

# Comparative Study on the Use of Output Specifications for Australian and U.K. PPP/PFI Projects

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**Abstract:** An output specification is an integral part of the contract documentation for procuring and monitoring public private partnership (PPP) or private finance initiative (PFI) projects throughout their life cycles. Unlike prescriptive specifications used in the traditional project delivery, the output specifications stipulate what is required from the project rather than how they should be delivered by the private sector. Performance standards or output parameters are used for bid evaluation and operational monitoring. Failure to achieve them would lead to ongoing payment deduction and rectifications that need to be undertaken within a specified time frame. The long concession periods of PPP/PFI projects mean that changes are inevitable, and these, if foreseeable, should be managed using the output specification as a tool. This unconventional approach of specifying requires special skills and care. This paper presents the results of a questionnaire survey conducted in Australia and the U.K. with PPP/PFI practitioners. The findings highlight the common pitfalls and change management issues encountered by the two jurisdictions, which use PPP or PFI extensively in delivering public assets and services. While common pitfalls include conflicts between input and output specifications, and performance standards being compromised with affordability, small changes are often made by the public sector authorities. Changes are dealt with by anticipatory provisions in output specifications, or negotiations as and when they arise. Procedural hiccups may slow down the process of introducing necessary changes, or give rise to disputes. DOI: 10.1061/(ASCE)CF.1943-5509.0000554. © 2014 American Society of Civil Engineers.

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## Introduction

Public private partnerships (PPPs) differ from conventional procurement in several respects. PPPs are long-term contractual relationships between the public and private sectors often established with the aim of utilizing the private sector's resources and expertise in the provision of infrastructure development and delivery of public services (Chinyio and Gameson 2010; Hardcastle and Boothroyd 2003; Zhang 2006). Broadly speaking, a PPP is defined as an "arrangement between the public and private sectors whereby part of the services or works that fall under the responsibilities of the public sector are provided by the private sector, with a clear agreement on shared objectives for delivery of public infrastructure and/or public services" (World Bank 2011). The Canadian Council for Public-Private Partnerships (2011) further elaborates PPP as "a cooperative venture between the public and private sectors, built on the expertise of each partner that best meets clearly defined public needs through the appropriate allocation of resources, risks and rewards." PPP has been used in more than 85 countries for procuring economic and social infrastructure projects (Regan et al. 2009). During the last couple of decades, PPP has grown very rapidly for the procurement of infrastructure and municipal services (Doloi and Jin 2007; Regan et al. 2011). The global infrastructure

requirements have been estimated to be more than US\$50 trillion over the next 25 years (Miller 2010). According to a report by the U.S. Department of Transportation (2005) on PPP infrastructure projects worldwide between 1985 and 2004, more than 1,000 projects were completed with an approximate total cost of US\$450 billion. In the US, PPPs are regarded as forming an evolving market with growing interest and new opportunities especially in the transport sector (Chase 2009; PricewaterhouseCoopers 2005). According to Public Works Financing (2013), US\$30 billion worth of transport-related public private partnership (PPP) projects are in the pipeline in the U.S. market in the coming 18 months.

Private finance initiative (PFI) is a common PPP model adopted by the U.K. government since 1992, and up to March 2012, the total capital value of current PFI projects was £54.7 billion—or approximately US\$85.3 billion (HM Treasury 2012a). The main sectors among the signed PFI projects include health (118 projects), education (166 projects) and transport (62 projects), which account for approximately 48% of the total capital value (HM Treasury 2012a). In December 2012, the U.K. government initiated a major re-assessment of its PFI practices and developed a new process termed as private finance 2 (PF2) (HM Treasury 2012b). The U.K. Treasury has estimated that the use of PFI has produced average savings of 17 to 25% over all sectors during the past 10 years (Alfen and Bauhaus-Universität Weimar 2009). In October 2009, a national audit office (NAO) report on the "Performance of PFI Construction" indicated that 94% of PFI projects surveyed were delivered with less than 5% over price. About 35% of projects came out above the originally contracted price, and 31% were delivered late. By way of comparison, a sample was also taken of public sector non-PFI projects, of which 46% exceeded the contractually agreed price, and 37% were late in construction completion (NAO 2009).

PPPs have also played a central role in infrastructure provision in Australia, and the Australian PPP market is regarded as one of the most mature PPP markets in the world (RICS 2011). PPP has

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become an integral part of the federal and state governments' procurement strategies in Australia (Allen Consulting Group et al. 2007) and is also expected to be a major collaborative project delivery approach in Australia in the foreseeable future. Between 1980 and 2005, A\$35.7 billion worth of PPP projects were contracted (English 2005), and the Allen Consulting Group et al. (2007) estimated that approximately A\$400 (US\$360) billion is likely to be spent on Australian infrastructure over the next decade.

Chew et al. (2007) and Yescombe (2007) stated that PPP infrastructure facilities can generally be divided into two major categories:

- Economic infrastructure: those facilities where users are directly charged for using the services by the concessionaire, such as toll roads, railways, power stations, water and sewage treatment plants, telecommunications, etc.; and
- Social infrastructure: those facilities that a government funds through a series of post-completion payments to the concessionaire, such as schools, hospitals, prisons, justice facilities, police stations, etc.

In economic infrastructure PPP projects, usually the concessionaire is responsible for the design, construction, operation, and maintenance of the entire facilities for the concession period. On the other hand, in social PPP infrastructure projects, the concessionaire may be responsible for the design, construction, and commissioning of the facilities, and the government provides "core services" associated with the facilities during the operational phase, such as clinical services at a hospital, teaching services at a school, etc. The concessionaire provides "non-core services" including hard and soft facilities management services.

The output specification is considered the most important document in PPP/PFI procurement, and a well-drafted and robust output specification is fundamental to the successful delivery of long-term services (4Ps 2006). Clear specifications benefit the whole lifecycle of a PPP/PFI contract because apart from the construction, the facilities management forms a critical part of the contractor's obligations (Cove 2007). Minimizing the risk of delivering the wrong product to the end user is of utmost importance (Cheung et al. 2009). The output specification (OS) writing process starts from the project brief stage and lasts till the completion of the contract (Javed 2013). In the precontract stage, output based specifications are normally developed in five phases: (1) strategic considerations, (2) defining output performance standards and service levels, (3) defining the technical evaluation criteria, (4) defining the scope and content of the bidder's proposal, and (5) finalizing the OS and the bidder's proposal for contract award (Ministry of Defence 2010).

In PPP/PFI projects, the public sector client procures fixed assets and services from the private contractor and stipulates its requirements in terms of performance output specifications (Robinson and Scott 2009); hence, the client does not specify how these are to be provided (Yescombe 2007). The contractor is paid to deliver the services to the required quality and performance level, which is a distinct feature of PPP projects (Yuan et al. 2009). The performance-based payment mechanism is embodied in PPP contracts (Ernst & Young 2008). Where the services do not meet the performance standards imposed by the public sector client, payments are deducted from the unitary charges (Oyedele 2013). It is important to have clear output specifications, so that both parties understand their implications and agree on as many details as possible prior to the financial close (4Ps 2006). The scope of output specification is much larger than that of conventional performance specifications. During the precontract stage, the public sector client and service provider need to engage in discussions to clarify issues of output specifications (Ramsey 2007). To ensure that minds meet

in the interpretation of an output specification, an iterative and interactive tendering process is commonly adopted during the bid process in PPP projects (Duffield and Clifton 2009; Ramsey 2007), and this is becoming more sophisticated as both the public and private sectors gain better experience with this model (Ernst & Young 2008). "An interactive tender process provides shortlisted bidders with an opportunity to discuss the development of their concepts and designs and to seek clarifications and feedback in the context of the government's output requirements prior to lodgment of RFP (Request for Proposal) responses" (Infrastructure Australia 2008a). It is also important for the government that the project is delivered on time and within budget and meets the preagreed functional requirements, quality standards, and service benchmarks throughout the contract period, which can be 20–30 years. The public sector should allow flexibility for the private sector to provide innovative and new technologies, and make incentive payments where necessary (Cheung et al. 2012). Javed et al. (2013) found in the interviews carried out in Australia that there was no direct financial incentive for overperformance in payment terms, but contractors were generally motivated to perform well to achieve the agreed standards. The contention is that if the contractor was incentivized for overperformance, then it would complicate the contract in that there would be difficulties in justifying who should receive those incentives (the actual service provider, the equity investor, or the debt provider). Ball (2007) found that in two early PFI projects, for which exhaustive bespoke contracts emphasized on-penalty clauses rather than benefit clauses, the former were later replaced by benefit-sharing clauses. Oyedele (2013) suggests the minimal use of subjective measures as key performance indicators (KPIs) and proposes the stipulation of explicit and realistic performance standards, criteria, and weighting systems to ensure the quality of service delivery of PPP/PFI projects.

