *Procs of CIB World Building Congress: Construction for development*. Cape Town, South Africa, 14-17 May 2007, Cape Town: Document Transformation Technologies.

Incentives and disincentives are common contractual tools to influence the behaviour of contracting parties. The type of incentivization differs according to the objectives involved. A contract may involve general objectives, for example, the enhancement of the client-contractor relationship, the establishment of long term relationships, or the use of certain business models. Other more tangible objectives concern the issues of cost, performance, and time/completion on schedule. In regard to the latter types of incentive, a range of different types of incentive may be used, e.g. monetary incentives such as fixed-price contracts, cost-plus-incentive fees, cost-plus-award-fees, share-in-savings incentives, and non-monetary incentives such as automatic extension of contract term, more frequent payments, letters of appreciation etc. There is little information available about how they are used and whether they are effective. Questions to be answered in this connection concern the scalability of performance, the choice of the appropriate kind of incentive, the frequency of their use, the percolation of incentives through supply chains and methods of incentive management.

Larbi, G. (2001) Performance contracting in practice: experience and lessons from the water sector in Ghana. *Public Management Review*, 3(3), 305-324.

<http://journalonline.tandf.co.uk/link.asp?id=q0lqg47a950x6t13>

This article provides some insights into how performance contracting works in practice in a developing country context, using the case of the Ghana Water and

Sewerage Corporation (GWSC). Performance contracting has been a useful instrument for restructuring the state-owned enterprises (SOE) sector in Ghana, and the GWSC has made some moderate improvements since its introduction. However, the article highlights some of the institutional constraints and capacity issues that reformers will have to pay attention to, including overstretched capacity of the monitoring agency, a weak information management system and inconsistent compliance to contract by government. The findings also highlight the difficulty of separating politics from operational/management issues, especially in politically sensitive public services, yet performance contracting relies on such separation to be effective. Also it shows how informal behaviour undermines the formality of performance contracting.

Levin, J. and Tadelis, S. (2004). Employment versus contracting in procurement: theory and evidence from US Cities. Department of Economics, Stanford University.

<http://www.nber.org/~confer/2004/oeff04/tadelis.pdf>

Local governments can choose to provide services with internally employed labour or through contracts with external providers. We develop a general procurement model that highlights the trade-off between productive efficiency and the costs of administering performance contracts. We construct a dataset of service provision choices by U.S. cities and document the relationship between service characteristics and contracting choices. Our analysis suggests that economic efficiency concerns, as well as politics, matter for contracting decisions. We discuss implications of our approach for the theory of the firm.

Ng, I.C.L., Williams, J. and Neely, A. (2009) *Outcome-based contracting: changing the boundaries of B2B customer relationships: an executive briefing*. Advanced Institute of Management,

London. <http://bit.ly/UhjkqN>

Outcome-based contracts (OBC) work effectively by only delivering specified outcomes then and only then does the customer pay. Rather than paying for activities and tasks the customer can benefit by knowing the outcome they require without the ins and outs of the process. This report reveals how the OBC can benefit organisations by lowering costs, increasing motivation and the opportunity for greater control, innovation and efficiency.

Sexton, M. and Barrett, P. (2005) Performance-based building and innovation: Balancing client and industry needs. *Building Research & Information*, 33(2), 142-148.

<http://www.ingentaconnect.com/content/routledg/rbri/2005/00000033/00000002/art00005>

One reason for the interest in performance-based building is that it is commonly advocated as a powerful way of enhancing innovation performance by articulating building performance outcomes, and by offering relevant procurement actors the discretion to innovate to meet these performance requirements more effectively and/or efficiently. The paper argues that the current approach to performance-based building assumes that relevant actors have the capacity, ability and motivation to innovate from a business perspective. It is proposed that the prevailing conceptualization of PBB is too restrictive and should be broadened explicitly to accommodate the required business logic that must be in place before actors will innovate. The relevant performance-based building and innovation literature is synthesized to support the assertion. The paper concludes with an innovation-focused definition of performance-based building.

Shang, T., Luo, Y., Liu, P. and Gao, J. (2011) Financing models of energy performance contracting projects. *IEEE EnergyTech* 1-5.

<http://dx.doi.org/10.1109/EnergyTech.2011.5948525>

Financing problem has always been the key factor of restricting the development of energy performance contracting projects in China. With the advent of the worldwide low-carbon economic age, the trading system and market of carbon emission reduction have become mature gradually. The emission quotas have become intangible goods with economic value. Most energy performance contracting projects can reach the desired effect of carbon emission reduction. According to the effect of EPC projects, using the saving emission quotas, we develop a new financing model of energy performance contracting based on existing shared saving financing models, and give corresponding limited conditions and application suggestions. Although this model needs further improvement and market testing, it broadens the financing channels and provides a new idea to solve the financing problems of energy performance contracting.

