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Risk under performance-based contracting in the UK construction sector

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As a method of procuring the services of the built environment, performance-based contracting (PBC) seeks to link the building supplier to longer term commitments than has traditionally been the case in the construction sector. By rewarding the building producer according to the way that building or structure delivers the users' requirements, rather than according to a list of assembled parts, a number of additional risks are taken by contractors, including fitness for purpose, costs and briefing. The extent to which contractors recognize these risks and their methods of dealing with them vary considerably and are influenced by their attitudes towards risk. As the risks associated with PBC are seen as large, uninsurable, and vulnerable to changing client requirements, the majority of respondents would reject the use of PBC as a method of contracting. Nevertheless, PBC may be used under particular conditions, where rewards are deemed sufficient to compensate for the additional risk to the contractor of undertaking work on the basis of a stream of payments paid over the life of a structure depending on the satisfactory performance of the building or as part of a private finance initiative.

Keywords: Performance-based contracting, risk management, private finance initiative

Introduction

Performance-based contracting (PBC) is sometimes seen as an extension of the conventional building contract. Conventional building contracts tend to deal with labour and materials, rather than the way that a completed facility performs. PBC may be variously referred to as 'performance-based building', 'performance-based specification', 'performance-based serviced building acquisition' or other terms using 'performance-based' as a prefix. In any event, all of these terms imply that it is the output of the building which is important—not the means by which it is achieved. This approach to contracting is interesting as it is the way that most things other than buildings are purchased. Indeed, many buildings are already purchased in this way; domestic housing, for example, is purchased in terms of its value, rather than the labour and material content. The emphasis in most discussions that propose and recommend PBC is on client or end-user satisfaction (for example, Ang *et al.*, 2001 and Hattis and Becker, 2001). A simple way to characterize the essence of a performance-based approach is that the focus is on what a building does, rather than its inputs.

Bramwell (2003) discusses PBC in terms of a contract that focuses on achieving a required outcome rather than a contract to supply a set of prescribed specifications. This, according to Bramwell, involves the use of functional terms in the contract to describe how a completed building will operate rather than specifying how a building will be constructed. He provides an example of where this approach was successfully utilized, for the procurement of a school in Western Australia. It is clear that performance may be defined at a number of different levels: in terms of the overall building, particular components, systems or subsystems, specific materials (as in a performance standard), a performance building code or other regulatory document, a performance tender, contract or subcontract. Similarly, Kashiwagi *et al.* (2003a) define PBC in terms of the performance required by the owner rather than the methods of performance, such as building specifications or design, thus reducing the need for detailed documentation and increasing the contractor's liability and risk.

These definitions illustrate some common themes. For example, Ang *et al.* (2001), Hattis and Becker

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(2001), Bramwell (2003) and Kashiwagi *et al.* (2003a) advocate the use of PBC. Typically, the building itself is viewed as an intermediate output and construction is focused on delivering (or paying for) a finished built facility. With an emphasis on what the final output achieves, rather than what it is made of, the procurement method and period of liability is inevitably extended under PBC. If a supplier has a responsibility for how something performs, then his or her contractual liability must extend into the performance period. This has the effect of increasing the risk to the contractor. As Smith *et al.* (2003) point out in their discussion of a case study of early design development in an apartment project: the identification and allocation of risks partly determine the procurement method and the building process. For the purposes of this paper, a dictionary definition of risk is adequate: 'hazard, danger, chance of loss or injury; the degree of probability of loss' (Brookes, 2003). However, the conventional operational management definition of risk as the combination of the probability of an event and the value of its consequence is clearly applicable in our discussion of risk in relation to PBC.

PBC clearly alters the nature of risk and its allocation, shifting increased risks on to the contractor and away from the client. This raises important questions concerning the identification and management of risks under PBC from a contractor's point of view. To date, little empirical research work has been carried out on the management of risk under PBC, even though projects are apparently being procured in this way.