Most PPP/PFI projects have a long concession period of 20–30 years. Changes are almost inevitable, which need to be managed to ensure the continued fitness-for-purpose of the asset and services provided. For example, in the five years preceding the observation by Cove (2007), the Victorian justice sector in Australia had initiated major structural modifications to provide additional capacities in their buildings for achieving better social policy objectives, as well as implementing security upgrades, regulatory changes, and consequential architectural and service infrastructure works.

A number of factors including affordability, value for money (VfM), and equitable risk transfer combine to determine the success of any PPP/PFI infrastructure project. The output specification is definitely an important factor (Duffield 2005; Fitzgerald and Machlin 2001; Grimsey and Lewis 2004; Jefferies et al. 2002). Apart from VfM, other nonfinancial factors such as nonquantifiable risk transfer, design amenity, and sustainability of the proposal should also be evaluated (Duffield 2005). Astron (2004) suggested that if affordability becomes a challenging issue, then the public sector authority needs to be clear about its priorities and should strike a balance between content, specification, and affordability. Robinson et al. (2010) argued that a major problem with PPP/PFI projects is the development of an output specification as this has a major impact on the bidding process, as well as cost and affordability of government agencies.

The purpose of this paper is to examine the challenges faced in the preparation of output specifications, firstly through the identification of common pitfalls in the output specification documents as experienced by both the public and private sectors from the U.K. and Australia and to discuss how these can be avoided. Secondly, in order to investigate the use of output specifications in change management, information was collected in these two countries on the

common types and values of changes, the approach by which those changes were adjusted financially, the problems faced in change mechanism, and the consequences on PPP projects due to problems in output specifications, to identify similarities and differences.

The structure of this paper comprises a description of the research methods employed (including the survey design, the sampling approach, and the profile of the respondents), a presentation of the data analysis and findings, and a triangulated study of the statistical results with additional comments made by the respondents, followed by recommendations for improvement of output specifications. The information presented should be of value to stakeholders of PPP/PFI projects, not only in Australia and the U.K. as a useful reflection (because literature on the use of output specification is relatively scarce), but also informative for jurisdictions intending to adopt this project delivery approach on a wider scale, especially in the provision of infrastructural facilities.

## Research Methodology

### Design of the Survey and the Questionnaire

The questionnaire comprises five major sections (a sample of the questionnaire is attached in Appendix A). All sections are interlinked with each other. In Section I, information on the respondents' involvement with various types of social and economic PPP/PFI projects and the nature of the projects is collected. Section II solicits the relative frequencies of pitfalls in output specifications using a five-point Likert scale, where "1 = very rare" and "5 = very frequent," and the same scale was used for the rest of the questions. The Likert scale's invention is attributed to Likert (1931), who described this technique for the assessment of attitudes. An additional choice of "Never happen" was also used to allow respondents' explicit statement of irrelevance since the same questionnaire was administered in both Australia and the U.K., which may have different practices. The only difference in the questionnaire was due to the change of currency values in the respective countries. In Section III, the relative frequencies of respondents encountering different types of change, the ranges of change values (i.e., small, medium, and large), and the payment adjustment methods in respect of changes were solicited. Section IV consists of questions about the types of change mechanism being practiced and the problems being faced in handling the changes based on output specifications. The final Section V collects information on the consequences of PPP/PFI projects due to problems in output specifications. Toward the end of the questionnaire, an open-ended question was also posed to respondents to solicit their further comments on output specifications.

### Sampling Approach and Response Rate

In order to solicit the opinions of different stakeholders, i.e., the public and private sectors in PPP/PFI projects, a structured questionnaire survey was conducted from January 2011 through September 2012 in Australia and the U.K. A cluster sampling approach was used in the empirical questionnaire survey (Wooldridge 2006). The targeted population consisted of individuals with experience or interest in PPPs. The questionnaire was devised through a study of sample output specifications and literature. It consists of questions on the ranking of problems in output specifications and change management issues in PPP/PFI projects. Before sending out the questionnaire to all respondents, a pilot study was carried out by sending a draft version to three experienced construction professionals familiar with contract administration to evaluate the questionnaire structure and readability. Feedback was incorporated, and the

full batch was sent out after making sure that no further problems were raised by the pilot study respondents.

The questionnaires were sent to public and private sector parties (including work commissioning departments, contractors, consultants, and facilities management operators) engaged in PPP/PFI projects in Australia and the U.K. Most of the U.K. addresses were retrieved from the Partnerships U.K. webpage (<http://data.gov.uk/dataset/private-finance-initiative-pfi-data>), which contains a centralized database of all public-private projects. Australian addresses were obtained from different sources including dedicated PPP organizations and state agencies (such as the Partnerships Victoria at <http://www.dtf.vic.gov.au/Infrastructure-Delivery/Public-private-partnerships> and the New South Wales Treasury at <http://www.treasury.nsw.gov.au>). Because the questionnaire was designed to cover the change mechanisms, it was targeted only at those projects that were in operation at the time the survey was conducted. Hence, nonoperational projects were screened out because some of them were in the planning stage and thus had not reached "financial close" (an important stage when all needed funds, especially loans, are assembled for a project).

The number of questionnaires sent and the response rates from Australia and the U.K. are recorded in Table 1. A total of 650 and 240 questionnaires were sent out by post and e-mails to the U.K. and Australia in sequence. A larger number was sent to the U.K. because more PFI projects have been conducted in the U.K. as compared to the PPP projects in Australia (Raisbeck et al. 2010). The postal batches provided stamped envelopes for return post from the U.K. and Australia. For those questionnaires sent by e-mail, instructions were given for the use of an alternative online questionnaire mounting and data collection platform, SurveyMonkey (2011). In the end, 131 valid questionnaires were completed and returned from the U.K., with 62 from Australia. The initial response rate was low, and to increase the response rate, one reminder was sent out. During the whole process, close monitoring was carried out to track the public and private sector replies. With these efforts, there were sufficient and roughly equal response rates from the two sectors in the U.K. and Australia for carrying out a meaningful analysis. The overall effective return rate was around 20 and 25% from the U.K. and Australia, respectively, as shown in Table 1.

It can be seen from Table 1 that there is a difference in the number of responses between the public and private sectors in both the U.K. and Australia. One reason for this may be that the public sector is more transparent, and direct contacts of the public sector officers are available in the public domain. The other reason might be that more than one letter was sent to the same government departments in different cities. However, usually only one contact was available from each private organization, and for those without contact names, the questionnaires were directly addressed to the chief executive officers.

### Profile of the Respondents

Table 2 shows the respondents' experience in terms of the number of PPP projects that they were involved with. Over half of the

**Table 1.** Response Statistics of U.K. and Australia Surveys

Sector/ location	Total number of questionnaire sent out		Number of valid replies received		Effective response rate within each sector (%)	
	U.K.	Australia	U.K.	Australia	U.K.	Australia
Public	400	150	79	33	20	22
Private	250	90	52	29	20	32
Total	650	240	131	62	20	25

**Table 2.** Number of PPP Projects with Which Respondents Were Involved

Number of PPP projects	U.K.	Australia
1	28	13
2	24	8
3	13	7
4	8	1
More than 4	58	32
Total	131	61

Note: One respondent in Australia did not indicate the number of projects.

respondents were involved with four or more PPP/PFI projects, indicating that they have a good understanding of this type of procurement method.