Ssengooba, F., McPake, B. and Palmer, N. (2012) Why performance-based contracting failed in Uganda: An “open box” evaluation of a complex health system intervention.

Social Science & Medicine, **75**(2), 377-83. <http://eresearch.qmu.ac.uk/2747/>

Performance-based contracting (PBC) is a tool that links rewards to attainment of measurable performance targets. Significant problems remain in the methods used to evaluate this tool. The primary focus of evaluations on the effects of PBC (black-box) and less attention to how these effects arise (open-box) generates suboptimal policy learning. A black-box impact evaluation of PBC pilot by the Development Research Group of the World Bank (DRG) and the Ministry of Health (MOH) concluded that PBC was ineffective. This paper reports a theory-based case study intended to clarify how and why PBC failed to achieve its objectives. To explain the observed PBC implementation and responses of participants, this case study employed two related theories i.e. complex adaptive system and expectancy theory respectively. A prospective study trailed the implementation of PBC (2003-2006) while collecting experiences of participants at district and hospital levels. Significant problems were encountered in the implementation of PBC that reflected its inadequate design. As problems were encountered, hasty adaptations resulted in a de facto intervention distinct from the one implied at the design stage. For example, inadequate time was allowed for the selection of service targets by the health centres yet they got 'locked-in' to these poor choices. The learning curve and workload among performance auditors weakened the validity of audit results. Above all, financial shortfalls led to delays, short-cuts and uncertainty about the size and payment of bonuses. The lesson for those intending to implement similar interventions is that PBC should not be attempted 'on the cheap'. It requires a plan to boost local institutional and technical capacities of implementers. It also requires careful consideration of the responses of multiple actors - both insiders and outsiders to the intended change process. Given the costs and complexity of PBC implementation, strengthening conventional approaches that are better attuned to low income contexts (financing resource inputs and systems management) remains a viable policy option towards improving health service delivery. © 2012 Elsevier Ltd. All rights reserved.

Steinberger, J., Vanniel, J. and Bourg, D. (2009) Profiting from negawatts: Reducing absolute consumption and emissions through a performance-based energy economy. *Energy Policy*, 37(1), 361–370. <http://dx.doi.org/10.1016/j.enpol.2008.08.030>

Current energy and GHG emissions policies either focus directly on emissions or promote renewable production and the implementation of specific efficiency measures. Meanwhile, the fundamental structure of the energy market based on profits through energy throughput remains largely unchallenged. This policy oversight prevents the transition to an energy economy in which profits are based on energy services delivered at the lowest energy cost: a performance-based energy economy (PBEE). The PBEE applies the combined concepts of the performance economy and energy services to the energy sector. Energy Service Companies (ESCOs) are discussed as an example of PBEE practices. The implications for energy suppliers and consumers as well as the conditions for PBEE diffusion and consequences for technological change are also explored. The expected environmental, social and economic benefits are described. However, absolute consumption and emissions reductions may prove elusive due to the rebound effect. In order to forestall rebounded increases, complementary policy measures likely to lead to absolute reductions are required.

Stenbeck, T. (2006) Part 1: Outsourcing and Quality Assurance: Effects of Outsourcing and Performance-Based Contracting on Innovations. *Transportation Research Record*, 1948(-1), 3–8. <http://dx.doi.org/10.3141/1948-01>

A savings of 13% to 28% was recorded as outsourcing and performance-based contracting were introduced in Swedish highway maintenance, in line with 21% gained in Massachusetts and 12% in Virginia. Few negative effects on service, environment, and quality were noted. However, there is concern that a slowdown of research and development (R&D) and innovations may lead to higher costs and a less effective transport system in the long run. France has used a benchmark for the effects on technical development, with an in-house policy similar to Sweden's before the reform. Initial results of an explorative study are that France has continued to produce technical development in the same period while it seems to have stalled in Sweden. This international comparison tends to support that outsourcing has lowered the pace of R&D compared with a situation if the in-house production system prevailed. However, innovation frequency is not a goal itself, so further study is needed to find the optimal mix of measures to develop an effective transport system. Professionals and politicians representing the Swedish taxpayers are reluctant to return to in-house production just to produce perhaps unnecessary technical development. Instead, the policy to develop complementary innovation promotion within the outsourcing model will continue. Measures within or complementary to the model are multi-criteria bid evaluation, alternative bids, on-line monitoring, bonus, penalties and profit sharing, competence development, partnering, and weather-regulated performance-based contracting. Such measures are used and evaluated continuously.

Sturgess, G.L. and Cumming, L.M. (2011) *Payment by outcome: a commissioner's toolkit*. 2020 Public Services Trust at the RSA, London.

http://clients.squareeye.net/uploads/2020/documents/payment_outcome.pdf

Executive summary: Payment-by-outcome is a form of performance management where providers are paid on the basis of outcomes rather than effort. It combines a high-stake form of performance contracting that has come to be known as payment-by-results, with intense focus on the primary outcomes for which government programmes have been introduced.