Exposure to risk

Risk management is about risk identification and allocation. Construction risks have been identified by a number of authorities, including Flanagan and Norman (1999), who mention design, construction costs, latent defects, faulty materials, safety, completion deadlines and quality. PBC includes these risks for the contractor because of the necessity of extending the contractor's reward structure in scope and in time. The responsibility for construction and some ongoing performance falls to the contractor. In principle, in return for taking on performance risk, the contractor should be rewarded when the building performs. The corollary of this is that the contractor is not rewarded when the building fails to perform as agreed. This process, however, gives rise to some different and differently weighted risks from those in traditional construction.

Risk is a combination of the three factors of probability, magnitude and frequency. Probability is about the likelihood of an event occurring and magnitude may be measured in terms of the financial impact of that event, whereas frequency is about how often someone engages with the risk. The first two are characteristics of the risky event; the third is a fact about the person or organization that engages with the risk. Although probability and magnitude are regularly discussed in the risk management literature (using various terms; see, for example, Loosemore *et al.*, 2006, pp. 10–11), it is also important to consider the modifying influence of how frequently a risk is encountered by a particular organization. All three aspects influence the way that risks might be responded to. For example, a large bus company has no need to insure against damage to its own vehicles, because it is cheaper to pay for repairs as they happen, rather than paying someone else to take the risk for them. Similarly, the risks associated with trade contractor performance and solvency are usually taken by a general contractor or a design–build contractor. Some clients, such as large property developers, engage with the construction process so frequently that they are better off taking these risks themselves, which is why procurement methods such as construction management emerged in that sector of the market, whereas occasional developers would continue to use general contractors to manage the risks. Probability of risks is difficult to assess in building projects because each project will have unique characteristics making it impossible to say what effect any one project will have on the firm providing it. Buildings are too dissimilar. When a series of buildings is repetitive, it becomes easier to generalize about probabilities. Inputs of the building may stand statistical scrutiny, but the building as a whole cannot. This is a problem caused by the lack of systematically collected performance data and reliability data. Adams (1995), in his discussion on risks, argues that risk management strategy in the 1990s was more concerned with reducing risk rather than balancing the costs and benefits. Lo's (1999) approach adopts such a balance. He suggests that total risk management involves a combination of the probability or likelihood of occurrence of a risk, assessing the price of hedging that risk, and the preferences or attitude of decision makers towards the balance between accepting the risk exposure or hedging it.

Moreover, identifying the source of such risks is also relevant to the successful management of risk and PBC may be seen as an attempt to change the way risks are allocated on a construction project by shifting them from client to producer. This may be a somewhat naïve view, especially when public sector projects are considered. For example, transferring to the private sector the performance risk associated with, say, a prison, may increase the contractor's risk, but if the contractor fails to perform, the public sector client still

has to provide a prison: closure due to failure of a commercial consideration is not an option as the public service would still need to be maintained. Therefore, there is not a finite amount of risk being shared around, but risk to contractors may be arbitrarily increased. By implication, if buildings are the focus of subjective and unmeasurable risk identification, only those producers who are confident in calculating the subjective risks and reward structures would be willing to accept a PBC project. Bing *et al.* (2005) researched risk allocation among private finance initiative (PFI) projects and came to the conclusion *inter alia* that public sector clients felt that most risks should be passed on to the private sector constructors with appropriate 'risk compensation'. PBC may be used in either the private sector or public sector projects. An example of PBC in current practice is PFI. It is demonstrable from PFI that PBC more generally increases the allocation of risk for the producer/provider, although for the reasons mentioned above, there is not necessarily a corresponding reduction in risk for the buyer.

Kashiwagi *et al.* (2003b), in discussing the installation of a roof, note that when contractors carry the risks in PBC, the position of the client is strengthened, because, in principle, the contractor relies on the client for payment after completion when the building is in use. However, if, by the time the building is constructed, a client's financial position has weakened, contractors may be extremely vulnerable financially as their cash flow is dependent on the client. Only the public sector can guarantee contractors' rewards by offering a guaranteed income stream. In any case it is unclear whether clients are in a position to abdicate all decisions to the building supplier without payment until the building begins to 'perform' according to some predetermined criteria.