Table 3 describes the PPP/PFI project types as experienced by the respondents. In the U.K., 24% of the respondents (the public and private sectors grouped together) were involved with school and education PFI projects, followed by hospitals (19.7%), transportation (9.5%) and others (13.5%). In Australia, around 21% of the respondents were working on transportation-related PPP projects, whereas 17.4 and 13.8% had experience in hospital and school projects, respectively. This spread of project types in the two countries resembles the findings of Ball (2011) and indicates that slightly more than one-half of the respondents in both countries had hands-on experience with health, education, and transportation projects. One point worth noting is that some respondents worked with more than one particular project type and therefore they chose more than one type of project in their answers.

## Data Analysis

Data concerning the pitfalls and change management of output specification was collected from the United Kingdom and Australia. A statistical package for social science (SPSS, Version 20.0) was used as a tool for data analysis. Different techniques were used for the questionnaire analysis including descriptive statistics (mean score and standard deviation). The mean score rank is the most widely used and reported measure of central tendency (Lind et al. 2002). Chan and Kumaraswamy (1996) adopted the mean score (MS) method to establish the relative importance of causes of delay in building construction projects in Hong Kong. Cheung

**Table 3.** Project Types as Experienced by Respondents

Project type	Both public and private sector (U.K.)		Both public and private sector (Australia)	
	Percentage	Percentage	Percentage	Percentage
Hospital	54	19.7	29	17.4
Transportation	26	9.5	35	20.9
Water supply and treatment	9	3.3	18	10.8
Power and energy	6	2.2	8	4.8
Information and communication	10	3.6	10	6.0
Housing estate	26	9.5	10	6.0
Police and prison	22	8.0	16	9.6
School and education	66	24.0	23	13.8
Waste management	18	6.6	6	3.6
Others	37	13.5	12	7.2
Total	274	100	167	100

and Chan (2011) also used the mean score method for their research into the risk factors of PPP projects in China and a comparative study of factors contributing to the success of PPP projects in the U.K., Australia, and Hong Kong (Cheung et al. 2012). Apart from the descriptive statistics (mean score and standard deviation), several nonparametric tests were also carried out including concordance analysis (to check for consistency of answers in groups of questions) and the Mann-Whitney  $U$  tests (to check for statistically significant differences between two countries for top-ranking scores when one of the scores exceeds 3.0, i.e., the midpoint of the Likert scale). A detailed analysis of the results is presented in the following paragraphs:

### Test on Reliability of the Questionnaire

Firstly, the Cronbach's alpha calculation was carried out on the survey data to test the reliability of the 5-point Likert scale used in the questionnaire (Nunnally 1978; Nunnally and Bernstein 1994). The Cronbach's alpha coefficients for questions 5 to 10 are tabulated in Table 4 for the U.K. and Australia.

The coefficients range from 0.501 (Q.9) to 0.823 (Q.5) for the U.K. samples, and from 0.601 (Q.8) to 0.851 (Q.5) for the Australian sample. Since the majority (9 out of 12) of the coefficients is at or above 0.7 in the two countries, where the same survey tool was used, the scale is considered "acceptable" overall (George and Mallery 2003; Nunnally 1978; Nunnally and Bernstein 1994).

### Test on Consistency of Responses

Next, the Kendall's coefficient of concordance  $W$  was used to measure the degree of association and consistency of responses by the U.K. and Australian respondents within groups of questions. The range of possible values of  $W$  is between 0 and +1. When there is a complete agreement, a significant  $W$  value near to +1 among all set of ranks will emerge. On the other hand, if there is no association among the responses, the value of  $W$  will be equal to 0 (Sheskin 2011; Siegel and Castellan 1988). The null hypothesis, which can be stated as "there is no association among the rankings given by the respondents," can be rejected if the value of  $W$  is at a low level of significance ( $p \leq 0.001$ ). This rejection of the null hypothesis means that there is some degree of consensus among the respondents answering a particular group of questions. Kendall's  $W$  test is suitable when the number of elements ( $N$ ) in each group of questions is  $\leq 7$ . If  $N > 7$ , the chi-square ( $\chi^2$ ) test is the best option for a near approximation (Siegel and Castellan 1988).

Tables 5 and 6 show the results of the Kendall's coefficients of concordance test applied to questions 5–10, in which rankings were given by the respondents from the U.K. and Australia. The right-most column in Table 5 shows rejection of the null hypothesis for all questions (except for question 10) (Note: In the U.K. samples, the null hypothesis is accepted for Q10, when the public and private sectors were tested together or separately, indicating that there is

**Table 4.** Test of Cronbach's Alpha

Question number	$N$	Cronbach's alpha (U.K. samples)	Cronbach's alpha (Australian samples)
5	11	0.823	0.851
6	6	0.747	0.819
7	3	0.732	0.805
8	4	0.588	0.601
9	4	0.501	0.739
10	8	0.699	0.822

**Table 5.** Test of Concordance for Survey on Output Specifications for U.K.'s PFI Projects

Question number	<i>N</i>	Kendall's <i>W</i>	$\chi^2$	DOF	Significance level from <i>SPSS</i> output	Critical value of $\chi^2$ at $\alpha = 0.001$	Null hypothesis
5	11	N/A	110.016	10	<0.001	29.59	R
6	6	0.239	N/A	5	<0.001	N/A	R
7	3	0.674	N/A	2	<0.001	N/A	R
8	4	0.124	N/A	3	<0.001	N/A	R
9	4	0.123	N/A	3	<0.001	N/A	R
10	8	N/A	18.954	7	<0.001	24.32	A

Note: Total sample size = 131; Public = 79; Private = 52; A = accept; DOF = degrees of freedom; *N* = number of elements; N/A = not applicable; R = reject.

**Table 6.** Test of Concordance for Survey on Output Specifications for Australian PPP Projects

Question number	<i>N</i>	Kendall's <i>W</i>	$\chi^2$	DOF	Significance level from <i>SPSS</i> output	Critical value of $\chi^2$ at $\alpha = 0.001$	Null hypothesis
5	11	N/A	62.108	10	<0.001	29.59	R
6	6	0.196	N/A	5	<0.001	N/A	R
7	3	0.180	N/A	2	<0.001	N/A	R
8	4	0.021	N/A	3	<0.001	N/A	R
9	4	0.110	N/A	3	<0.001	N/A	R
10	8	N/A	26.279	7	<0.001	24.32	R

Note: Total sample size = 62; Public = 33; Private = 29; A = accept; DOF = degrees of freedom; *N* = number of elements; N/A = not applicable; R = reject.

inconsistency in the answers provided for problems in the change mechanism), which means that there was some degree of consensus amongst the respondents. Although *W* values for questions 6–9 were not close to 1, indicating that the degree of association was low, the results were still statistically significant.

### Mann-Whitney *U* Test

The nonparametric Mann-Whitney *U* Test is employed to study the association of ordinal (rank order) data in a hypothesis testing situation with two independent sample groups, one from the U.K. and another from Australia not necessarily having equal sample sizes nor any assumed distributions (Sheskin 2011; Siegel and Castellan 1988). For the Mann-Whitney Test, if the *p* value is equal to or smaller than a predetermined level of significance ( $\alpha = 0.05$ ), there is a statistically significant difference between the two samples. On the other hand, if *p* is larger than this level of significance ( $\alpha = 0.05$ ), then there is no significant difference between the two samples.