Payment by Outcome is a toolbox. It explores the challenges involved in using this complex form of performance contracting. It seeks to understand the tools that have been employed in the past to cope with these challenges. And it imagines ways in which these instruments might be used differently in the future. It does this by examining the use of payment-by-outcome in welfare to work, offender management and long-term condition management, and drawing on additional insights from several other areas, including pharmaceutical pricing and foster care.

In the public sector, programme objectives are often ambiguous, with primary outcomes surrounded by a variety of contextual goals. Having established the need for early resolution of these ambiguities, Payment by Outcome turns to the tools that lie at the heart of this particular form of performance contracting, measures, standards and incentives, arguing that in the design and application of these instruments, commissioners must give full regard to the human dimensions of performance regimes.

Successful performance contracting draws on a wide range of non-financial incentives, so that in designing a system based on payment-by-outcome, commissioners can adjust both the diversity as well as the intensity of incentives. They can also adjust the definition of the service population and the duration of contracts to further improve the alignment of the providers' and commissioners' interests.

However, commissioners also have more strategic instruments at their disposal, enabling them to adjust the design of the system within which contracts are made. The most complex payment-by-outcome systems currently in operation – those assisting the long-term unemployed into work – have been under development for more than 60 years. While there are obvious benefits to be gained from studying past experience, policymakers must also be patient, recognising that any move to high-stake performance incentives and outcome specification will inevitably be a process of discovery, with initial mistakes and misunderstandings.

It follows that the ideal set of performance incentives and the most effective segmentation of the population cannot be known in advance, but will only be discovered through systemic learning. The report argues that commissioners should deliberately create adaptive systems from the outset, where exploration is encouraged and learning is embraced.

The third high-level conclusion of this report is that payment-by-outcome works best in public services where there are 'known unknowns'. Where the linkages between inputs and outcomes are well understood and tightly connected, there is little point in specifying outcomes. Commissioners might as well purchase the key inputs or processes that they know will deliver the desired outcomes. On the other hand, where these linkages are so poorly understood that there is very little agreement about the relationship between effort and outcome, it will be virtually impossible to write an outcome-based contract that effectively transfers risk. Under such conditions, providers might just as easily be penalised for failings over which they had no control, or rewarded for successes to which they made only a small contribution.

Payment-by-outcome seems to work best in circumstances where commissioners already have some confidence about the service models that are likely to work, but lack confidence about the capacity of existing delivery chains to deliver significantly better outcomes. Much of the interest in payment-by-outcome seems to relate to certain kinds of innovation: (i) identification of those beneficiaries for whom particular service models will work best; (ii) creation of effective management processes (for example, through joining up fragmented supply chains) enabling services to be tailored to different classes of beneficiary; and (iii) encouragement of much greater co-production on the part of beneficiaries.

The final high-level conclusion from the report is that payment-by-outcome is not always appropriate. Policymakers must be clear about the policy challenge they are grappling with and the nature of the interventions that are most likely to work. If payment-by-outcome is the default option, social problems for which it is not the appropriate solution may be overlooked. When the only available tool is a hammer, there is a danger that every problem looks like a nail.

In some cases, there will be such a long delay between intervention and impact that payment-by-outcome will simply not work. Since the need for longterm investment in intractable social problems is one of the principal reasons why governments become involved, this may be a significant constraint on the use of payment-by-outcome. At other times, the use of a term contract will create a threshold problem at contract termination, with the commissioner and not the provider owning the residual benefits of successful intervention. In such cases, choice-based markets rather than competitively-tendered ones may be more appropriate.

Having been written as a toolkit, much of the report's value is to be found in the detail, which cannot easily be written up into an executive summary. Its real worth will lie with commissioners who rummage through it and come back to it from time to time for new insights as they grapple with real-world challenges of policy design.

Yik, F.W.H. and Lee, W.L. (2004) Partnership in building energy performance contracting. *Building Research & Information*, 32(3), 235-243.

Building energy performance contracting is a business strategy to assist building owners in overcoming the financial barriers for improving the energy performance of their buildings. In return for the investments made into the energy-saving measures, the energy service contractors would share with the building owners the energy cost saving. Although the contractual arrangement is meant to create a win-win situation, disappointments could arise due to mismatches between the expected and actual outcomes. From a micro-economics viewpoint, the key factors contributing to the failure of a building energy performance contract are reviewed. To solve the commonly encountered problems in building energy performance contracting, it is proposed the conventional performance contract is replaced with a partnership formed jointly by the building owner and the energy service contractor, with the latter assuming the role of the performance contractor. This would unite the goals of the two parties and cultivate genuine cooperation between them. The key features for this new contractual arrangement are described along with how this arrangement could resolve typical energy performance contracting problems.