High product quality in products and building components is often perceived to arise only when they have been tested and awarded a recognized standard from testing bodies such as the International Standards Organization (ISO) or the American Society of Technical Manufacturers (ASTM) or the European Committee for Standardisation (CEN), etc. but there is a considerable time lag between testing and implementation. Moreover, internationally, product standards are not always consistent (which is a necessary prerequisite to establishing a successful trade in building products) (Foliente, 2000, Knocke, 1993). Poirier *et al.* (2004) recognize the difficulties of certifying new processes and products and note that it takes time and many experts from many fields to understand the complexities of change approvals. Moreover, product quality may even be reduced by the practice of working to minimum standards as these may become the norm, rather than the minimum. This occurred as a consequence of the Parker Morris (1961) minimum space standards for public sector housing. Instead of being the minimum the standards became the norm. Moreover, as it becomes increasingly uncompetitive to exceed the norm, revised standards are required to enable current market players to conform and therefore survive. This is brought about partly by representing the interests of the suppliers on the committees who negotiate standards, and partly through inculcating an attitude in the producers' workforce that quality is someone else's remit, not theirs (Kanter, 1983; Dawson, 1996). These arguments provide some of the justification for removing a reliance on specifying standardized materials and components and moving towards enabling suppliers to decide for themselves the best and most innovative way to achieve a client's aims.

Foliente (2000) describes the proposed development of performance-based codes. These would describe required performance in terms of quantity and ideally in terms of risk. This, according to Foliente, would then give designers more freedom to provide alternative solutions under the terms of the PBC arrangements. However, designers may prefer to include tried and tested products and processes because they are known, less risky and easier to monitor, especially if they have a delayed-reward contract. The purpose of codes or regulations is to enable designers to prescribe certain performance-based products knowing that they have a minimum standard. All the products in that group would then comply with a particular performance criterion. In the interim, prescriptive bases are safer but prone to declining standards and unchallenging solutions.

A key problem in PBC is whether to specify that the building must perform to the client's requirements before the constructors can claim their rewards, or simply to make the builder liable for financial losses that stem from non-performance, as measured by the difference between specification and outcome. Either way, this liability will need underpinning if it is to have any meaning. Financial backing for these liabilities could be provided by a number of mechanisms, most of which are discussed in Hughes *et al.* (1998).

If PBC is seen as encouraging contractors to be innovative, then any new product or process would need testing before implementation. Unless the innovations had been tested previously there would be every possibility that the constructor would bear the development costs and development time of these innovations without any guarantee of a reduction in the construction cost. The disincentive for contractors to innovate would therefore remain.

The risk of performance failure is real and potentially onerous for contractors and for clients. Most rational

responses to an increase in risk involve an increase in price, either to build up a contingency or to pay for some kind of hedging of risk. As a consequence, PBC may lead to higher-priced buildings.

No work has yet been published on the practical implications of the way that PBC changes risks, although there are papers which study the risk implications of transferring risk from the public to the private sector, including Pollock and Price, (2004). Pollock and Price (2004) and Gruneberg and Hughes (2005) point out that special purpose vehicles (SPVs) are often used as a shell company to operate a PFI agreement. These joint venture companies have few assets and are quite separate from their parent firms. Consequently they form a barrier between the public sector client and the private sector firms actually undertaking the project work. Indeed, most current examples of PBC are accomplished by the introduction of a third party between builders and procurers. In PFI this is the SPV; in leased office space, this is the developer, and so on. Where a contractor acts as a developer, such as in speculative housebuilding or office development, then indeed the contractor takes all the risks of procurement. PBC may offer a new and innovative arrangement to provide buildings directly from the contractor to the client.