## Survey Findings

### Potential Pitfalls for Output Specifications

#### Question: Relative frequencies of pitfalls occurring in output specifications

Table 7 shows the details about the number of respondents, the mean scores, the standard deviations, and relative ranks of pitfalls in output specifications. It shows the public and private sector respondents' rating from 1 to 5 (i.e., very rare, rare, sometimes, frequent, and very frequent). The mean values of the relative frequency scores of the top four pitfalls in output specifications of PPP/PFI contracts are close to each other as rated by the U.K. and Australian respondents. Item 5(iv), "Performance standards compromised with affordability," is at the top of the list for the U.K. (mean = 2.97), whereas this item was ranked 4th in Australia. Affordability constraints can lower the performance standards, thus arousing concerns over the cost and quality assessment, as

**Table 7.** Descriptive Statistics of Potential Pitfalls in Output Specifications (Their Mean Scores on Relative Frequency and Rankings in the U.K. and Australia—Public and Private Sectors Grouped Together)

Question number	Pitfalls in output specifications	U.K.			Australia		
		Mean	Rank	Standard deviation	Mean	Rank	Standard deviation
5 (i)	Lack of clarity in performance requirements	<b>2.48</b>	<b>2</b>	1.193	<b>2.84</b>	<b>2</b>	1.043
5 (ii)	Unclear risk allocation	1.97	6	0.983	2.52	6	1.178
5 (iii)	Conflict between output and input-based specifications	<b>2.41</b>	<b>4</b>	1.202	<b>2.86</b>	<b>1</b>	1.176
5 (iv)	Performance standards compromised with affordability	<b>2.97</b>	<b>1</b>	1.285	<b>2.82</b>	<b>4</b>	1.182
5 (v)	Breach of intellectual property rights	1.58	11	0.920	1.68	11	0.904
5 (vi)	Performance requirements not facilitating monitoring	1.90	8	0.963	2.46	8	0.993
5 (vii)	Incompatibility between different providers' systems	2.10	5	1.062	2.38	9	1.073
5 (viii)	Unclear basis for payment adjustment in case of non-compliance	1.84	10	1.124	2.15	10	1.080
5 (ix)	No users' involvement in the specification process	1.94	7	1.075	2.47	7	1.100
5 (x)	No objective criteria for measurement of performance	1.89	9	0.999	2.61	5	0.940
5 (xi)	Poor readability (e.g., lots of cross referencing to other documents)	<b>2.48</b>	<b>3</b>	1.291	<b>2.83</b>	<b>3</b>	1.107

Note: Top positions in bold.

happened in a number of hospital projects in the U.K. (Heavisides and Price 2001). Item 5(iii), “Conflict between output and input based specifications,” tops the list of potential pitfalls for Australia (mean = 2.86) and was ranked 4th in the U.K. Conflicts in specifications may cause design and operational problems, when input specifications are immutable because of the design standards established for “sensitive” facilities (such as prisons) (Ernst & Young 2008; Infrastructure Australia 2008b). The other pitfalls identified by the U.K. and Australian respondents are 5(i), “Lack of clarity in performance requirements,” and 5(xi), “Poor readability,” which have the 2nd and 3rd ranks in both countries.

These problems were also found by PricewaterhouseCoopers in their study on a number of earlier PFI projects in operation in the U.K. A project director of a health authority was quoted as saying, “The output specifications need utmost clarity but it has proved difficult to achieve... consequently the (public sector) has paid out more on outputs for soft facilities management (FM) not covered by the output specification than it has taken away in penalties” (PricewaterhouseCoopers 2001). In the same PricewaterhouseCoopers report, another comment about the need for clarity of output specifications by a health authority director was “The [public sector] has learned many lessons, ... in particular ... the ambiguity of the output specification allowed the private sector to get away with too much.” Actually, similar problems were observed in both U.K. and Australian PPP projects. For example, in U.K.’s Norfolk and Norwich Hospital, negative pressure rooms were not properly operational for two years. Seacroft Hospital in Leeds has curving corridors that make both patient observation and quick evacuation difficult (Hencke 2005; Parliament UK 2006; McKee et al. 2006). In the Darent Valley, for the Dartford and Gravesham NHS Trust, there was disagreement between the Trust and service provider for deicing the car park in exceptionally heavy snowfall that was not foreseen and explicitly written in the output specification (NAO 2005). In a South Manchester hospital, the NHS Trust suffered an increase in charges due to failure to specify its needs accurately and precisely (Shaoul et al. 2008).

In earlier U.K. contracts for train operation, the penalty for cancelling a train was so high that operators went to great lengths to avoid it, neglecting other performance measures and disrupting passenger travel by running trains late system-wide. Hence, the key is to avoid specifying overdetailed performance criteria, leaving detailed decisions about resources and processes to the service provider. Specifying heavily on one criterion might push a contractor to cater for that parameter only at the expense of other attributes, e.g., in specifying light rail headways or service intervals tightly, journey lengths may affect each other.

The National Physics Laboratory reportedly ran into trouble due to the stringent specification of the temperature and sub-audible noise controls needed by the 16 laboratories (NAO 2006). A *Project Finance International* (16 November, 2005) reports that “There was widespread criticism of insufficiently detailed or objective measurable performance indicators in output specifications, leading to difficulties in imposing payment deductions.” Other concerns were that there were few sanctions for unavailable outdoor areas and no sanctions to ensure the standard of the performance monitoring reports or the performance of the help desk. The public sector managers would like a more detailed specification on furniture, fixtures, and equipment to ensure their requirements are met precisely. At that time, there was widespread dissatisfaction with output specifications (Project Finance International 2005).

Similarly, in an Australian Royal Women’s Hospital Redevelopment at Melbourne of Victoria, the quantity and quality of the utility services set out in the output specifications were not achieved to the level necessary for the commissioning (Chew et al. 2007).

Victorian Auditor-General (2010) also found contract weaknesses in their audit of a number of prison projects, i.e., Philip Prison, Fulham Correctional Centre, the Metropolitan Remand Centre, Marngoneet Correctional Centre, and Ararat Prison, particularly those signed before 2001. The prison accommodation service quality standards were not adequately specified and were difficult to monitor for the Department of Justice (DOJ). Deficiencies were found in the contract management and administration clauses as well as provisions for the handover conditions of prison assets after expiry of the contracts. The audit report criticized that for the post-2001 PPP prison contracts, the DOJ did not fully exercise its rights to monitor contractors’ performance and to manage service failure. The contract variations and facility modifications did not achieve value for money because the decisions and contract variations were poorly documented.

Notably from the survey results in the U.K. and Australia, with the passage of time and the gain of experience, both the public and private sectors have learned lessons from past PPP/PFI projects and developed standard documents for output specifications. Unfortunately, problems still arise from time to time because of incomplete and unclear output specifications (Oyedele 2013). Drafting a clear and concise output specification is fundamental to developing a robust PFI contract and the successful delivery of long-term services (Sanders and Lipson 2001), and this can only be achieved if sufficient time (typically one year) and expertise are devoted while appropriate consultations with key stakeholders are undertaken for drafting the output specifications (4Ps 2007; Lam et al. 2010; Robinson and Scott 2009). Output specifications need to be developed from the outset of a project (Astron 2004), and they should be fully owned by the project team. During the initial design development stage, end users’ and other stakeholders’ consultations should be arranged through workshops, seminars, and design display. Stakeholders need plenty of time to develop their understanding of PPP/PFI approaches and to contribute to key documents such as the output specification. The public sector authorities should not underestimate the amount of time required for drafting the key documents (4Ps 2007).

It is interesting to note from both Table 7 and 8 that 5(v), “Breach of intellectual property rights,” is given the lowest ranking by both the U.K. and Australian respondents, and this attribute also has the highest proportion of “never happen” in each country (Table 9), which means that they have not experienced any major incident where intellectual property rights were breached. To deal with intellectual property issues, there are probity guidelines provided in the U.K. and Australia (NSW Treasury 2006). Similarly other attributes such as “No objective criteria for measurement of performance” and “No users’ involvement in the specification process” have high proportions of “never happen” respectively in both countries. By contrast, the lowest proportions of “never happen” are observed in “lack of clarity in performance requirements.”

Table 9 shows the “never happen” cases and the percentage of respondents who have not experienced any of the problems.