SPVs are one method used by the private sector to deal with the risks associated with public sector projects. These SPVs have no assets, except their contracts and some non-recourse financing. SPVs only work because the public sector client has a guaranteed income stream and the companies concerned can price the risks accordingly. In the private sector this does not apply and the risks would be prohibitively large over the long term. Moreover, the proposition that a firm (or an SPV) may take on obligations, but have no resources to back them up, appears to be contrary to the whole concept of PBC. Shell companies would never be able to satisfactorily discharge PBC, as they have no resources to back up their obligations. In PBC, the PBC operator would be required to have a portfolio of projects to be able to cross-subsidize projects, if necessary, in such a way that their liabilities were not allowed to exceed their assets.

This discussion of some of the key issues associated with risk raises the question of how practitioners interpret and perceive the risks associated with PBC. Indeed, it is of interest to learn whether the idea of PBC is a current issue in the industry as it appears to be in some of the literature. A number of interviews were conducted to investigate whether practitioners recognized PBC and the risks associated with it. Strategies for dealing with perceived project risks were also discussed. As projects using PBC were seen as the focus for this survey, the wider aspects of corporate strategy to deal with risk, such as hedging and diversification are not considered.

Method

In order to carry out an assessment of contractors' attitudes towards risk management of PBC, a semi-structured telephone survey based on the questions given in Appendix A was conducted in June 2005. This approach using telephone interviews was adopted as direct contact with respondents was needed in view of the understandable lack of familiarity with the terminology of a new concept or approach represented by PBC, which had been found in discussions with earlier interviewees, not included in the survey. The survey was targeted at the top 50 UK construction companies, ranked by turnover (Building Magazine, 2004). The measurement of size by turnover was preferred to operating profit because profit is related to management expertise and for this particular research, contractor turnover was a better measure of the work undertaken by firms. The purpose of the survey was to assess the extent of awareness of PBC (as promoted by various authors) and to find if there was any link between the academic discussion of PBC and the approach of practitioners.

Forty-five companies were contacted and 22 responses received. Clearly, greater numbers of interviewees would have been statistically useful, but it was felt that the results are nevertheless sufficiently indicative to justify some qualitative conclusions. In the survey it was found that responsibility for risk management is not usually allocated to any one person or department in particular and it was rarely straightforward to ascertain the responsible person. The survey was concerned with strategic issues arising out of the concept of PBC. Respondents to the survey included marketing directors, commercial directors, managing directors, risk managers, regional directors, business development managers, directors of risk, finance directors, chief estimators, and quality and standards executives. From these responses, it was possible to conclude that some had board-level responsibilities, others were middle-managers and others office clerks. Clearly not all respondents were equally involved with strategic issues such as risk management, but the results of the survey nevertheless represent a broad perspective of a variety of practitioner attitudes towards risk under PBC.

Most questions were open-ended. For example, respondents were invited to suggest what they considered to be the risks associated with PBC (see Appendix B) and subsequent questions related to the risks they had particularly identified.

Research findings: defining PBC risks

Identifying risks associated with PBC involves defining PBC in the first place. Only then is it at all meaningful to discuss the risk exposure of contractors undertaking PBC. Senior managers in large construction firms, many of whom are involved in PFI projects, might have been expected to understand PBC concepts. However, in response to the survey question, 'Do you know what performance-based contracting is?' of the 22 interviewees only five respondents claimed to be aware of it. This may simply be because of unfamiliar terminology, and had been anticipated by providing an operational definition of PBC for the purposes of securing consistent answers in the survey.

Respondents were invited to describe risks they associated with PBC (see Appendix B). In all, 27 risks were suggested by the respondents. Some respondents mentioned multiple risks, some only identified single risks and others did not attempt to provide any risk suggestions. Each mention of a risk by respondents was noted and included as a separate exposure. From the results of the enquiry, seven key risk groups emerged from the use of common terms by respondents. These are ranked in Table 1, according to the frequency they were mentioned by respondents.

Clearly fitness for purpose (FFP) and associated insurance issues are the most frequently perceived risk for contractors. Many contractors explained that they would consider accepting only 'reasonable skill and care' as this is an insurable risk. FFP is apparently a problem for insurers and is usually excluded in professional indemnity (PI) policies because of the allocation of strict liability, a point that could render PI an unhelpful safeguard for clients. The problem lies in the nature of a guarantee which is, in general, uninsurable and, therefore, dependent on resources that lie behind the risk taker, in relation to their liability. According to the respondents, many clients would want to pass FFP obligations on to contractors as well as risks associated with 'skill and care'. Responsibility for FFP may also make the contractor vulnerable to any late change in the client's purpose. Moreover, the duration of the exposure to the risk of a building not being fit for its purpose depends on the terms of the performance-based contract, which could extend 10, 20 or even 30 years or more.

Table 1 Frequency of respondent-suggested risks

Area of risk	Frequency	%
FFP and associated insurance issues	18	36
Costs rising above budget	8	16
Measurement (performance and indicators)	6	12
Briefing/specification	5	10
Contractual issues	5	10
Resource issues	4	8
Other	5	8
Total	51	100

The risk of unanticipated costs driving the contractor's costs over budget as a consequence of the prolonged responsibility to maintain the building once in use was also seen as a major risk for contractors. The third risk cited was related to disputes arising over the difficulty of measuring the performance of a completed structure and agreeing unambiguous indicators of performance that took into account the fact that the contractor would have little or no control over how completed structures might be used on a day-to-day basis over a long period causing the building to underperform.

The risk embedded in the brief and specification of projects concerns the additional complexity of defining the life cycle of components and their performance over and above the specifications contractors have traditionally undertaken to provide. This uncertainty is the result of the innovation represented by PBC and the fact that contractors have not usually been concerned with the performance of buildings once completed to construction specifications.

Contractual issues were also seen by contractors as a risk of PBC due to the ongoing responsibility they would have after completion. At present contractors saw themselves as only providing a service to the point of completion rather than extending the obligations to maintaining the building, a service of which they had no experience as contractors. Moreover, as components were supplied by manufacturers and often fitted by subcontractors, the main contractor could be seen as being exposed to more complex contractual arrangements with suppliers, arrangements that might not always protect the contractor from additional costs imposed by the client.

Resource issues were also seen as a risk in so far as contractors might be forced to undertake roles for which their staff were unprepared or inexperienced. Contractors have been project orientated and as such employ labour on a project-by-project basis. Continuing responsibility for completed structures could involve employment structures that are different from those practices with which contractors have become familiar. PBC might involve contractors returning to direct employment in order to provide continuity of care over their completed buildings. As many contractors may not be structured to accommodate the number of direct employees required to manage facilities, the organizational changes needed might be more costly to the firm than the advantages of additional PBC contracts.

Other areas of risk noted by respondents include the inability to provide and deliver creative built solutions that meet client expectations, additional operational safety considerations during the building in use phase and risk issues arising out of the additional length and complexity in the lines of communication between the contractor and the client, tenants and building users, who may include employees and the general public.

Risk response strategies in the context of PBC

Table 2 shows how respondents said they would manage the risks they had previously mentioned. Most respondents tended to mention that they would manage them as they would manage their existing arrangements. The first risk strategy given in Table 2 is product quality. The management strategies to deal with ensuring product quality involved ensuring that suppliers retained liability, and that they themselves obtained appropriate sourcing of components. Only proven, inspected and tested products should be used, and once installed defects liability periods were to be stated. Second, there was no strategy as such to deal with the risk associated with FFP as this was considered to be unacceptable to contractors and they were not prepared to manage or take on FFP conditions. As far as contractors were concerned, responsibility for their output only extended to reasonable skill and care in the construction and maintenance phases. The third type of risk management strategy, contractual risk, could be dealt with by adopting a formal risk register as part of the contract to identify the allocation of risk to the different parties involved.

One contractor stated that FFP would be too onerous and would not be included in any contract. One reason for considering FFP to be too onerous, given by a number of respondents, was that agreeing fitness for purpose depended on perceptions of functionality. As it was not always possible to arrive at a consensus on the definition of functionality, the contractor would be exposed to an unacceptable level of risk and dispute leading to payment delays or even non-payment by the client. Obtaining the client's complete specification was seen as an obstacle, particularly at bidding time.