**Table 8.** Rank Relationships between U.K. and Australia

Pitfalls in output specifications	U.K.	Australia
Performance standards compromised with affordability	1st	4th
Lack of clarity in performance requirements	2nd	2nd
Poor readability	3rd	3rd
Conflict between output and input-based specifications	4th	1st
Breach of intellectual property rights	11th	11th

**Table 9.** Descriptive Statistics of Potential Pitfalls in Output Specifications for Never Happen Cases

Question number	Pitfalls in output specifications	U.K.		Australia	
		Percentage and number of counts (in parentheses) indicating "never happen"	Grouped frequency rating of pitfalls	Percentage and number of counts (in parentheses) indicating "never happen"	Grouped frequency rating of pitfalls
5 (i)	Lack of clarity in performance requirements	5.3 (7)	124	0.0 (0)	62
5 (ii)	Unclear risk allocation	6.1 (8)	123	1.6 (1)	61
5 (iii)	Conflict between output and input-based specifications	6.9 (9)	121	6.5 (4)	58
5 (iv)	Performance standards compromised with affordability	6.9 (9)	122	8.1 (5)	57
5 (v)	Breach of intellectual property rights	38.2 (50)	81	39.3 (24)	37
5 (vi)	Performance requirements not facilitating monitoring	12.6 (16)	111	1.6 (1)	61
5 (vii)	Incompatibility between different providers' systems	18.3 (23)	103	6.5 (4)	58
5 (viii)	Unclear basis for payment adjustment in case of non-compliance	14.0 (18)	111	4.8 (3)	59
5 (ix)	No users' involvement in the specification process	21.1 (27)	101	23.0 (14)	47
5 (x)	No objective criteria for measurement of performance	21.7 (28)	101	17.7 (11)	51
5 (xi)	Poor readability (e.g., lots of cross reference to other documents)	8.6 (11)	117	3.2 (2)	60
Total (% in overall term)		14.52 (206)	1215	10.2 (69)	611

### Change Management

#### Question: Relative frequencies of types of changes in PPP/PFI projects

Questions 6 to 8 seek information on the types of change, the cost magnitudes, and how the changes are addressed for the PPP/PFI projects. The types of change, monetary value ranges (divided into small, medium and large changes), and financial adjustment methods are adapted from the HM Treasury documents "Standardization of PFI Contracts (SoPC) Version 4" and "Change Protocol Principles," both published in the U.K. (HM Treasury 2007, 2009). Tables 10–15 show the mean scores of relative frequency of various types of changes, the monetary value of changes, and the financial adjustments with respect to changes to the output specifications.

From Table 10, it can be seen that the three most frequent types of changes are similar in Australia and the U.K., including the common top ranked Item 6(i), "Change in need/requirement of public authority"; 6(iv), "Change in scope of construction" (2nd rank in Australia and 3rd rank in the U.K.); and 6(v), "Change in service provisions" (2nd rank in the U.K. and 3rd rank in Australia). These are followed by "Changes brought about by the private sector" (4th rank in Australia and 5th rank in the U.K.), "Changes in legislation" (4th rank in the U.K. and 6th in Australia), etc. The lowest proportions of "never happen" are also noted in Item 6(i), "Change in need/requirement of public authority," in both Australia (0%) and the U.K. (3.8%), indicating that the public sector is the usual source of changes (Table 11). The Mann-Whitney test also confirms that there is no statistically significant difference

**Table 10.** Descriptive Statistics of Changes to Output Specifications

Question number	Type of change	U.K.			Australia		
		Mean	Rank	Standard deviation	Mean	Rank	Standard deviation
6 (i)	Change in need/requirement of public authority	<b>3.10</b>	<b>1</b>	1.319	<b>2.85</b>	<b>1</b>	1.022
6 (ii)	Change brought about by the private party	1.89	5	0.976	2.43	4	0.921
6 (iii)	Change in legislation	1.99	4	1.054	1.97	6	0.938
6 (iv)	Change in scope of construction	2.09	<b>3</b>	1.172	2.72	<b>2</b>	0.968
6 (v)	Change in service provisions	2.38	<b>2</b>	1.159	2.54	<b>3</b>	1.023
6 (vi)	Change in performance measurement standard	1.81	6	1.039	2.08	5	0.915

Note: Top positions in bold.

**Table 11.** Statistics of Changes to Output Specifications for "Never Happen" Cases

Question number	Type of change	U.K.		Australia	
		Percentage and number of count of "never happen"	Grouped frequency rating of changes	Percentage and number of count of "never happen"	Grouped frequency rating of changes
6 (i)	Change in need/requirement of public authority	3.8 (5)	125	0.0 (0)	62
6 (ii)	Change brought about by the private party	14.6 (19)	111	1.6 (1)	61
6 (iii)	Change in legislation	8.5 (11)	119	3.2 (2)	60
6 (iv)	Change in scope of construction	7.0 (9)	119	1.6 (1)	61
6 (v)	Change in service provisions	5.4 (7)	122	3.3 (2)	60
6 (vi)	Change in performance measurement standard	17.3 (22)	105	4.8 (3)	59
Total (% in overall term)		9.43 (73)	701	2.42 (9)	363

**Table 12.** Descriptive Statistics of Negotiated Changes to Contract after Financial Close

Question number	Change category (by value)	U.K.			Australia		
		Mean	Rank	Standard deviation	Mean	Rank	Standard deviation
7 (i)	Small change (less than £10,000 or A\$16,500 or US\$15,600)	<b>3.74</b>	<b>1</b>	1.365	<b>3.06</b>	<b>1</b>	1.420
7 (ii)	Medium change (£10,000 to £200,000 or A\$16,500 to A\$326,000 or US\$15,600 to US\$312,000)	2.62	2	1.349	2.96	2	1.160
7 (iii)	Large change (more than £200,000 or A\$326,000 or US\$312,000)	2.15	3	1.394	2.63	3	1.175

Note: Equivalent value ranges are based on then-prevailing exchange rates as inserted in the questionnaire for each jurisdiction separately. The US\$ values are for reference and were not included in the questionnaires. Top position in bold.

**Table 13.** Statistics of Negotiated Changes to Contract after Financial Close for “Never Happen” Cases

Question number	Change category (by value)	U.K.		Australia	
		Percentage and number of count of “never happen”	Grouped frequency rating of change categories	Percentage and number of count of “never happen”	Grouped frequency rating of change categories
7 (i)	Small change (less than £10,000 or A\$16,500 or US\$15,600)	11.1 (13)	104	12.1 (7)	51
7 (ii)	Medium change (£10,000 to £200,000 or A\$16,500 to A\$326,000 or US\$15,600 to US\$312,000)	8.3 (10)	111	8.6 (5)	53
7 (iii)	Large change (more than £200,000 or A\$326,000 or US\$312,000)	24.6 (29)	89	6.6 (4)	57
Total (% in overall term)		14.67 (52)	304	9.1 (16)	161

Note: Equivalent value ranges are based on then-prevailing exchange rates as inserted in the questionnaire for each jurisdiction separately. The US\$ values are for reference and were not included in the questionnaires.

**Table 14.** Descriptive Statistics of the Financial Adjustments in Respect of Changes

Question number	Financial adjustment due to change	U.K.			Australia		
		Mean	Rank	Standard deviation	Mean	Rank	Standard deviation
8 (i)	Adjustments in unitary charge only	<b>2.46</b>	<b>1</b>	1.351	2.26	2	1.179
8 (ii)	Adjustments in lump sum payment only	2.39	2	1.358	<b>2.56</b>	<b>1</b>	1.037
8 (iii)	Adjustments in both unitary charge and lump sum payment	2.12	3	1.170	2.24	3	1.135
8 (iv)	Additional financing required	1.59	4	0.918	2.17	4	1.081

Note: Top positions in bold.

**Table 15.** Statistics of the Financial Adjustment Mechanism for “Never Happen” Cases

Question number	Financial adjustment due to change	U.K.		Australia	
		Percentage and number of count of “never happen”	Grouped frequency rating of adjustment mechanisms	Percentage and number of count of “never happen”	Grouped frequency rating of adjustment mechanism
8 (i)	Adjustments in unitary charge only	15.5 (20)	109	11.7 (7)	53
8 (ii)	Adjustments in lump sum payment only	25.2 (31)	92	13.3 (8)	52
8 (iii)	Adjustments in both unitary charge and lump sum payment	35.3 (42)	77	16.7 (10)	50
8 (iv)	Additional financing required	45.2 (56)	68	20.7 (12)	46
Total (% in overall term)		30.3 (149)	346	15.6 (37)	201

between Australia (mean score at 2.85) and the U.K. (mean score at 3.10) in the top-ranked type of change ( $p = 0.173$ ).