Contractors were asked how PBC risks could be distributed between themselves, clients and suppliers. Their preferences are shown in Table 3. Although the majority of respondents (63%) who answered this question did not express a particular preference, of those who did, there was a clear preference to offload risks on to clients and suppliers, with only a minority accepting that contractors should absorb some or all of the risk. Some respondents felt that although suppliers were required to take the risk for new products, they generally did not return to take responsibility if their products failed.

Clients were perceived to place the risks on to the contractor either through the job or through the contract. Contractors expressed a preference for involvement in contract negotiations at the earliest stages of projects. However, using contracts to manage risk in the United Kingdom was inadequate as standard building contracts do not cover all risks. In any case risks shifted between the contracting parties as projects progressed—even on PFI projects.

In view of the difficulties in identifying and managing risk under PBC, respondents were asked under what conditions or circumstances (if any) they would be prepared to use PBC. Their responses are given in Table 4.

One of the most significant results from this survey is that most contractors (66%) felt that they would not

Table 2 Risk management strategy of PBC risk

Type of risk	Number of strategy suggestions*	%
Product quality	8	32
FFP	5	20
Contractual issues	3	12
Other	4	16
No comment	5	20
Total	25	100

Note: *Some respondents listed more than one strategy.

Table 3 Contractors' preferences for risk allocation

Risk allocation	Respondents	%
Clients	3	11
Shared between clients/component suppliers	3	11
Contractors	2	7
Shared between contractors/clients	1	4
Suppliers	1	4
Don't know	17	63
Total	17	100

Table 4 Potential use of PBC

Circumstances	Respondents	%
Under PFI arrangements	3	9
Criteria must be properly expressed	1	5
Risk assessment favourable	1	5
Company policy	1	5
If the contractor were also the developer	1	5
Only on minor projects	1	5
Would not accept PBC	14	66
Total	22	100

accept a PBC contract, although under PFI contracts, it might be acceptable. Once again, FFP was often given as a reason while others noted that risk decisions were made on a job-by-job basis which did not take into account any long-term obligations past the contract. In fact 86% of the contractors in the survey would not accept responsibility for their building beyond their current expectation.

If contractors were not prepared to take on long-term liabilities beyond completion, they were asked if they required their suppliers or subcontractors to be responsible for their inputs beyond building completion. Of the respondents, 38% required their suppliers to accept responsibility beyond completion, 21% required it from their subcontractors and 25% did not know.

Discussion

As some of the questions in the survey were open-ended, respondents were invited to discuss PBC more broadly. It emerged that the lack of awareness of PBC combined with fears over the long-term implications for FFP implied that PBC was not a method of contracting that non-PFI contractors had been actively considering. This is not surprising as few innovations in procurement methodology have been made other than by clients. When demand for construction is depressed contractors need to redouble their efforts to gain work. One strategy open to contractors is to reduce their profit margins. An alternative is to look for work at higher risk compared to work undertaken when order books are full. In this way the level of demand relative to capacity may influence contractors to take on risks associated with PBC. Furthermore, the uninsurable risks arising from FFP are major obstacles to contractors accepting PBC. Therefore, it would require firms with very different business models compared to existing contractors. Existing contractors do not have sufficient resources and capital to undertake PBC obligations. Many contractors would be surplus to requirements because without sufficient capital they would be merely managers of the construction process.

Under PFI contracting the client accepts some risks, the contractor accepts others. FFP requirements are clearly stated in the specifications. In PBC, as defined in the literature, contractors are expected to accept liability for the building's function to ensure that it matches the client's FFP requirements (Ang *et al.*, 2001; Hattis and Becker, 2001). Clients' requirements may change over time (and the building production can extend over a considerable period), thereby changing the objectives of the FFP. The contractor will be uninsured for such changes of use. In traditional construction contracts, contractors would be able to take advantage of changes because they can negotiate a new price and extra time. Under PBC the contractor may be more exposed, having agreed a fixed price for a particular service, if the detailed definition of what is needed to achieve that service develops or changes. In the event of such changes, contractors may fear they will not receive the agreed rewards if the client is not satisfied. Since contract enforcement through the courts is costly, the producer is vulnerable in a deal which has demanded considerable up-front investment from the supply side. The worst case scenario is:

- the clients will have a building which has been procured for the original purpose but is no longer suitable;
- the producers may be unable either to receive their post-construction reward or dispose of the building profitably and quickly to reduce their financial exposure.

Furthermore, if the FFP changed over the longer term (during client occupation), contractors in the survey feared that they would be in danger of not being paid the ongoing rewards. This was also considered to be an unacceptable risk, even for the largest firms.

Using innovative products (an integral part of PBC) was also seen as 'risky' as many products had not been available for sufficiently long periods of time to ensure their durability. This contradicts the innovative aspects of PBC as described by Poirier *et al.* (2004), Foliente (2000) and Bramwell, (2003). Although, in principle, contractors could require suppliers to take responsibility for individual products to perform over time as a prerequisite of PBC, contractors appear to be reluctant to take responsibility for buildings as a whole.

Conclusions

Risk decisions are often taken only for the life of the construction project, not for the life of the building. The risk decision-making process is structured accordingly, because contractors tend not to accept responsibilities (apart from those covered under the typical terms of retention clauses) after the construction phase, unless they have an ongoing contract. Longer-term risk obligations will require contractors to have new organizational structures. The difficulty of insuring and dealing with FFP are major obstacles to the adoption of PBC by contractors. Contractors prefer suppliers to assume responsibility for their products under PBC.

Under PBC it may be argued that contractors are given the freedom, responsibility and authority to perform their work as they see fit. However, there are many risks for the contractors. As the rewards of

payment are delayed and repeat business may not materialize, taking on the additional risks of PBC could jeopardize the solvency of the contractors involved. Therefore, the question becomes one of balancing the increased risks against the possibility of increased rewards. Given the nature of the construction market it may not always be possible for contractors to pass on expected increased costs to their clients.

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Appendix A

Questions used in this research

(1) Do you know what performance-based contracting is?
(2) Bearing in mind the definition* above, what would you consider to be the risks in performance-based contracting?
(3) How do you deal with these risks?
(4) Which of these risks do you absorb and which do you think should be taken by your suppliers, yourselves or your clients?
(5) Under what circumstances (if any) would you be prepared to use performance-based construction?
(6) Do you require suppliers or subcontractors to be responsible for their inputs beyond building completion/retention?
(7) If yes, please give an example.
(8) Do you accept responsibility for your output (building) beyond building completion/retention period/warranty period?
(9) If you do accept responsibility, how is this effected and under what circumstances?

*The definition supplied to respondents was 'the building is procured, based on its fitness for purpose, not the method of construction or the building components used'.

Appendix B

Twenty-seven risks associated with PBC as suggested by respondents

Risks	Frequency
Fitness for purpose (FFP)	7
Lack of insurance for FFP	6
Lifetime costs (including responsibility for lifetime maintenance)	4
Price (capital cost)	3
Inadequate client specification	3
Changing the mindset of clients, consultants, designers and contractors	2
Setting the key indicators	2
Measurements of key indicators over time	2
'Wouldn't touch it!'	2
The 'fitness for purpose' changing after completion	2
Too risky for a contractor	2
Client may not get what he perceived	1
Not truly understanding what 'fitness for purpose' means	1
Delivery to a price and a programme	1
Consultants cannot get insurance	1
Type of contract	1
Type of specification	1
PBC may not promote creative design	1
Measurement of project indicators	1
Third party intervention for key indicator measurement	1
Poor communication	1
Inadequate materials	1
Inadequate staffing levels	1
Considerable rework	1
Minimum quantity	1
PBC would give minimal safety	1
Client may not like input which contractor identifies as 'fit for purpose'	1
Total	51