Table 12 shows that “Small changes (less than £10,000 or A\$16,500 or US\$15,600)” (Note: Equivalent value ranges are based on the then-prevailing exchange rates as inserted in the questionnaire for each jurisdiction separately. The US\$ values are shown for reference here and were not included in the original questionnaires.) are the most frequent, followed by “Medium changes (£10,000 to £200,000 or A\$16,500 to A\$326,000 or US\$15,600 to US\$312,000)” and then “Large changes (more than £200,000

or A\$326,000 or US\$312,000),” with the same order in the U.K. and Australia. These changes were negotiated in the contract after the financial close as reported by the respondents from the U.K. and Australia. The Mann-Whitney  $U$  test shows that small value changes are more prevalent in the U.K. (mean score at 3.74) than Australia (mean score at 3.06) with statistical significance ( $p = 0.003$ ). Managing changes is a time-consuming and costly process. The NAO (2008) reported on one case that, in addition to the mark-ups to cover the overhead and profit by the service provider, an additional service fee was charged by the special



purpose vehicle (SPV) for changes. These additional management fees typically ranged from 5–10% of the cost of change, and in 2006, the public sector authorities paid £60 million in such fees. The NAO (2009) found that changes initiated by the public sector and third parties were the most commonly reported causes of price increases. Further, the NAO (2008) discovered higher value changes were not always competitively tendered partly because of timing and cost constraints and because of the difficulties of integrating new work with the existing set of obligations under a long-term PFI contract. Another reason was that the contractual provisions in previous PFI deals did not provide the public sector client with an adequate right for competitive tendering. Minor changes were also expensive when compared with the industry benchmark prices published by the Royal Institution of Chartered Surveyors (RICS). Generally small changes took a longer time to process under PFI contracts as compared to conventionally procured outsourced work (NAO 2008). The NAO (2010) found in their recent PFI hospitals survey that around 34% of major changes and 39% of minor changes were bureaucratic and time consuming. Where competitive tendering for changes was not taking place, there would be a risk of not achieving VfM.

As to the financial adjustments to address these changes, Table 14 shows that in the U.K., the most frequent method is to adjust the unitary charges payable to the private sector contractor; whereas in Australia, the most frequent adjustment is made through lump sum payments. Having adjustments to both unitary charges and lump sum payments is relatively less common, and it is even more unlikely to entail additional financing in both countries. The highest proportions of the replies to “never happen” for additional financing are seen in the U.K. (at over 45%) and also in Australia (at over 20%), as shown in Table 15. These results tally with the predominance of the small value changes as identified in the survey, which are more conveniently settled by unitary charge adjustments.

The fundamental principle is to have thorough planning from inception to reduce the occurrence of changes during the operational period of PPP projects. Yet, since changes will inevitably occur over the lifetime of the long concession periods of PPP/PFI contracts, there is a need to have a clear change mechanism that is balanced and fair. It should deal with the variety of small, medium and large changes as reflected in this survey. An integrated approach needs to be taken by the public sector in providing clear conditions of contract, payment mechanism, and output specifications to manage changes. As commented by one private sector respondent, “Delay in handling changes is often a feature of the public sector. If they are not clear about what changes they actually desire, that will affect and delay the change negotiation process.”

Table 13 shows the “never happen” cases and the percentage of respondents who have not experienced any of the changes after the financial close. The highest proportions of the replies to “never happen” against large value change are seen in the U.K. (at around 25%) and small value changes in Australia (at around 12%).

## Change Mechanisms for Output Specifications

### Questions: Relative frequencies of different change mechanisms

When changes are foreseeable, it would be sensible to incorporate some means to cater for the changes and facilitate negotiation when they actually occur. From a study of sample output specifications for PPP/PFI convention center and college projects, several approaches were extracted and generalized for soliciting the relative frequencies of their use in Australia and the U.K. Table 16 shows such statistics on the change mechanisms as embedded in the output specifications. It is noted from the survey results that 9(iv), “Negotiation as and when need arises,” is most often encountered by the U.K. respondents, followed by 9(i), “Anticipatory provisions in output specifications.” The reverse situation was experienced by the Australian respondents. Other measures such as the inclusion of 9(ii), “Add-on modules/units of asset or service when needed,” and 9(iii), “Undesignated use of space for premises; exact use to be decided later,” are less prevalent in the two countries. The Mann-Whitney *U* test shows that Australia (mean score at 3.03) uses anticipatory provisions more than the U.K. (mean score at 2.32) with statistical significance ( $p < 0.001$ ). Examples of the use of 9(ii) were seen in the output specifications of school premises in Australia and 9(iii) in Singapore (which is not covered in the scope of this survey), where some rooms were designated as “white boxes” with only basic finishing specified in a college of higher education, allowing for flexibility in the final allocation (Javed 2013). In Australia, a provision was made for additional capacity by using vacant space within the perimeters of several Department of Justice facilities or using space initially provided as “shell floors” in multi-story buildings (Cove 2007).

The strategy in the public sector for changes to be negotiated as and when the need arises is desirable (the “never happen” proportion among the British and Australian respondents was also the lowest for this, indicating consistency), as shown in Table 17. For example, one private sector contractor from the U.K. observed, “Waste management projects are designed with set capacities that can deal with the public sector anticipated waste requirements over the life of concessions, with underutilized capacity sold to the commercial market during the early years. However, recently it was seen in the U.K. that some local authorities asked for a reduction in capacity after the concession has been let, particularly for food waste anaerobic digestion.” Another respondent from the U.K. opined, “The output specifications were flexible enough to adjust for future changes with a provision of variations in the contract but in some cases the client is not willing to pay a premium price as proposed by the contractor.” Similarly the Waste Management Procurement Pack produced by the Department for Environment Food and Rural Affairs (2008) highlights the point that the landfill diversion performance standards (European Union 1999) will increase during the waste project’s concession period, so the output specification should be flexible enough to allow for this adjustment of standards. If the client requirements are not adequately defined,

**Table 16.** Descriptive Statistics of Change Mechanisms

Question number	Change mechanism	U.K.			Australia		
		Mean	Rank	Standard deviation	Mean	Rank	Standard deviation
9 (i)	Anticipatory provisions in output specification	2.32	2	1.157	<b>3.03</b>	<b>1</b>	0.956
9 (ii)	Add-on modules/units of asset or service when needed	2.07	3	0.973	2.93	3	0.880
9 (iii)	Undesignated use of space for premises; exact use to be decided later	1.82	4	1.029	2.53	4	1.020
9 (iv)	Negotiation as and when need arises	<b>2.77</b>	<b>1</b>	1.269	2.97	2	0.983

Note: Top positions in bold.

**Table 17.** Statistics of Change Mechanisms for “Never Happen” Cases

Question number	Change mechanism	U.K.		Australia	
		Percentage and number of count of “never happen”	Grouped frequency rating of change mechanisms	Percentage and number of count of “never happen”	Grouped frequency rating of change mechanisms
9 (i)	Anticipatory provisions in output specification	16.0 (21)	110	3.2 (2)	60
9 (ii)	Add-on modules/units of asset or service when needed	21.4 (28)	103	3.2 (2)	60
9 (iii)	Undesignated use of space for premises; exact use to be decided later	32.1 (42)	89	8.1 (5)	58
9 (iv)	Negotiation as and when need arises	10.2 (13)	114	0.0 (0)	61
Total (% in overall term)		19.93 (104)	416	3.63 (9)	239

then these variations and alteration will be costly and may affect the scope of the project during the operation of the contract (Ramsey 2007).

### Problems in Change Mechanisms

#### Question: Relative frequencies of problems in change mechanism

Failure to cater for changes may lead to a variety of problems in PPP/PFI projects. In Table 18, U.K. respondents seem to show a tendency to use 10(viii), “Single procedure to deal with all types of changes.” In contrast, Australian respondents perceived 10(iv), “Competitive tenders not called in case of major change,” as the major problem. These may result in diminished value for money for the changes. The U.K. respondents ranked 10(iv) fifth, but NAO (2008) noted that higher value changes were not always competitively tendered for, due to the abovementioned reasons. However,

these issues have been rectified recently since both Australia and the U.K. have published guidelines for managing changes. Hence, the validity of answers by the U.K. respondents to this question is uncertain, given that the results of the Kendall’s concordance analysis reveal inconsistency in the U.K. responses, as mentioned in an earlier section. The standard deviation for the top rank problem in the U.K. is also relatively high at 1.37. Table 19 also shows that there are high proportions of “never happen” for the 10(iv) and (vi) attributes (around 35% by the U.K. respondents) and for the 10(ii) attribute, 17% by the Australian respondents.

### Consequences on PPP/PFI Projects

#### Question: Consequences to PPP projects and whether these are due to problems in output specifications

This question attempts to collect sample statistics from the respondents on possible consequences to PPP/PFI projects, particularly if

**Table 18.** Descriptive Statistics of Problems in Respect of Changes

Question number	Problems in changes	U.K.			Australia		
		Mean	Rank	Standard deviation	Mean	Rank	Standard deviation
10 (i)	Extension of built facilities not contemplated/ no such provision in output specification	2.24	4	1.369	2.41	5	1.058
10 (ii)	New legislation not contemplated	1.82	8	1.045	2.06	8	0.988
10 (iii)	New standards not contemplated	1.99	7	1.104	2.15	6	1.036
10 (iv)	Competitive tenders not called for in case of major change	2.07	5	1.242	<b>2.58</b>	<b>1</b>	1.090
10 (v)	Lenders’ resistance due to additional risk involved	2.45	2	1.256	2.48	3	0.995
10 (vi)	Unclear procedures for raising changes and approval	2.00	6	1.134	2.09	7	1.005
10 (vii)	No bundling mechanism for minor changes	2.39	3	1.381	2.43	4	1.110
10 (viii)	Single procedure to deal with all types of changes	<b>2.65</b>	<b>1</b>	1.370	2.52	2	1.240

Note: Top positions in bold.

**Table 19.** Statistics of Problems in Respect of Change for “Never Happen” Cases

Question number	Problems in changes	U.K.		Australia	
		Percentage and number of count of “never happen”	Grouped frequency rating of change problems	Percentage and number of count of “never happen”	Grouped frequency rating of change problems
10 (i)	Extension of built facilities not contemplated/ No such provision in output specification	30.0 (39)	91	9.7 (6)	56
10 (ii)	New legislation not contemplated	31.8 (41)	88	17.7 (11)	51
10 (iii)	New standards not contemplated	27.6 (35)	92	16.1 (10)	52
10 (iv)	Competitive tenders not called for in case of major change	34.6 (45)	85	16.7 (10)	50
10 (v)	Lenders’ resistance due to additional risk involved	20.9 (27)	102	4.9 (3)	59
10 (vi)	Unclear procedures for raising changes and approval	34.6 (45)	85	13.1 (8)	53
10 (vii)	No bundling mechanism for minor changes	24.8 (32)	97	8.2 (5)	56
10 (viii)	Single procedure to deal with all types of changes	20.2 (26)	103	11.5 (7)	54
Total (% in overall term)		28.06 (290)	743	12.24 (60)	431

**Table 20.** Descriptive Statistics of Consequences to Output Specification Problems

Question number	Consequences	U.K. (percentage)			Australia (percentage)		
		Yes	No	Due to OS <sup>a</sup>	Yes	No	Due to OS <sup>a</sup>
11 (i)	Impossibility of performance leading to contract termination	6.9	93.1	2.3	4.8	95.2	1.6
11 (ii)	Not achieving value for money	23.1	76.9	10.0	19.4	80.6	9.7
11 (iii)	Too many changes leading to chaos	8.5	91.5	5.4	14.5	85.5	4.8
11 (iv)	Slow to bring about necessary changes	<b>43.8</b>	56.2	7.7	<b>44.3</b>	55.7	13.1
11 (v)	Differences invoking disputes resolution procedures	<b>33.3</b>	66.7	10.9	<b>41.0</b>	59.0	11.5

Note: OS = output specifications. Top positions in bold.

<sup>a</sup>For those indicating the stated consequences, this percentage shows a causal link to OS.

they arose from problems in output specifications. Although uncommon, output specifications had been associated with PPP contract termination, as in the case of the National Physical Laboratory in the U.K. (NAO 2006). In the survey results, although it was found that PPP/PFI projects were in general not seriously affected due to problems with output specifications in both Australia and the U.K., a number of respondents did indicate adverse consequences. The most common consequences were noted as 11(iv), "Slow to bring about necessary changes" (44.3% in Australia; 43.8% in the U.K.), followed by 11(v), "Differences invoking dispute resolution procedures" (41% in Australia; 33.3% in the U.K.), as shown in Table 20. About one-fifth to one-third of the respondents linked the consequences to the problems in output specifications. Some respondents did share that their experience of consequences was due to the problems in output specifications such as 11(iii), "Too many changes leading to chaos," and 11(ii), "Not achieving value for money." A small proportion of respondents (4.8% in Australia; 6.9% in the U.K.) experienced 11(i), "Impossibility of performance leading to contract termination," with about one-third of them attributing it to output specification problems. Despite the teething problems caused by some output specifications, the project stakeholders usually overcome them by working together closely to resolve the differences and mitigate problems arising in output specification for the remaining contract periods. Output specifications can be updated through the variation process and value testing, i.e., benchmarking and market testing, which are commonly practiced for soft FM services such as catering, potting, cleaning, and so on for hospital projects after every five years both in Australia and the U.K. This gives an opportunity for the public sector to renegotiate and update the specifications of the contract (NAO 2007, 2010). Some of the disputes could be resolved through dispute resolution clauses in the contract such as in the Southern Cross (a Victorian railway station in Australia); a construction dispute has been effectively resolved through dispute resolution clauses in the contract (Victorian Auditor-General 2007).

As mentioned earlier, one common problem is the conflict within the specifications. One private sector respondent pointed out, "generally authorities are not good at writing output-based specifications and actual contracts end up as a hybrid of input/output specifications." By contrast, another viewpoint by a public sector respondent was, "there are occasions when specifications are better written as input-based specifications."

It was found in an official U.K. inquiry into one contractor's performance that a major reason for user dissatisfaction with a number of PFI school refurbishment projects was the output specifications. A spokesman for the "Public Private Partnership Programmes" (4Ps) in the U.K. pointed out that there was a gap between user expectations of what the output specifications would deliver in terms of quality and what was actually delivered. It was recommended "the output specification be replaced with clear input specification in all schools PFI refurbishment projects in the future"

(Carol 2003). Most contractors prefer the use of input specifications because everyone will then know exactly what is expected and what to deliver (Carol 2003), apart from the retention of design liability by the specifiers. In the case of cleaning in hospitals, which can be subjective in nature, it is difficult to describe outputs in contractually effective ways, and they are thus difficult to monitor (Edward et al. 2004).

Incidentally, a similar public sector respondent's view was, "Input specifications should not be excluded in specifications where the client knows what they want. This does not limit innovation if the bidder has something truly innovative to present but in prisons that is very rare, whereas if the specification is totally output based, bidders frequently do not truly comprehend what the client requires." For prison facilities, there is a limited flexibility in defining security requirements in purely output terms (Ernst & Young 2008).

## Discussion

The questionnaire survey has examined the more common problems that occur in the output specifications of PPP/PFI projects and different change management issues as experienced in two jurisdictions that often use this procurement approach. In the last section of the questionnaire, respondents were invited to comment on output specification issues as an open-ended question, which provides good insights on the statistical results, when they are triangulated with literature supports as mentioned above.

Regarding pitfalls, the results show that performance standards being compromised with affordability constraint as well as conflicts between specifications were ranked as the most common by both Australian and the U.K. respondents. One private sector respondent remarked, "Output specifications in the U.K. and Australia have been improved over the years providing clarity on risk and long-term performance. However, there is still a tendency by the public sector to over-specify and spend the entire affordability limit, rather than achieve a perfectly good balance, fit-for-intended-purpose building with no costly design features and performance requirements above affordability." The remark echoes with an earlier survey by the NAO (2008), which showed that in about half of the cases they studied, works were taken out from the original deals for reason of affordability. Taken in a broader sense, overall affordability relates to the ability of all parties to complete a PPP/PFI project with available resources (Eaton and Akbiyikli 2005). It is not only the procuring agencies that need to secure the financial commitments and evaluate the achievable quality through the cost records of similar projects, but the private sector also has to assess their funding sources to meet the long-term whole-lifecycle cash flow requirements. Conflicts between the construction documents are common occurrences, not only with PPP/PFI projects but also with projects in general; hence, they reflect the generic problem of hastiness and lack of skill. Laryea (2011) concluded after

studying a number of case studies of U.K. projects that the quality of tender documents was perceived to have dropped markedly in the past 15–20 years. Added to this, the inevitable use of input specifications could have aggravated the conflict problems, as mentioned earlier. One public sector respondent observed, “There is a delicate balance to strike between a genuine output specification which can be followed if disputes arises and not one that is too prescriptive and does not allow innovation or creativity in the design and construction . . . it should be clear and precise where you need to be and allow more freedom where your ideas are less clear and where you are open to a greater range of solutions.” Another public sector respondent opined, “The authority’s output specification substantially derives the bids. The bidders proposed in their method statements and input specs as to how they intend to deliver the services. The successful bidders’ specs are included in the contract” and further elaborated, “The client’s output specs derive the payment mechanism. It is therefore a key for the output specs to be comprehensive.”

Other common pitfalls identified by the U.K. and Australian respondents are the lack of clarity in the performance requirements and poor readability, respectively. While performance parameters directly affect the end results to be achieved and user satisfaction, the readability of contract documents was found to affect the level of commonality in interpretation by the project participants (Rameezdeen and Rajapakse 2007). A public sector officer responded in the questionnaire survey, “output specification is a document which must be black and white with no shades of grey.” For a long-term PPP/PFI project, apart from taking care in preparing the output specifications, one way to resolve these problems is to ensure a constant dialogue between the project participants to iron out discrepancies at all stages. Standard documents help in drafting the output specifications to a great extent by accumulating a wealth of project experience for sharing under scenarios of similar types of facilities, but care must be taken not to conform on grounds of bureaucracy. As a private sector respondent puts it, “Output specs should be tailored to the project specific needs and requirements. Standardization does not always work. It should also be sufficiently flexible to accommodate different technologies.” This indicates that a good balance needs to be struck, and much depends on the types of facilities and services (e.g., whether repetitive or unique) to be provided.

Regarding the types of change, the results show that the most common ones in both Australia and the U.K. are due to the changes in requirements of the public sector. The changes may arise because of changes of policy (such as accommodation standards), or due to incomplete or inadequate communication of users’ requirements, or changes in the use or functionality, or changes in law (HM Treasury 2009; Wang et al. 2000). The New South Wales government in Australia explicitly states the principle that it may initiate modifications to the facility and the service specifications at any time, whereas the private sector may only propose modifications to a facility for the government’s acceptance, and provide its own funding (NSW Treasury 2007). To minimize such changes, an Australian public sector expert commented that “extensive input by users and stakeholders to output specifications at an early stage is essential to achieving the best outcome.” Another private sector respondent replied that, “stakeholders’ involvement in the production of all stages of the projects is invaluable.” In addition, to avoid miscommunication of users’ needs, a process of sign-off at the end of preparation of output specifications by the awarding authority is highly recommended in both Australia (Partnerships Victoria 2003) and the U.K. (Ramsey 2007). The values of change reported in both countries mostly belong to the “small” category (below £10,000 or A\$16,500 or US\$15,600), which match with

an earlier finding of the NAO that over 90% of the changes negotiated in the U.K. PFI projects were below £5,000 (NAO 2008). Yet, in terms of values, a few large changes can make up the whole change amount in any year. The implication of this is that the financial adjustment mechanism needs to be streamlined, for example, through bundling small changes for evaluation.

From the survey results, it appears that more Australian PPP projects tend to incorporate anticipatory clauses in their output specifications for future changes. An experienced respondent from Australia stated, “All of our contracts are reasonably flexible providing for State rights to seek changes for any number of specific reasons, e.g., change of law, change of policy but also provide for ‘general rights’ of the State to initiate modifications (to construction or service specs) at any time during the contract term.” As an illustration extracted from one of the sample project deeds obtained, the facility specifications for a hospital provide that it should have a high level of adaptability to the changing requirements of different clinical services and to maximize their utilization. Anticipatory provisions include colocation of similar service units, modular spaces for multifunctional uses, spaces being configured to facilitate staff deployment and future operational needs, diagnostic rooms to cater for advancements in medical technology, and so on (NSW Health 2008). In the New Royal Women’s Hospital, a PPP hospital project in the state of Victoria, allowance was made for an extra two floors to be built on top in later years to cater for future maternity demand (Victorian Auditor-General 2008).

“You cannot expect a long-term contract to remain stable,” as one Australian public sector respondent commented and continued, “PPP’s are long-term contracts; therefore changes must be expected and built into the contract so that changes can be effected without the need for lots of lawyers on both sides.” A private sector respondent opined, “The fundamental issue is to have clarity from inception to reduce the occurrence of changes. Planning is a key to this. Changes do occur over the life time of the concession. However, there is a need to have a clear change mechanism that is balanced, fair and deal with the variety of small, medium and large changes.” “Standard docs and change management processes are comprehensive but slow and cumbersome to implement,” remarked another private sector expert in the U.K. Equally, an Australian respondent pointed out, “sometimes changes are slow to be negotiated because of differences in views regarding the commercial cost of (otherwise) acceptable standards. With a Victorian PPP prison, it took several years to agree a (new) level of acceptable ‘false alarms’ (before abatement).”

By and large, the overall picture of the surveys in both Australia and the U.K. shows that output specifications are generally serving their purposes, but pitfalls still exist, as the following remarks by an Australian respondent indicate: “Overall, output specifications are too complex. Performance measurement regimes tend to be ambiguous, overly complex and difficult to manage.” “In our experience output specifications have been excessively detailed and complex, this makes the project difficult to manage and expensive in consuming resources to clarify. Dispute resolution procedures need to be clearer. Individual fee abatement is an important component. However the abatement formulas must be practical and easy to interpret and apply. Failure to precisely detail all services requirements can lead to unsatisfactory outcomes.”

## Conclusion

The surveys reveal the most common pitfalls of output specifications as experienced by the U.K. and Australian PPP participants,

and change management issues are statistically analyzed. Although the overall results only show mild to midlevels of output specification problems, the relatively high level of standard deviations (often more than 1 in a scale of 5) mean that there are more severe cases, such as the feedback provided by the respondents in the open-ended question section. Standard output specifications are being developed and used in mature PPP markets such as Australia and the U.K., contributing to the reduction of pitfalls in output specifications, but where pitfalls occurred, they have affected the performance of PPP projects. Small changes are negotiated very frequently in both jurisdictions. The study also examined the relative frequencies of different types of changes as negotiated in PPP/PFI projects. Changes in need/requirements and scope of work are common in both countries. The survey shows that there are more similarities than differences in terms of potential pitfalls and change mechanisms between Australia and the U.K., which are early adopters in the use of PPP/PFI in the world. One significant difference has been highlighted as the tendency of Australian projects in using anticipatory provisions for changes in PPP projects. Findings of this research would be useful to countries and jurisdictions intending to adopt this project delivery approach on a larger scale. While avoiding the pitfalls in the output specifications, which should be used sensibly in performance monitoring, proactive change management can be built in through stakeholder consultations, incorporating an agreed change protocol between the contracting parties, and providing close links to the payment mechanism. In any event, a collaborative working attitude among the public-private partners is indispensable in this type of project.

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## Supplemental Data

The Questionnaire Survey Sample is available online in the ASCE Library (<http://www.ascelibrary.org>).

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